Module Handbook
Economathematics M.Sc.
SPO 2016
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Date: 04/09/2023
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1 General information

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

1.1 Structural elements

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

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

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

1.2 Begin and completion of a module

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

1.3 Module versions

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

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

1.4 General and partial examinations

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

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

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

1.5 Types of exams

Exams are split into written exams, oral exams and alternative exam assessments. Exams are always graded. Non exam assessments can be repeated several times and are not graded.
1.6 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 losing the examination claim. 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).

1.10 Contact

If you have any questions about modules or exams with WIWI-ID, please contact the examination office of the KIT Department of Economics and Management:

Ralf Hilser
Anabela Relvas
Telefon +49 721 608-43768
E-Mail: pruefungssekretariat@wiwi.kit.edu

If you have any questions about modules or exams with MATH-ID, please contact at the KIT Department of Mathematics:

Dr. Bernhard Klar
Telefon +49 721 608-42047
E-Mail: Bernhard.Klar@kit.edu

Editorial responsibility:

Dr. André Wiesner
Telefon: +49 721 608-44061
Email: modul@wiwi.kit.edu
## 2 Field of study structure

### Mandatory

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<thead>
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<tbody>
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<tr>
<td>Mathematical Methods</td>
<td>36 CR</td>
</tr>
<tr>
<td>Finance - Risk Management - Managerial Economics</td>
<td>18 CR</td>
</tr>
<tr>
<td>Operations Management - Data Analysis - Informatics</td>
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*This field will not influence the calculated grade of its parent.*

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### 2.1 Master's Thesis

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2.2 Mathematical Methods

| Credits | 36 |
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<td>M-MATH-102903</td>
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### Analysis or Applied and Numerical Mathematics, Optimization (Election: at least 8 credits)

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### 2 FIELD OF STUDY STRUCTURE

#### Finance - Risk Management - Managerial Economics

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#### 2.3 Finance - Risk Management - Managerial Economics

Finance - Risk Management - Managerial Economics (Election: at least 18 credits)

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#### 2.4 Operations Management - Data Analysis - Informatics

Operations Management - Data Analysis - Informatics (Election: at least 18 credits)

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## 2.5 Seminar in Economics and Management

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3 Modules

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

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<th>Prof. Dr. Willy Dörfler</th>
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**Prerequisites**

none
### 3.2 Module: Advanced Inverse Problems: Nonlinearity and Banach Spaces [M-MATH-102955]

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**Mandatory**

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

**Prerequisites**

None
3.3 Module: Advanced Machine Learning and Data Science [M-WIWI-105659]

- **Responsible:** Prof. Dr. Maxim Ulrich
- **Organisation:** KIT Department of Economics and Management
- **Part of:** Finance - Risk Management - Managerial Economics

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**Competence Certificate**

Due to the professor’s research sabbatical, the BSc module “Financial Data Science” and MSc module “Foundations for Advanced Financial -Quant and -Machine Learning Research” and the MSc module “Advanced Machine Learning and Data Science” along with the respective examinations will not be offered in SS2023. Bachelor and Master thesis projects are not affected and will be supervised.

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

**Prerequisites**

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

**Competence Goal**

After a successful project, the students can:

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

**Content**

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

**Workload**

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

**Recommendation**

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

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

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Compulsory Elective Courses (Election: 9 credits)

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<td>Strategy and Management Theory: Developments and &quot;Classics&quot;</td>
<td>3 CR</td>
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Competence Certificate
The assessment is carried out as partial exams (according to Section 4 (2), 1-3 SPO) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately.

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

Prerequisites
None

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

Content
The module is divided into three main topics:
The students
- analyze and discuss a wide range of business strategies on the basis of collectively selected case studies.
- participate in a business wargaming workshop and analyze strategic interactions.
- write a paper about current topics in the field of strategic management theory.

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

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

Recommendation
None
3.5 Module: Algebra [M-MATH-101315]

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

Credits 8
Grading scale Grade to a tenth
Recurrence Each winter term
Duration 1 term
Level 4
Version 2

Mandatory
T-MATH-102253 Algebra 8 CR Kühnlein, Sauer

Competence Certificate
Oral examination of ca. 30 minutes.

Prerequisites
None

Competence Goal
Students are able to

- understand essential concepts from Algebra,
- apply results from Galois theory to concrete situations,
- name basic results concerning discrete valuations and relate them to integral ring extensions.

They are prepared to write a thesis on a topic from algebra.

Content
- algebraic field extensions, Galois theory, roots of unit, applications of Galois theory
- discrete valuations, discrete valuation rings
- Tensor products of modules, integral ring extensions, normalization, noetherian rings, Hilbert's Basis Theorem

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

Workload
Total workload: 240 hours.
Attendance: 90 h
- lectures and tutorials including the examination
Self studies: 150 h
- follow-up and deepening of the course content
- work on problem sheets
- literature study and internet research on the course content
- preparation for the module examination

Recommendation
Basic knowledge on groups and rings is beneficial.
3.6 Module: Algebraic Geometry [M-MATH-101724]

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

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

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<tr>
<td>T-MATH-103340</td>
<td>Algebraic Geometry</td>
<td>8 CR</td>
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Herrlich, Kühnlein
3.7 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

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

Mandatory

| T-MATH-103346 | Algebraic Number Theory | 8 CR | Herrlich, Kühnlein |

Competence Certificate
oral examination of ca. 30 minutes

Prerequisites
none

Competence Goal
Students are able to

- understand basic structures and concepts from algebraic number theory,
- apply abstract concepts to concrete problems,
- read research papers and write a thesis in the field of algebraic number theory.

Content

- Algebraic number fields: rings of integers, Minkowski theory, class-groups and Dirichlet's unit theorem,
- Extensions of number fields: Ramified primes, Hilbert's ramification theory,
- Local fields: Ostrowski's theorem, valuation theory, Hensel's lemma, extensions of local fields,
- analytic methods: Dirichlet series, Dedekind's zeta function, L-series

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

Workload
Total workload: 240 hours

Attendance: 90 h
- lectures, problem classes and examination

Self studies: 150 h
- follow-up and deepening of the course content,
- work on problem sheets,
- literature study and internet research on the course content,
- preparation for the module examination

Recommendation
The contents of the module "Algebra" are strongly recommended.
3.8 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 | Krannich, Sauer |

**Prerequisites**

none
3.9 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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**Mandatory**

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

**Prerequisites**

none
3.10 Module: Analytic and Algebraic Aspects of Group Rings [M-MATH-106305]

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

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**Competence Certificate**  
oral examination of ca. 30 minutes

**Prerequisites**  
none

**Content**  
- group rings  
- universal localizations  
- Kaplansky conjectures  
- property T

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

**Workload**  
Total workload: 150 hours

**Recommendation**  
The module ‘Introduction into Algebra and Number Theory’ is strongly recommended. Some knowledge of spectral theory is recommended.
3.11 Module: Analytical and Numerical Homogenization [M-MATH-105636]

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

**Organisation:** KIT Department of Mathematics

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

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**Mandatory**

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

**Prerequisites**

none

**Competence Goal**

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

**Content**

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

**Annotation**

Upon request the lecture will be held in English.
3.12 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**

**Credits:** 9

**Grading scale:** Grade to a tenth

**Recurrence:** Each term

**Duration:** 2 terms

**Language:** German

**Level:** 4

**Version:** 4

### Compulsory Elective Courses (Election: )

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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**

A Student

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

**Content**

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

**Annotation**

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

**Workload**

The total workload for this module is approximately 270 hours.

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

<table>
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Compulsory Elective Courses (Choice: between 1 and 2 items)

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<td>T-WIWI-102714</td>
<td>Tactical and Operational Supply Chain Management</td>
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Supplementary Courses (Choice: at most 1 item)

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

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

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

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

Competence Goal
The student

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

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

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

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

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

**Recommendation**
The courses Introduction to Operations Research I and II are helpful.
### 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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**Prerequisites**  
None
3.15 Module: Bayesian Inverse Problems with Connections to Machine Learning [M-MATH-106328]

**Responsible:** TT-Prof. Dr. Sebastian Krumscheid  
**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-112842 | Bayesian Inverse Problems with Connections to Machine Learning | 4 CR | Krumscheid |

**Competence Certificate**
oral exam of ca. 30 min

**Prerequisites**
None

**Competence Goal**
After completing the module's classes and the exam, students will be familiar with the theory of inverse problems. They will be able to apply the Bayesian framework to a given inverse problem and assess the well-posedness of the Bayesian posterior. In addition, students will be able to describe the basics of several solution methods for accessing the Bayesian posterior, including approximation and machine-learning techniques, and their limitations. Finally, they will be able to name and discuss essential theoretical concepts for Bayesian inversion in Banach spaces and describe the suitable sampling-based solution techniques. In particular, the course prepares students to write a thesis in the field of Uncertainty Quantification.

**Content**
The course offers an introduction to the subject of statistical inversion, where, in its most basic form, the goal is to study how to estimate model parameters from data. We will introduce mathematical concepts and computational tools for systematically treating these inverse problems in a Bayesian framework, including an assessment of how uncertainties affect the solution. In the first part of the course, we will study the Bayesian framework for finite-dimensional inverse problems. While the first part will introduce some machine-learning ideas, the second part will address how machine learning is impacting, and has the potential to impact further on, the subject of inverse problems. In the final part of the course, we will generalize the Bayesian inverse problem theory to a Banach space setting and discuss sampling strategies for accessing the Bayesian posterior.

Topics covered include:
- Bayesian Inverse Problems and Well-Posedness
- The Linear-Gaussian Setting
- Optimization Perspective on Bayesian Inverse Problems
- Gaussian Approximation
- Markov Chain Monte Carlo
- Blending Inverse Problems and Machine-Learning
- Bayesian Inversion in Banach spaces

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

**Workload**
total workload: 120 hours

**Recommendation**
The contents of the modules 'M-MATH-101321 - Introduction to Stochastics', 'M-MATH-103214 – Numerical Mathematics 1+2', and 'M-MATH-106053 – Stochastic Simulation' are recommended.
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
### Module: Bott Periodicity [M-MATH-104349]

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

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**Prerequisites**

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

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

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**Mandatory**

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

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Economathematics M.Sc.  
Module Handbook as of 04/09/2023
3.19 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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Mandatory

| T-MATH-109851 | Boundary Element Methods | 8 CR | Arens |

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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</table>

**Prerequisites**

None
### 3.21 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 |

Economathematics M.Sc.  
Module Handbook as of 04/09/2023
3.22 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**

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<td>Each term</td>
<td>1 term</td>
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**Compulsory Elective Courses (Election: )**

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<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
<th>Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>T-WIWI-102740</td>
<td>Public Management</td>
<td>4,5 CR</td>
<td>Wigger</td>
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<tr>
<td>T-WIWI-102859</td>
<td>Social Choice Theory</td>
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<td>Puppe</td>
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</table>

**Competence Certificate**

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

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

**Prerequisites**

None

**Competence Goal**

Students

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

**Content**

The focus of the module is on mechanisms for public decision 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.
Module: Combinatorics [M-MATH-102950]  

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

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<td>Combinatorics</td>
<td>8 CR</td>
</tr>
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</table>

**Competence Certificate**

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

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

**Prerequisites**

none

**Competence Goal**

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

**Content**

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

**Module grade calculation**

The grade of the module ist the grade of the written exam.

**Annotation**

- Regular cycle: every 2nd year, summer semester
- Course is held in English
3.24 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>
<thead>
<tr>
<th>Credits</th>
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**Mandatory**

| T-MATH-108398 | Commutative Algebra | 8 CR | Herrlich |

**Prerequisites**

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

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

**Organisation:** KIT Department of Mathematics

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

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**Mandatory**

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

**Prerequisites**

none
3.26 Module: Complex Analysis [M-MATH-102878]

- **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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<td>Complex Analysis</td>
<td>8 CR Herzog, Plum, Reichel, Schnaubelt, Tolksdorf</td>
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**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
### 3.27 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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Rieder
3.28 Module: Computational Group Theory [M-MATH-106240]

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

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<td>Computational Group Theory Tutorial</td>
<td>2 CR</td>
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<tr>
<td>T-MATH-112669</td>
<td>Computational Group Theory exam</td>
<td>6 CR</td>
<td>Kaluba</td>
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**Coursework Certificate**

coursework in the tutorial plus oral examination of ca. 20 minutes

**Prerequisites**

none

**Competence Goal**

The aim of the course is to give a gentle introduction to group theory from a computational point of view. The students will learn not only the mathematical theory, but also how to think in terms of the computational feasibility. As a result, students will develop computational understanding for questions within group theory.

After successful participation, students can:

- understand the difference between construction and definition by property
- understand how scaling of the computational problems influences the choice of algorithms and data structures
- choose the correct algorithms and data structures balancing speed and storage to obtain computational feasibility
- exploit the structure of permutation groups to quickly find (some or all) elements satisfying requested properties.
- understand the basics of the theory of automata and their role for computation in finitely presented groups
- use string-rewriting algorithms to potentially solve the word problem in (some) finitely presented groups.

**Content**

1. Group actions, orbits, stabilizers, Schreier vectors
2. Permutation groups, bases, Stabilizer chains, Schreier-Sims algorithm.
3. Broad overview of transitive groups, primitive groups
4. Finitely presented groups, their homomorphisms, quotients
5. Formal languages, and rewriting systems
6. Knuth-Bendix completion
7. Automata for problems in finitely presented groups
8. Coset enumeration, subgroups and their presentation

**Module grade calculation**

The module grade is the weighted average of the grade of the oral exam (weight 75%) and the grade of the tutorial (weight 25%).

The assessment of the tutorial can have different forms, which will be determined during the course, e.g. a seminar talk or a programming task (documented by a report and the source code).

**Workload**

total workload: 240 hours

**Attendance:** 90 h

- lectures and tutorials including the examination

**Self studies:** 150 h

- follow-up and deepening of the course content,
- work on problem sheets and programming tasks
- literature study and internet research on the course content,
- preparation for the module examination
**Recommendation**
Some basic understanding of group theory and programming are strongly recommended.

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

**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-105854 | Computer-Assisted Analytical Methods for Boundary and Eigenvalue Problems | 8 CR | Plum |

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**Economathematics M.Sc.**

Module Handbook as of 04/09/2023
3.30 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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<th>Duration</th>
<th>Level</th>
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<tbody>
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<td>T-MATH-105930</td>
<td>Continuous Time Finance</td>
<td>8 CR</td>
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</tbody>
</table>

Competence Certificate
oral examination of ca. 30 min.

Prerequisites
The module cannot be completed together with "Stochastic Calculus and Finance [T-WIWI-103129]".

Competence Goal
Students are able to
- understand, describe and use fundamental notions and techniques of modern continuous time finance,
- use specific probabilistic techniques,
- analyze mathematically economical questions in option pricing and optimization

Content
- Stochastic processes and filtrations
  - Martingales in continuous time
  - Stopping times
  - Quadratic variation
- Stochastic Ito-Integral w.r.t. continuous semimartingales
- Ito-calculus
  - Ito-Doeblin formula
  - Stochastic exponentials
  - Girsanov theorem
  - Martingale representation
- Black-Scholes financial market
  - Arbitrage and equivalent martingale measures
  - Options and no-arbitrage prices
  - market completeness
- Portfolio optimization
- Bonds, forwards and interest rate models

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

Workload
Total workload: 240 hours
Attendance: 90 h
- lectures, problem classes and examination
Self studies: 150 h
- follow-up and deepening of the course content,
- work on problem sheets
- literature study and internet research on the course content,
- preparation for the module examination
Recommendation
The content of the module „Probability theory” is strongly recommended. The module „Discrete time finance” is recommended.
3.31 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>
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**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

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

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: Data Science: Evidence-based Marketing [M-WIWI-101647]

Responsible: Prof. Dr. Martin Klarmann
Organisation: KIT Department of Economics and Management
Part of: Finance - Risk Management - Managerial Economics

<table>
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<th>Language</th>
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Compulsory Elective Courses (Election: 9 credits)

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<tr>
<td>T-WIWI-107720</td>
<td>Market Research</td>
<td>4,5 CR</td>
<td>Klarmann</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 courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately.

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

Prerequisites
Keine.

Competence Goal
Students
- possess advanced knowledge of relevant market research contents
- know many different qualitative and quantitative methods for measuring customer behavior, preparation of strategic decisions, making causal deductions, usage of social media data and sales forecasting
- possess the statistical skills required for working in marketing research

Content
This module provides in-depth knowledge of relevant quantitative and qualitative methods used in market research. Students can attend the following courses:
- The course “Market Research” provides contents of practical relevance for measuring customer attitudes and customer behavior. The participants learn using statistical methods for strategic decision-making in marketing. Students who are interested in writing their master thesis at the Marketing & Sales Research Group are required to take this course.
- The course “Marketing Analytics” is based on “Market Research” and teaches advanced statistical methods for analyzing relevant marketing and market research questions. Please note that a successful completion of “Market Research” is a prerequisite for the completion of “Marketing Analytics”.

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

Recommendation
None
3.34 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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**Wahlpflichtangebot (Election: 9 credits)**

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<td>Auction Theory</td>
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<td>T-WIWI-102614</td>
<td>Experimental Economics</td>
<td>4,5</td>
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<td>T-WIWI-102861</td>
<td>Advanced Game Theory</td>
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<td>Ehrhart, Puppe, Reiß</td>
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**Competence Certificate**

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

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

**Prerequisites**

None

**Competence Goal**

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

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

**Content**

See German version.

**Workload**

The total workload for this module is approximately 270 hours. For further information see German version.
3.35 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

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**Prerequisites**

None
3.36 Module: Digital Marketing [M-WIWI-106258]

Responsible: Prof. Dr. Ann-Kristin Kupfer
Organisation: KIT Department of Economics and Management
Part of: Finance - Risk Management - Managerial Economics

Mandatory

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T-WIWI-112693 Digital Marketing 4,5 CR Kupfer

Supplementary Courses (Elect: at most 1 item)

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<td>Klar Mann</td>
<td>Each term</td>
<td>2 terms</td>
<td>English</td>
<td>4</td>
<td>1</td>
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</table>

Competence Certificate

The assessment is carried out as partial exams of the core course and further single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately.

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

Prerequisites
None

Competence Goal
Students

- have an advanced knowledge about central marketing contents
- have a fundamental understanding of the marketing instruments
- know current fundamental principles and latest trends in the field of digital marketing
- know and understand several strategic concepts and how to implement them
- are able to implement their extensive marketing knowledge in a practical context
- are able to critically discuss and question theoretical concepts and current practices in marketing
- have theoretical knowledge that is fundamental for writing a master thesis in the field of marketing
- have gained insight into scientific research that prepares them to independently write a master’s thesis
- have the theoretical knowledge and skills necessary to work in or collaborate with the marketing department of a company

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

Workload
Total effort for 9 credit points: approx. 270 hours.
The exact distribution is done according to the credit points of the courses of the module.
### 3.37 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>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Duration</th>
<th>Language</th>
<th>Level</th>
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</table>

**Mandatory**

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

**Prerequisites**

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

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

**Credits** 8
**Grading scale** Grade to a tenth
**Recurrence** Each winter term
**Duration** 1 term
**Level** 4
**Version** 1

**Mandatory**

<table>
<thead>
<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>T-MATH-105839</td>
<td>Discrete Time Finance</td>
<td>8 CR</td>
</tr>
</tbody>
</table>

**Bäuerle, Fasen-Hartmann, Trabs**

**Competence Certificate**

Written exam of 2h.

**Prerequisites**

none

**Competence Goal**

Students are able to

- understand, describe and use fundamental notions and techniques of modern discrete time finance,
- use specific probabilistic techniques,
- analyze mathematically economical questions in discrete option pricing and optimization,
- work self-organized and in a reflective manner.

**Content**

- Finite financial markets
- The Cox-Ross-Rubinstein-model
- Limit to Black-Scholes
- Characterizing no-arbitrage
- Characterizing completeness
- Incomplete markets
- American options
- Exotic options
- Portfolio optimization
- Preferences and stochastic dominance
- Mean-Variance portfolios
- Risk measures

**Module grade calculation**

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

**Workload**

Total workload: 240 hours

- Attendance: 90 h
  - lectures and examination

Self studies: 150 h

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

**Recommendation**

The content of the module „Probability theory“ is strongly recommended.
3.39 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>
<thead>
<tr>
<th>Credits</th>
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<th>Duration</th>
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<th>Type</th>
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<tr>
<td>T-MATH-109001</td>
<td>Dispersive Equations</td>
<td>6</td>
<td>CR</td>
<td>Reichel</td>
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Prerequisites
None
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<tr>
<th>Credits</th>
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<th>Recurrence</th>
<th>Duration</th>
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**Mandatory**

| T-MATH-106114 | Dynamical Systems | 8 CR | Reichel |

**Prerequisites**

none
**3.41 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>Recurrence</th>
<th>Duration</th>
<th>Language</th>
<th>Level</th>
<th>Version</th>
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<td>Each term</td>
<td>1 term</td>
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### Mandatory

- T-WIWI-111388 Applied Econometrics 4,5 CR Schienle

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

- T-WIWI-103064 Financial Econometrics 4,5 CR Schienle
- T-WIWI-103126 Non- and Semiparametrics 4,5 CR Schienle
- T-WIWI-103127 Panel Data 4,5 CR Heller
- T-WIWI-110868 Predictive Modeling 4,5 CR Heller
- T-WIWI-111387 Probabilistic Time Series Forecasting Challenge 4,5 CR Krüger
- T-WIWI-103065 Statistical Modeling of Generalized Regression Models 4,5 CR Schienle
- T-WIWI-110939 Financial Econometrics II 4,5 CR Schienle

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

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

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

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

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

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

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

Election notes

This module will not count towards the degree until the module "Econometrics and Statistics I" has also been successfully completed. If the module "Econometrics and Statistics I" is booked out to the additional examinations, the "Econometrics and Statistics II" module loses its curricular validity/valuation for the degree.

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

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Grading Scale</th>
<th>Responsible</th>
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<tbody>
<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-103124</td>
<td>Multivariate Statistical Methods</td>
<td>4.5 CR</td>
<td>Grothe</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>
<td></td>
</tr>
<tr>
<td>T-WIWI-103128</td>
<td>Portfolio and Asset Liability Management</td>
<td>4.5 CR</td>
<td>Safarian</td>
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<tr>
<td>T-WIWI-110868</td>
<td>Predictive Modeling</td>
<td>4.5 CR</td>
<td>Krüger</td>
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<tr>
<td>T-WIWI-111387</td>
<td>Probabilistic Time Series Forecasting Challenge</td>
<td>4.5 CR</td>
<td>Krüger</td>
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<tr>
<td>T-WIWI-103065</td>
<td>Statistical Modeling of Generalized Regression Models</td>
<td>4.5 CR</td>
<td>Heller</td>
<td></td>
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<tr>
<td>T-WIWI-103129</td>
<td>Stochastic Calculus and Finance</td>
<td>4.5 CR</td>
<td>Safarian</td>
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</tr>
<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 exams (according to Section 4(2), 1-3 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The examinations are offered every semester. Re-examinations are offered at every ordinary examination date. The assessment procedures are described for each course of the module separately.

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

Prerequisites

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

Competence Goal

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

Content

This 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.
### 3.43 Module: Economic Theory and its Application in Finance [M-WIWI-101502]

<table>
<thead>
<tr>
<th>Responsible:</th>
<th>Prof. Dr. Kay Matusch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organisation:</td>
<td>KIT Department of Economics and Management</td>
</tr>
<tr>
<td>Part of:</td>
<td>Finance - Risk Management - Managerial Economics Elective Field</td>
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<table>
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<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Duration</th>
<th>Language</th>
<th>Level</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Grade to a tenth</td>
<td>Each term</td>
<td>1 term</td>
<td>German/English</td>
<td>4</td>
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#### Compulsory Elective Courses (Election: 1 item)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
<th>Instructor(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T-WIWI-102609</td>
<td>Advanced Topics in Economic Theory</td>
<td>4,5 CR</td>
<td>Mitusch</td>
</tr>
<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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</table>

#### Supplementary Courses (Election: )

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
<th>Instructor(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T-WIWI-102647</td>
<td>Asset Pricing</td>
<td>4,5 CR</td>
<td>Ruckes, Uhrig-Homburg</td>
</tr>
<tr>
<td>T-WIWI-102622</td>
<td>Corporate Financial Policy</td>
<td>4,5 CR</td>
<td>Ruckes</td>
</tr>
<tr>
<td>T-WIWI-109050</td>
<td>Corporate Risk Management</td>
<td>4,5 CR</td>
<td>Ruckes</td>
</tr>
<tr>
<td>T-WIWI-102623</td>
<td>Financial Intermediation</td>
<td>4,5 CR</td>
<td>Ruckes</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 exams are offered at the beginning of the recess period about the subject matter of the latest held lecture. Re-examinations are offered at every ordinary examination date. The assessment procedures are described for each course of the module separately. The overall grade for the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

#### Prerequisites

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

#### Competence Goal

The students

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

#### Content

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

#### Workload

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

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

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

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

**Elective Field**

<table>
<thead>
<tr>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Duration</th>
<th>Language</th>
<th>Level</th>
<th>Version</th>
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<tbody>
<tr>
<td>9</td>
<td>Grade to a tenth</td>
<td>Each term</td>
<td>1 term</td>
<td>German</td>
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**Compulsory Elective Courses (Electing: at least 9 credits)**

<table>
<thead>
<tr>
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<th>Course Name</th>
<th>Credits</th>
<th>Grading</th>
<th>Lecturer</th>
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<tr>
<td>T-WIWI-107501</td>
<td>Energy Market Engineering</td>
<td>4,5</td>
<td>CR</td>
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<tr>
<td>T-WIWI-107503</td>
<td>Energy Networks and Regulation</td>
<td>4,5</td>
<td>CR</td>
<td>Weinhardt</td>
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<tr>
<td>T-WIWI-107504</td>
<td>Smart Grid Applications</td>
<td>4,5</td>
<td>CR</td>
<td>Weinhardt</td>
</tr>
<tr>
<td>T-WIWI-109940</td>
<td>Special Topics in Information Systems</td>
<td>4,5</td>
<td>CR</td>
<td>Weinhardt</td>
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</table>

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

**Prerequisites**
None.

**Compétence Goal**
The student

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

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

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

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

**Responsible:** Prof. Dr. Wolf Fichtner

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

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

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

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<th>Grading</th>
<th>Instructor</th>
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<tr>
<td>T-WIWI-107043</td>
<td>Liberalised Power Markets</td>
<td>5.5 CR</td>
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**Supplementary Courses (Election: at least 6 credits)**

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<tbody>
<tr>
<td>T-WIWI-107501</td>
<td>Energy Market Engineering</td>
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<tr>
<td>T-WIWI-112151</td>
<td>Energy Trading and Risk Management</td>
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<tr>
<td>T-WIWI-108016</td>
<td>Simulation Game in Energy Economics</td>
<td>3.5 CR</td>
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<tr>
<td>T-WIWI-107446</td>
<td>Quantitative Methods in Energy Economics</td>
<td>3.5 CR</td>
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<tr>
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<td>Regulation Theory and Practice</td>
<td>4.5 CR</td>
<td>Mitusch</td>
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**Competence Certificate**
The assessment is carried out as partial written exams (according to Section 4(2), 1 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The examinations take place every semester. Re-examinations are offered at every ordinary examination date. The assessment procedures are described for each course of the module separately.

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

**Prerequisites**
The lecture Liberalised Power Markets has to be examined.

**Competence Goal**
The student

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

**Content**
Liberalised Power Markets: The European liberalisation process, energy markets, pricing, market failure, investment incentives, market power

Energy Trade and Risk Management: trade centres, trade products, market mechanisms, position and risk management

Simulation Game in Energy Economics: Simulation of the German electricity system

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

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

**Responsible:** Prof. Dr. Wolf Fichtner

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

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

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

<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Duration</th>
<th>Language</th>
<th>Level</th>
<th>Version</th>
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<tr>
<td>T-WIWI-102793</td>
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<td>3.5 CR</td>
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<tr>
<td>T-WIWI-102650</td>
<td>Energy and Environment</td>
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<td>German/English</td>
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<tr>
<td>T-WIWI-102830</td>
<td>Energy Systems Analysis</td>
<td>3 CR</td>
<td>Grade to a tenth</td>
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<td>German/English</td>
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<td>T-WIWI-113073</td>
<td>Machine Learning and Optimization in Energy Systems</td>
<td>3.5 CR</td>
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<td>German/English</td>
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<tr>
<td>T-WIWI-107464</td>
<td>Smart Energy Infrastructure</td>
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<td>German/English</td>
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<tr>
<td>T-WIWI-102695</td>
<td>Heat Economy</td>
<td>3.5 CR</td>
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<td></td>
<td></td>
<td>German/English</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

**Prerequisites**

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

**Competence Goal**

The student

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

**Content**

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

**Workload**

The total workload for this module is approximately 270 hours. For further information see German version.
### 3.47 Module: Ergodic Theory [M-MATH-106473]

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

<table>
<thead>
<tr>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Duration</th>
<th>Language</th>
<th>Level</th>
<th>Version</th>
</tr>
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<tbody>
<tr>
<td>8</td>
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<td>Irregular</td>
<td>1 term</td>
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**Mandatory**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
<th>CR Link</th>
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<tbody>
<tr>
<td>T-MATH-113086</td>
<td>Ergodic Theory</td>
<td>8</td>
<td>Link</td>
</tr>
</tbody>
</table>

**Competence Certificate**

Oral examination of ca. 20-30 minutes.

**Prerequisites**

None

**Competence Goal**

Students

- know important examples of dynamical systems,
- can state and discuss substantial concepts of ergodic theory,
- can state important results on qualitative properties of dynamical systems and relate them,
- are prepared to read recent research articles and write a bachelor or master thesis in the field of ergodic theory.

**Content**

- Elementary examples of dynamical systems such as Bernoulli systems and billiards
- Poincare rekurrence and ergodic theorems
- mixing, weak mixing, equidistribution
- entropy
- advanced topic(s) (as for example hyperbolic dynamics, symbolic dynamics and coding, Furstenberg correspondence principle or unitary representations of SL(2,R))

**Module grade calculation**

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

**Workload**

Total workload: 240 hours  
Attendance: 90 h

- lectures, problem classes and examination

Self studies: 150 h

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

**Recommendation**

Some basic knowledge of measure theory, topology, geometry, group theory and functional analysis is recommended.
Module: Evolution Equations [M-MATH-102872]

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

**Credits**: 8  
**Grading scale**: Grade to a tenth  
**Recurrence**: see Annotations  
**Duration**: 1 term  
**Language**: German/English  
**Level**: 4  
**Version**: 1

<table>
<thead>
<tr>
<th>Mandatory</th>
<th>Evolution Equations</th>
<th>8 CR</th>
<th>Frey, Kunstmann, Schnaubelt</th>
</tr>
</thead>
</table>

**Competence Certificate**  
Oral examination of ca. 30 minutes.

**Prerequisites**  
none

**Competence Goal**  
The students can explain the basics of the theory of strongly continuous operator semigroups and their generators, in particular the theorems on generation and wellposedness, and they can apply it to examples.  
- can also describe and use the solution and regularity theory of inhomogeneous Cauchy problems.  
- are able to construct analytic semigroups and to characterize their generators. Using these results and perturbations theorems, they can solve partial differential equations.  
- are able to explain main aspects of approximation theory of evolution equations.  
- can discuss the core statements of stability and spectral theory of operator semigroups and discuss examples by means of them.  
- have mastered the important techniques for proofs in evolution equations and are able to, at least, sketch the complicated proofs.

**Content**  
- strongly continuous operator semigroups and their generators,  
- generation results and wellposedness,  
- inhomogeneous Cauchy problems,  
- analytic semigroups,  
- perturbation and approximation theory,  
- stability and spectral theory of operator semigroups,  
- applications to partial differential equations

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

**Annotation**  
Regular cycle: every 2nd year. The module "Nonlinear Evolution Equations" is based on "Evolution Equations"
Workload
Total workload: 240 hours
Attendance: 90 h
- lectures, problem classes and examination

Self studies: 150 h
- follow-up and deepening of the course content,
- work on problem sheets,
- literature study and internet research on the course content,
- preparation for the module examination

Recommendation
The module “Functional Analysis” is strongly recommended.

Literature
K.-J. Engel und R. Nagel, One-Parameter Semigroups for Linear Evolution Equations.
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**

<table>
<thead>
<tr>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Duration</th>
<th>Language</th>
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**Compulsory Elective Courses (Election: 2 items)**

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<tr>
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<td>Experimental Economics</td>
<td>4.5 CR</td>
<td>Weinhardt</td>
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<tr>
<td>T-WIWI-105781</td>
<td>Incentives in Organizations</td>
<td>4.5 CR</td>
<td>Nieken</td>
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<tr>
<td>T-WIWI-102862</td>
<td>Predictive Mechanism and Market Design</td>
<td>4.5 CR</td>
<td>Reiß</td>
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<tr>
<td>T-WIWI-102863</td>
<td>Topics in Experimental Economics</td>
<td>4.5 CR</td>
<td>Reiß</td>
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</tbody>
</table>

**Competence Certificate**

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

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

**Prerequisites**

None.

**Competence Goal**

Students

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

**Content**

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

**Annotation**

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

**Workload**

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

**Recommendation**

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

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

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

Mandatory
T-MATH-107475 Exponential Integrators

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.
3.51 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>
<thead>
<tr>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Duration</th>
<th>Language</th>
<th>Level</th>
<th>Version</th>
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<tbody>
<tr>
<td>4</td>
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<td>Irregular</td>
<td>1 term</td>
<td>English</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

Mandatory

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

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

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

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

Annotation
Course is held in English

Recommendation
Basic knowledge of linear algebra, analysis and graph theory is recommended.
3.52 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**

<table>
<thead>
<tr>
<th>Credits</th>
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<th>Duration</th>
<th>Level</th>
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<td>Irregular</td>
<td>1 term</td>
<td>4</td>
<td>2</td>
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</tbody>
</table>

**Mandatory**

| T-MATH-105908 | Extreme Value Theory | 4 CR | Fasen-Hartmann |

**Prerequisites**

None
### 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>
<thead>
<tr>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Duration</th>
<th>Language</th>
<th>Level</th>
<th>Version</th>
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</thead>
<tbody>
<tr>
<td>9</td>
<td>Grade to a tenth</td>
<td>Each term</td>
<td>1 term</td>
<td>German/English</td>
<td>4</td>
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</table>

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

<table>
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<th>Course Title</th>
<th>Credits</th>
<th>Lecturer</th>
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</thead>
<tbody>
<tr>
<td>T-WIWI-102643</td>
<td>Derivatives</td>
<td>4.5 CR</td>
<td>Uhrig-Homburg</td>
</tr>
<tr>
<td>T-WIWI-102621</td>
<td>Valuation</td>
<td>4.5 CR</td>
<td>Ruckes</td>
</tr>
<tr>
<td>T-WIWI-102647</td>
<td>Asset Pricing</td>
<td>4.5 CR</td>
<td>Ruckes, Uhrig-Homburg</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.

**Prerequisites**
None

**Competence Goal**
The student

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

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

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

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

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

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

<table>
<thead>
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<th>Grading scale</th>
<th>Recurrence</th>
<th>Duration</th>
<th>Language</th>
<th>Level</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Grade to a tenth</td>
<td>Each term</td>
<td>1 term</td>
<td>German/English</td>
<td>4</td>
<td>8</td>
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</table>

**Election notes**

This module will not count towards the degree until the module Finance 1 has also been successfully completed. If the module Finance 1 is booked out to the additional examinations, the Finance 2 module loses its curricular validity/valuation for the degree.

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

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
<th>Responsible</th>
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<tbody>
<tr>
<td>T-WIWI-110513</td>
<td>Advanced Empirical Asset Pricing</td>
<td>4,5 CR</td>
<td>Thimme</td>
</tr>
<tr>
<td>T-WIWI-102647</td>
<td>Asset Pricing</td>
<td>4,5 CR</td>
<td>Ruckes, Uhrig-Homburg</td>
</tr>
<tr>
<td>T-WIWI-108880</td>
<td>Blockchains &amp; Cryptofinance</td>
<td>4,5 CR</td>
<td>Schuster, Uhrig-Homburg</td>
</tr>
<tr>
<td>T-WIWI-110995</td>
<td>Bond Markets</td>
<td>4,5 CR</td>
<td>Uhrig-Homburg</td>
</tr>
<tr>
<td>T-WIWI-110997</td>
<td>Bond Markets - Models &amp; Derivatives</td>
<td>3 CR</td>
<td>Uhrig-Homburg</td>
</tr>
<tr>
<td>T-WIWI-110996</td>
<td>Bond Markets - Tools &amp; Applications</td>
<td>1,5 CR</td>
<td>Uhrig-Homburg</td>
</tr>
<tr>
<td>T-WIWI-102622</td>
<td>Corporate Financial Policy</td>
<td>4,5 CR</td>
<td>Ruckes</td>
</tr>
<tr>
<td>T-WIWI-109050</td>
<td>Corporate Risk Management</td>
<td>4,5 CR</td>
<td>Ruckes</td>
</tr>
<tr>
<td>T-WIWI-102643</td>
<td>Derivatives</td>
<td>4,5 CR</td>
<td>Uhrig-Homburg</td>
</tr>
<tr>
<td>T-WIWI-110797</td>
<td>eFinance: Information Systems for Securities Trading</td>
<td>4,5 CR</td>
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<td>Financial Analysis</td>
<td>4,5 CR</td>
<td>Luedecke</td>
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<td>Financial Intermediation</td>
<td>4,5 CR</td>
<td>Ruckes</td>
</tr>
<tr>
<td>T-WIWI-102626</td>
<td>Business Strategies of Banks</td>
<td>3 CR</td>
<td>Müller</td>
</tr>
<tr>
<td>T-WIWI-102646</td>
<td>International Finance</td>
<td>3 CR</td>
<td>Uhrig-Homburg</td>
</tr>
<tr>
<td>T-WIWI-110511</td>
<td>Strategic Finance and Technology Change</td>
<td>1,5 CR</td>
<td>Ruckes</td>
</tr>
<tr>
<td>T-WIWI-102621</td>
<td>Valuation</td>
<td>4,5 CR</td>
<td>Ruckes</td>
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</table>

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

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

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

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

**Content**
The module Finance 2 is based on the module Finance 1. The courses of this module equip the students with advanced skills in economics and methodology in the field of modern finance on a broad basis.
Annotation
The courses eFinance: Information Engineering and Management for Securities Trading [2540454] and Financial Analysis [2530205] can be chosen from summer term 2015 on.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.
### 3.55 Module: Finance 3 [M-WIWI-101480]

**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 | Grade to a tenth | Recurrence | Duration | Language | Level | Version
--- | --- | --- | --- | --- | --- | ---
9 |  |  |  |  | 4 | 8

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

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>T-WIWI-110513</td>
<td>Advanced Empirical Asset Pricing</td>
<td>4.5 CR</td>
<td>Thimme</td>
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<td>T-WIWI-102647</td>
<td>Asset Pricing</td>
<td>4.5 CR</td>
<td>Ruckes, Uhrig-Homburg</td>
</tr>
<tr>
<td>T-WIWI-108880</td>
<td>Blockchains &amp; Cryptofinance</td>
<td>4.5 CR</td>
<td>Schuster, Uhrig-Homburg</td>
</tr>
<tr>
<td>T-WIWI-110995</td>
<td>Bond Markets</td>
<td>4.5 CR</td>
<td>Uhrig-Homburg</td>
</tr>
<tr>
<td>T-WIWI-110997</td>
<td>Bond Markets - Models &amp; Derivatives</td>
<td>3 CR</td>
<td>Uhrig-Homburg</td>
</tr>
<tr>
<td>T-WIWI-110996</td>
<td>Bond Markets - Tools &amp; Applications</td>
<td>1.5 CR</td>
<td>Uhrig-Homburg</td>
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<td>T-WIWI-102622</td>
<td>Corporate Financial Policy</td>
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<td>Ruckes</td>
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<td>Corporate Risk Management</td>
<td>4.5 CR</td>
<td>Ruckes</td>
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<td>T-WIWI-102643</td>
<td>Derivatives</td>
<td>4.5 CR</td>
<td>Uhrig-Homburg</td>
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<td>T-WIWI-110797</td>
<td>eFinance: Information Systems for Securities Trading</td>
<td>4.5 CR</td>
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<td>Financial Intermediation</td>
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<td>T-WIWI-102626</td>
<td>Business Strategies of Banks</td>
<td>3 CR</td>
<td>Müller</td>
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<td>International Finance</td>
<td>3 CR</td>
<td>Uhrig-Homburg</td>
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<td>T-WIWI-110511</td>
<td>Strategic Finance and Technology Change</td>
<td>1.5 CR</td>
<td>Ruckes</td>
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<td>Valuation</td>
<td>4.5 CR</td>
<td>Ruckes</td>
</tr>
<tr>
<td>T-WIWI-110933</td>
<td>Web App Programming for Finance</td>
<td>4.5 CR</td>
<td>Thimme</td>
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### Competence Certificate
The assessment is carried out as partial exams (according to Section 4(2), 1 or 2 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately.

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

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

### Competence Goal
The student is in a position to discuss, analyze and provide answers to advanced economic and methodological issues in the field of modern finance.
Content
The courses of this module equip the students with advanced skills in economics and methodology in the field of modern finance on a broad basis.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.
3.56 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

<table>
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<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Duration</th>
<th>Level</th>
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<td>Each winter term</td>
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**Mandatory**

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<tr>
<td>T-MATH-105857</td>
<td>Finite Element Methods</td>
<td>8 CR</td>
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Dörfler, Hochbruck, Jahnke, Rieder, Wieners
Module: Forecasting: Theory and Practice [M-MATH-102956]

**Responsible:** Prof. Dr. Tilmann Gneiting

**Organisation:** KIT Department of Mathematics

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

**Elective Field**

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**Mandatory**

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

**Prerequisites**

None

**Annotation**

- Regular cycle: every 2nd year, starting winter semester 16/17
- Course is held in English
Competence Certificate
Due to the professor's research sabbatical, the BSc module “Financial Data Science” and MSc module “Foundations for Advanced Financial -Quant and -Machine Learning Research” and the MSc module “Advanced Machine Learning and Data Science” along with the respective examinations will not be offered in SS2023. Bachelor and Master thesis projects are not affected and will be supervised.

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

The module-wide exam (all 4 worksheets) must be taken in the same semester.

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

Competence Goal
This MSc module teaches students fundamental stats and analytics concepts, as well necessary financial economic intuition, necessary to identify, design and execute interesting research questions in quant finance and financial machine learning.

Topics include: Maximum Likelihood learning of arma-garch models, expectation maximization learning applied to stochastic volatility and valuation models, Kalman filter techniques to learn latent states, estimation of affine jump diffusion models with options and higher-order moments, stochastic calculus, dynamic modeling of asset markets (bond, equity, options), equilibrium determination of risk premiums, risk premiums for higher moment risk, risk decomposition (fundamental vs idiosyncratic), option-implied return distributions, mixture-density-networks and neural nets.

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

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

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

<table>
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Mandatory

| T-MATH-107044 | Foundations of Continuum Mechanics | 3 CR | Wieners |

Prerequisites

none
### 3.60 Module: Fourier Analysis and its Applications to PDEs [M-MATH-104827]

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

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**Mandatory**

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

**Prerequisites**  
None
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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**Mandatory**

| T-MATH-111296 | Fractal Geometry | 6 CR | Winter |

**Prerequisites**

None
3.62 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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**Mandatory**

| T-MATH-102255 | Functional Analysis | 8 CR | Frey, Herzog, Hundertmark, Lamm, Liao, Reichel, Schnaubelt, Tolksdorf |

**Competence Certificate**

Written examination of 120 minutes.

**Prerequisites**

None

**Competence Goal**

The students can

- explain basic topological concepts such as compactness in the framework of metric spaces, and are able to apply these in examples.
- describe the structure of Hilbert spaces and can use them in applications.
- explain the principle of uniform boundedness, the open mapping theorem and the Hahn-Banach theorem, and are able to derive conclusions from them.
- describe the concepts of dual Banach spaces, in particular weak convergence, reflexivity and the Banach-Alaoglu theorem. They can discuss these concepts in examples.
- explain the spectral theorem for compact self-adjoint operators.
- come up with a proof for simple functional analytic statements.

**Content**

- Metric spaces (basic topological concepts, compactness),
- Hilbert spaces, Orthonormal bases, Sobolev spaces,
- Continuous linear operators on Banach spaces (principle of uniform boundedness, open mapping theorem),
- Dual spaces and representations, Hahn-Banach theorem, Banach-Alaoglu theorem, weak convergence, reflexivity,
- Spectral theorem for compact self-adjoint operators.

**Module grade calculation**

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

**Workload**

Total workload: 240 hours

Attendance: 90 h

- lectures, problem classes and examination

Self studies: 150 h

- follow-up and deepening of the course content,
- work on problem sheets,
- literature study and internet research on the course content,
- preparation for the module examination
Module: Functional Data Analysis [M-MATH-106485]

**Responsible:** Dr. rer. nat. Bruno Ebner

**Organisation:** KIT Department of Mathematics

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

**Elective Field**

**Credits:** 4

**Grading scale:** Grade to a tenth

**Recurrence:** Irregular

**Duration:** 1 term

**Language:** English

**Level:** 4

**Version:** 2

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### Mandatory

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<td>4 CR</td>
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### Competence Certificate

Oral examination of ca. 25 minutes.

### Prerequisites

None

### Competence Goal

The aim of the course is to give an introduction to weak convergence concepts in metric spaces and to highlight some statistical applications.

After successful participation students can

- model random elements in metric spaces,
- explain the concept of weak convergence in metric spaces and are familiar with structural problems in this context,
- apply limit laws for functionals of the empirical distribution function,
- model the normal distribution for random elements in Hilbert spaces,
- derive limit distributions of L2 type goodness-of-fit statistics,
- apply goodness-of-fit tests to functional data.

### Content

- Theorem of Glivenko-Cantelli,
- weak convergence in metric spaces,
- Theorem of Prokhorov,
- Gaussian Processes,
- Donsker’s Theorem,
- functional central limit theorem,
- empirical processes,
- random elements in separable Hilbert spaces,
- Goodness-of-fit tests.

### Module grade calculation

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

### Workload

Total workload: 120 hours

- Attendance: 45 h
  - lectures and examination

- Self studies: 75 h
  - follow-up and deepening of the course content,
  - literature study and internet research on the course content,
  - preparation for the module examination

### Recommendation

The contents of the modules "Probability Theory" and "Mathematical Statistics" are strongly recommended.
### 3.64 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
3.65 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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Mandatory

| T-MATH-105905 | Functions of Operators | 6 CR |
### 3.66 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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**Mandatory**

| T-MATH-105870 | Generalized Regression Models | 4 CR | Ebner, Fasen-Hartmann, Klar, Trabs |

**Prerequisites**

None
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<th>Prof. Dr. Roman Sauer</th>
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**Credits**: 8  
**Grading scale**: Grade to a tenth  
**Recurrence**: Irregular  
**Duration**: 1 term  
**Level**: 4  
**Version**: 1

### Mandatory

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Herrlich, Leuzinger, Link, Llosa Isenrich, Sauer, Tuschmann
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**

none
3.69 Module: Geometry of Schemes [M-MATH-102866]

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

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Mandatory

| T-MATH-105841 | Geometry of Schemes | 8 CR | Herrlich, Kühnlein |

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Economathematics M.Sc.
Module Handbook as of 04/09/2023
3.70 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
3 MODULES

3.71 Module: Graph Theory [M-MATH-101336]

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

**Organisation:** KIT Department of Mathematics

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

**Elective Field**

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**Competence Certificate**

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

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

**Prerequisites**

None

**Competence Goal**

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

**Content**

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

**Annotation**

- Regular cycle: every 2nd year, winter semester
- Course is held in English
3.72 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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**Prerequisites**

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

**Responsible:** Prof. Dr. Ingrid Ott

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

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

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

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<td>4,5 CR</td>
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<td>T-WIWI-112816</td>
<td>Growth and Development</td>
<td>4,5 CR</td>
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<td>Spatial Economics</td>
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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.

**Prerequisites**

None

**Competence Goal**

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

**Content**

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

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

**Workload**

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

**Recommendation**

Attendance of the course Introduction Economic Policy [2560280] is recommended.

Successful completion of the courses Economics I: Microeconomics and Economics II: Macroeconomics is required.
3.74 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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**Mandatory**

| T-MATH-111289 | Harmonic Analysis | 8 CR | Frey, Kunstmann, Schnaubelt, Tolksdorf |

**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: Harmonic Analysis 2 [M-MATH-106486]

Responsible: Prof. Dr. Dorothee Frey

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
Language German
Level 4
Version 1

Mandatory

<table>
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<tr>
<th>T-MATH-113103</th>
<th>Harmonic Analysis 2</th>
<th>8 CR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frey, Kunstmann, Tolksdorf</td>
<td></td>
</tr>
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</table>

Competence Certificate
Oral examination of ca. 30 minutes.

Prerequisites
None

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

Workload
Total workload: 240 hours
Attendance: 90 h
- lectures, problem classes and examination

Self studies: 150 h
- follow-up and deepening of the course content,
- work on problem sheets,
- literature study and internet research on the course content,
- preparation for the module examination

Recommendation
The following modules are strongly recommended: "Harmonic Analysis", "Functional Analysis".
### 3.76 Module: Homotopy Theory [M-MATH-102959]

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

<table>
<thead>
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<th>Duration</th>
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<th>Homotopy Theory</th>
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<th>Sauer</th>
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Economathematics M.Sc.  
Module Handbook as of 04/09/2023  
106
### 3.77 Module: Informatics [M-WIWI-101472]

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

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

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

**Elective Field**

<table>
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<tr>
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#### Compulsory Elective Area (Election: )

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<tr>
<td>T-WIWI-102680</td>
<td>Computational Economics</td>
<td>4,5 CR</td>
<td>Shukla</td>
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<tr>
<td>T-WIWI-112690</td>
<td>Cooperative Autonomous Vehicles</td>
<td>4,5 CR</td>
<td>Vinel</td>
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<td>T-WIWI-109248</td>
<td>Critical Information Infrastructures</td>
<td>4,5 CR</td>
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<td>T-WIWI-109246</td>
<td>Digital Health</td>
<td>4,5 CR</td>
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<tr>
<td>T-WIWI-109270</td>
<td>Human Factors in Security and Privacy</td>
<td>4,5 CR</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>Supplement Software- and Systemsengineering</td>
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<td>Information Service Engineering</td>
<td>4,5 CR</td>
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<td>T-WIWI-102666</td>
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<td>4,5 CR</td>
<td>Färber</td>
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<td>T-WIWI-112599</td>
<td>Management of IT-Projects</td>
<td>4,5 CR</td>
<td>Schätzle</td>
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<td>T-WIWI-106340</td>
<td>Machine Learning 1 - Basic Methods</td>
<td>4,5 CR</td>
<td>Zöllner</td>
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<td>T-WIWI-106341</td>
<td>Machine Learning 2 – Advanced Methods</td>
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<td>T-WIWI-111265</td>
<td>Modeling and Simulation</td>
<td>4,5 CR</td>
<td>Lazarova-Molnar</td>
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<td>T-WIWI-102697</td>
<td>Business Process Modelling</td>
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<td>T-WIWI-102679</td>
<td>Nature-Inspired Optimization Methods</td>
<td>4,5 CR</td>
<td>Shukla</td>
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<td>T-WIWI-109799</td>
<td>Process Mining</td>
<td>4,5 CR</td>
<td>Oberweis</td>
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<tr>
<td>T-WIWI-110848</td>
<td>Semantic Web Technologies</td>
<td>4,5 CR</td>
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<tr>
<td>T-WIWI-102895</td>
<td>Software Quality Management</td>
<td>4,5 CR</td>
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#### Seminars and Advanced Labs (Election: between 0 and 1 items)

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<tr>
<td>T-WIWI-110144</td>
<td>Emerging Trends in Digital Health</td>
<td>4,5 CR</td>
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<tr>
<td>T-WIWI-110143</td>
<td>Emerging Trends in Internet Technologies</td>
<td>4,5 CR</td>
<td>Sunyaev</td>
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<tr>
<td>T-WIWI-109249</td>
<td>Sociotechnical Information Systems Development</td>
<td>4,5 CR</td>
<td>Sunyaev</td>
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<tr>
<td>T-WIWI-111126</td>
<td>Advanced Lab Blockchain Hackathon (Master)</td>
<td>4,5 CR</td>
<td>Sunyaev</td>
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<tr>
<td>T-WIWI-111125</td>
<td>Advanced Lab Sociotechnical Information Systems Development (Master)</td>
<td>4,5 CR</td>
<td>Sunyaev</td>
</tr>
<tr>
<td>T-WIWI-110548</td>
<td>Advanced Lab Informatics (Master)</td>
<td>4,5 CR</td>
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<tr>
<td>T-WIWI-112914</td>
<td>Advanced Lab Realization of Innovative Services (Master)</td>
<td>4,5 CR</td>
<td>Oberweis</td>
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<tr>
<td>T-WIWI-108439</td>
<td>Advanced Lab Security, Usability and Society</td>
<td>4,5 CR</td>
<td>Volkamer</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>
<td>5 CR</td>
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</table>
Competence Certificate
The assessment is carried out as partial exams of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. For passing the module exam in every singled partial exam the respective minimum requirements has to be achieved.

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

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

Prerequisites
It is only allowed to choose one lab.

Competence Goal
The student

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

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

Workload
The total workload for this module is approximately 270 hours. The total number of hours per course is calculated from the time required to attend the lectures and exercises, as well as the examination times and the time required for an average student to achieve the learning objectives of the module.
3.78 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

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

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<th>Course Name</th>
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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>
</tr>
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</table>

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

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

**Prerequisites**
None

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

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

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

**Annotation**
New module starting summer term 2018.

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

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

Credits: 9
Grading scale: Grade to a tenth
Recurrence: Each term
Duration: 1 term
Language: German/English
Level: 4
Version: 5

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

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<th>Recurrence</th>
<th>Duration</th>
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<th>Level</th>
<th>Version</th>
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<td>T-WIWI-109194</td>
<td>Dynamic Macroeconomics</td>
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<td>T-WIWI-112822</td>
<td>Economics of Innovation</td>
<td>4,5 CR</td>
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<td>T-WIWI-112816</td>
<td>Growth and Development</td>
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Competence Certificate
The assessment is carried out as partial written exams (according to Section 4(2), 1 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The exams are offered at the beginning of the recess period about the subject matter of the latest held lecture. Re-examinations are offered at every ordinary examination date. The assessment procedures are described for each course of the module separately.

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

Prerequisites
None

Competence Goal
Students shall be given the ability to

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

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

Workload
Total expenditure of time for 9 credits: 270 hours

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

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

Recommendation
Basic knowledge of micro- and macroeconomics is assumed, as taught in the courses Economics I [2600012], and Economics II [2600014]. In addition, an interest in quantitative-mathematical modeling is required.
M 3.80 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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<th>Credits</th>
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<tr>
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<th>Integral Equations</th>
<th>8 CR</th>
<th>Arens, Griesmaier, Hettlich</th>
</tr>
</thead>
</table>
Module: Introduction into Particulate Flows [M-MATH-102943]

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

**Organisation:** KIT Department of Mathematics

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

**Elective Field:**

<table>
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<td>Introduction into Particulate Flows</td>
<td>3 CR</td>
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**Prerequisites**

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

<table>
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<th>Prof. Dr. Tobias Hartnick</th>
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</table>

**Prerequisites**

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

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

<table>
<thead>
<tr>
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<th>Recurrence</th>
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Mandatory

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

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

Prerequisites
none

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

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

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

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

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

Workload
Total workload: 90 hours
Attendance: 30 h

- lectures and examination

Self studies: 60 h

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

Recommendation
The modules "Classical Methods for Partial Differential Equations" and "Functional Analysis" are recommended.
### 3.84 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>
<thead>
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<th>Recurrence</th>
<th>Duration</th>
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**Mandatory**

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

**Prerequisites**  
None

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

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

**Content**  
Mathematical description and analysis of fluid dynamics:

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

**Recommendation**  
Partial Differential Equations
Module: Introduction to Fluid Mechanics [M-MATH-106401]

Responsible: TT-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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<th>Recurrence</th>
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<th>Version</th>
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<td>1 term</td>
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Mandatory

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<tbody>
<tr>
<td>T-MATH-112927</td>
<td>Introduction to Fluid Mechanics</td>
<td>6 CR</td>
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</tbody>
</table>

Competence Certificate

The module examination takes the form of an oral examination of approx. 25 minutes.

Prerequisites

None

Competence Goal

Graduates can

- recognize the essential formulations of the partial differential equations in fluid mechanics and explain them using examples,
- use techniques to describe the weak and strong solutions for the Euler and Navier-Stokes equations, and show the existence, uniqueness and regularity results,
- name the special difficulties in the three-dimensional case,
- understand the concept of stratification and explain it using concrete examples.

Content

- Derivation of models, modeling
- Euler equations, Navier-Stokes equations
- Biot-Savart law, Leray-Hopf decomposition
- Wellposedness results
- Regularity results

Module grade calculation

The module grade is the grade of the oral exam.

Workload

total work load: 180 hours

Recommendation

The module *Functional Analysis* is strongly recommended.
<table>
<thead>
<tr>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Duration</th>
<th>Level</th>
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**Mandatory**

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<tbody>
<tr>
<td>T-MATH-105918</td>
<td>Introduction to Geometric Measure Theory</td>
<td>6 CR</td>
<td>Winter</td>
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</table>

**Prerequisites**

none
3.87 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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<tr>
<td>T-MATH-110323</td>
<td>Introduction to Homogeneous Dynamics</td>
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<td>Hartnick</td>
</tr>
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</table>

Prerequisites
None
3.88 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**

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<th>Credits</th>
<th>Grading scale</th>
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**Mandatory**

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

**Competence Certificate**

oral examination of circa 30 minutes

**Prerequisites**

none

**Competence Goal**

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

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

**Content**

Mathematical description and analysis of kinetic transport equations:

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

**Module grade calculation**

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

**Workload**

Total workload: 90 h

Attendance: 30 h

- lectures and examination

Self studies: 60 h

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

**Recommendation**

The course "Classical Methods for Partial Differential Equations" should be studied beforehand.
3.89 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

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

Mandatory

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<th>Course Name</th>
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<tbody>
<tr>
<td>T-MATH-108013</td>
<td>Introduction to Kinetic Theory</td>
<td>4 CR</td>
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</table>

Prerequisites
None

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

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

Recommendation
Partial Differential Equations, Functional Analysis
Module: Introduction to Microlocal Analysis [M-MATH-105838]

**Responsible:** TT-Prof. Dr. Xian Liao

**Organisation:** KIT Department of Mathematics

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

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

**Prerequisites**
none

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

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

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

**Workload**
Total workload: 90 h

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

**Recommendation**
The following courses should be studied beforehand: "Classical Methods for Partial Differential Equations" and "Functional Analysis".
# 3.91 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>
<td>8 CR Dörfler, Hochbruck, Jahnke, Rieder, Wieners</td>
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</table>

**Prerequisites**

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

### Responsible
Prof. Dr. Mathias Trabs

### Organisation
KIT Department of Mathematics

### Part of
Mathematical Methods (Stochastics)
    - Elective Field

### Credits
4

### Grading scale
Grade to a tenth

### Recurrence
Irregular

### Duration
1 term

### Language
English

### Level
4

### Version
1

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<td>Introduction to Stochastic Differential Equations</td>
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#### Competence Certificate
The module will be completed with an oral exam (approx. 30 min).

#### Prerequisites
none

#### Competence Goal
The students will

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

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

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

#### Workload
Total workload: 120 hours

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

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

**Organisation:** KIT Department of Mathematics

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

**Elective Field**

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<th>Inverse Problems</th>
<th>8 CR</th>
<th>Arens, Griesmaier, Hettlich, Rieder</th>
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</table>
## M 3.94 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

<table>
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<td>Key Moments in Geometry</td>
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**Prerequisites**  
None
### 3.95 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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<th>Kammeyer, Sauer</th>
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</thead>
</table>

**Prerequisites**  
none
### 3.96 Module: Lie Groups and Lie Algebras [M-MATH-104261]

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

<table>
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<td>T-MATH-108799</td>
<td>Lie Groups and Lie Algebras</td>
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Hartnick, Leuzinger
3.97 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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<tr>
<td>T-MATH-111723</td>
<td>Lie-Algebras (Linear Algebra 3)</td>
<td>8 CR</td>
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</table>
3.98 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

**Elective Field**

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

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<th>Course Title</th>
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<th>Lecturer(s)</th>
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<td>Digital Marketing</td>
<td>4,5 CR</td>
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<td>T-WIWI-111099</td>
<td>Judgement and Decision Making</td>
<td>4,5 CR</td>
<td>Scheibehenne</td>
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<td>T-WIWI-107720</td>
<td>Market Research</td>
<td>4,5 CR</td>
<td>Klarmann</td>
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<tr>
<td>T-WIWI-111848</td>
<td>Online Concepts for Karlsruhe City Retailers</td>
<td>3 CR</td>
<td>Klarmann</td>
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<td>T-WIWI-109864</td>
<td>Pricing</td>
<td>4,5 CR</td>
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<td>T-WIWI-102835</td>
<td>Product and Innovation Management</td>
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**Supplementary Courses (Election: at most 1 item)**

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<tbody>
<tr>
<td>T-WIWI-106981</td>
<td>Digital Marketing and Sales in B2B</td>
<td>1,5 CR</td>
<td>Klarmann, Konhäuser</td>
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<tr>
<td>T-WIWI-110985</td>
<td>International Business Development and Sales</td>
<td>6 CR</td>
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<td>Terzidis</td>
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<td>T-WIWI-102835</td>
<td>Marketing Strategy Business Game</td>
<td>1,5 CR</td>
<td>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.

**Prerequisites**

The course “Market Research” is obligatory.

**Competence Goal**

Students

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

**Content**

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

**Annotation**

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

**Workload**

The total workload for this module is approximately 270 hours.
3.99 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>
<thead>
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<th>Credits</th>
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<tr>
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<td>5 CR Bäuerle</td>
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**Prerequisites**

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

**Responsible:** PD Dr. Stefan Kühnlein  
**Organisation:** KIT Department of Mathematics  
**Part of:** Master's Thesis

<table>
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</table>
Module: Mathematical Methods in Signal and Image Processing [M-MATH-102897]

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

**Organisation:** KIT Department of Mathematics

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

<table>
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**Prerequisites**

none
### 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:**  
**Credits:** 5  
**Grading scale:** Grade to a tenth  
**Recurrence:** Irregular  
**Duration:** 1 term  
**Level:** 4  
**Version:** 1

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<th>Level</th>
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**Prerequisites:**  
None
### 3.103 Module: Mathematical Modelling and Simulation in Practise [M-MATH-102929]

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

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

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

**Prerequisites**

None
3.04 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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<th>Language</th>
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Compulsory Elective Courses (Election: at most 2 items)

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<td>4,5 CR</td>
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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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<tr>
<td>T-WIWI-103638</td>
<td>Global Optimization I and II</td>
<td>9 CR</td>
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<td>Convex Analysis</td>
<td>4,5 CR</td>
<td>Stein</td>
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<td>T-WIWI-111587</td>
<td>Multicriteria Optimization</td>
<td>4,5 CR</td>
<td>Stein</td>
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<td>4,5 CR</td>
<td>Stein</td>
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<td>Nonlinear Optimization I and II</td>
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<td>Parametric Optimization</td>
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Supplementary Courses (Election: at most 2 items)

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<td>Mixed Integer Programming II</td>
<td>4,5 CR</td>
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<td>Global Optimization II</td>
<td>4,5 CR</td>
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<td>T-WIWI-102723</td>
<td>Graph Theory and Advanced Location Models</td>
<td>4,5 CR</td>
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<td>T-WIWI-106549</td>
<td>Large-scale Optimization</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.

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

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

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

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

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

**Organisation:**  KIT Department of Mathematics

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

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**Prerequisites**

none
3.106 Module: Mathematical Topics in Kinetic Theory [M-MATH-104059]

**Responsible:** Prof. Dr. Dirk Hundertmark

**Organisation:** KIT Department of Mathematics

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

**Elective Field**

<table>
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<td>Mathematical Topics in Kinetic Theory</td>
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<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.

**Content**

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

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<th>Maxwell's Equations</th>
<th>8 CR</th>
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</table>
**3.108 Module: Medical Imaging [M-MATH-102896]**

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

<table>
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**Mandatory**

- **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

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

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<td>Each term</td>
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<tr>
<td>T-WIWI-103638</td>
<td>Global Optimization I and II</td>
<td>9 CR</td>
<td></td>
<td>Each term</td>
<td>1 term</td>
<td>4</td>
<td>10</td>
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<tr>
<td>T-WIWI-102724</td>
<td>Nonlinear Optimization I</td>
<td>4,5 CR</td>
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<td>Each term</td>
<td>1 term</td>
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Supplementary Courses (Electon: )

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<th>Recurrence</th>
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<td>Global Optimization II</td>
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<td>Nonlinear Optimization II</td>
<td>4,5 CR</td>
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<td>1 term</td>
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<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.

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

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

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

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

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

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

**Responsible:** Prof. Dr. Alexander Lytchak

**Organisation:** KIT Department of Mathematics

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

<table>
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</table>

**Mandatory**

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

**Competence Certificate**
oral examination of circa 20 minutes

**Prerequisites**
None

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

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

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

Compulsory Elective Courses (Election: at least 9 credits)

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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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<tr>
<td>T-WIWI-102859</td>
<td>Social Choice Theory</td>
<td>4,5 CR</td>
<td>Puppe</td>
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<td>T-WIWI-102613</td>
<td>Auction Theory</td>
<td>4,5 CR</td>
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<td>Incentives in Organizations</td>
<td>4,5 CR</td>
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Compence Certificate

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

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

Prerequisites

None

Competence Goal

Students

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

Here is an example of a positive question: what firm decisions does a specific regulatory policy result in under imperfect competition? An example of a normative question would be: which voting rule has appealing properties?

Content

The module teaches advanced concepts and content in microeconomic theory. Thematically, it offers a formally rigorous treatment of game theory and exemplary applications, such as strategic interaction on markets and non-/cooperative bargaining (“Advanced Game Theory”), as well as specialized courses dedicated to auctions (“Auktionstheorie”) and incentive systems in organizations (“Incentives in Organizations”). Moreover, it offers the opportunity to delve deeper into the mathematical theory of voting and collective decision making, i.e. the systematic aggregation of preferences and judgments (“Social Choice Theory”).

Workload

The total workload for this module is approximately 270 hours. For further information see German version.
3.112 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**

<table>
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**Mandatory**

| T-MATH-105877 | Monotonicity Methods in Analysis | 3 CR | Herzog |
### 3.113 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 |

<table>
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</table>

**Mandatory**

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

**Prerequisites**

None

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

<table>
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<td>Grade to a tenth</td>
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<td>1 term</td>
<td>4</td>
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Mandatory

| T-MATH-106484 | Nonlinear Maxwell Equations | 3 CR | Schnaubelt |

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.
Module: Nonlinear Maxwell Equations [M-MATH-105066]

3.115 Module: Nonlinear Maxwell Equations [M-MATH-105066]

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

**Organisation:** KIT Department of Mathematics

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

**Elective Field**

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**Prerequisites**

none
### 3.116 Module: Nonlinear Wave Equations [M-MATH-105326]

<table>
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<tr>
<th>Responsible</th>
<th>Dr. Birgit Schörkhuber</th>
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**Prerequisites**

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

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

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

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

**Organisation:** KIT Department of Mathematics

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

**Elective Field**

<table>
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**Mandatory**

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

**Competence Certificate**

oral examination of circa 30 minutes

**Prerequisites**

none

**Module grade calculation**

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

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

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

### Mandatory

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**Competence Certificate**
oral exam of ca. 20 minutes

**Prerequisites**
none

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

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

**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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**Prerequisites**

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

**M-MATH-103709**

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<th>Responsible:</th>
<th>Prof. Dr. Hartwig Anzt</th>
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**Mandatory**

| T-MATH-107497 | Numerical Linear Algebra for Scientific High Performance Computing | 5 CR | Anzt    |

**Prerequisites**

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

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

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**Prerequisites**

None

**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

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<th>6 CR</th>
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**Prerequisites**
none

**Competence Goal**

3.125 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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<th>8 CR</th>
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</table>
Module: Numerical Methods for Maxwell's Equations [M-MATH-102931]

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

Organisation: KIT Department of Mathematics

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

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Hochbruck, Jahnke
### 3.127 Module: Numerical Methods for Time-Dependent Partial Differential Equations

**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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3.128 Module: Numerical Methods in Computational Electrodynamics [M-MATH-102894]

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

**Organisation:** KIT Department of Mathematics

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

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**Prerequisites**
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<tr>
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### 3.129 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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Dörfler, Thäter
3.130 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

Credits 8
Grading scale Grade to a tenth
Recurrence see Annotations
Duration 1 term
Language German/English
Level 4
Version 1

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

Competence Certificate
oral exam of ca. 30 minutes

Prerequisites
none

Competence Goal
The lecture concentrates on option pricing with numerical methods.
After participation, students

- know how to model the price dynamics of different types of options by stochastic or partial differential equations, and to evaluate the differences between these models.
- know, in particular, the assumptions on which these models are based, which enables them to discuss and question the meaningfulness and reliability of the models.
- know different methods for solving stochastic and partial differential equations numerically, and for solving high-dimensional integration problems.
- are able to implement and apply these methods to different types of options, and to analyze their stability and convergence.

Content
- Options, arbitrage and other basic concepts,
- Black-Scholes equation und Black-Scholes formulas,
- Numerical methods for stochastic differential equations,
- (Multilevel) Monte Carlo methods,
- (Quasi-)Monte Carlo integration,
- Numerical methods for Black-Scholes equations,
- Numerical methods for American options

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

Annotation
The module is offered every second winter term.

Workload
Total workload: 240 hours
Attendance: 90 h
- lectures, problem classes and examination
Self studies: 150 h
- follow-up and deepening of the course content,
- work on problem sheets,
- literature study and internet research on the course content,
- preparation for the module examination
**Recommendation**
Familiarity with stochastic differential equations, the Ito integral, and the Ito formula is strongly recommended. MATLAB skills are strongly recommended for the programming exercises.
# 3.131 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**

<table>
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</thead>
</table>
3.132 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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**Prerequisites**

None

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

Credits: 9
Grading scale: Grade to a tenth
Recurrence: Each term
Duration: 2 terms
Language: German
Level: 4
Version: 8

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

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

<table>
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<th>Instructor</th>
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<tr>
<td>T-WIWI-106200</td>
<td>Modeling and OR-Software: Advanced Topics</td>
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<td>T-WIWI-102715</td>
<td>Operations Research in Supply Chain Management</td>
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Supplementary Courses (Election: at most 1 item)

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<td>Applied material flow simulation</td>
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<tr>
<td>T-WIWI-106546</td>
<td>Introduction to Stochastic Optimization</td>
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<td>Discrete-Event Simulation in Production and Logistics</td>
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<td>Topics in Stochastic Optimization</td>
<td>4.5</td>
<td>CR</td>
<td>Rebennack</td>
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</table>

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

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

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

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

Competence Goal
The student

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

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

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

Workload
Total effort for 9 credits: ca. 270 hours
- Presence time: 84 hours
- Preparation/Wrap-up: 112 hours
- Examination and examination preparation: 74 hours

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

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

**Organisation:** KIT Department of Mathematics

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

**Elective Field**

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<tr>
<td>T-MATH-105864</td>
<td>Optimisation and Optimal Control for Differential Equations</td>
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**Prerequisites**

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

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

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Mandatory

| T-MATH-105893 | Optimization in Banach Spaces | 5 CR | Griesmaier, Hettlich |

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

Prerequisites
none

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

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

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

Workload
Total workload: 150 hours
Time of attendance: 60 hours
- lecture including course related examinations
Self-study: 90 hours
- enhancement of course content by post-processing the lectures at home
- working on exercises
- enhancement of course content by additional literature and internet research
- preparation of the course related modul-exam

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

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

Organisation: KIT Department of Mathematics

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

Elective Field

Credits: 5
Grading scale: Grade to a tenth
Recurrence: Irregular
Duration: 1 term
Level: 4
Version: 1

Mandatory

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

Prerequisites
None
3.137 Module: Percolation [M-MATH-102905]

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

<table>
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<th>Credits</th>
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<td>Percolation</td>
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<td>Hug, Last, Winter</td>
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</table>

Prerequisites

none

Competence Goal

The students

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

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

**Organisation:** KIT Department of Mathematics

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

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<tr>
<th>Credits</th>
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**Fasen-Hartmann, Hug, Last, Winter**

**Competence Certificate**

oral exam

**Prerequisites**

none

**Competence Goal**

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

**Content**

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

**Module grade calculation**

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

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

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Arens, Griesmaier, Hettlich, Reichel

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

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Mandatory

T-MATH-105923 Probability Theory and Combinatorial Optimization 8 CR Hug, Last

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

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

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</table>

**Prerequisites**

none
3.142 Module: Random Graphs [M-MATH-102951]

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

<table>
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<th>Credits</th>
<th>Grading scale</th>
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<td>T-MATH-105929</td>
<td>Random Graphs</td>
<td>6 CR</td>
<td>Hug</td>
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</table>

**Prerequisites**

none

**Annotation**

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

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

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

#### Mandatory

| T-MATH-112241 | Random Graphs and Networks | 8 CR | Hug |

**Competence Certificate**
oral exam of ca. 30 min

**Prerequisites**
none

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

In particular, the following models are treated:

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

and the following methods are addressed:

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

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

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

**Workload**
Total workload: 240 hours

**Recommendation**
The contents of the module 'Probability Theory' are strongly recommended.
3.144 Module: Riemann Surfaces [M-MATH-106466]

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

**Organisation:** KIT Department of Mathematics

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

**Elective Field**

<table>
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</table>

**Mandatory**

| T-MATH-113081 | Riemann Surfaces | 8 CR | Herrlich |

**Competence Certificate**

Oral examination of ca. 30 minutes.

**Prerequisites**

None

**Competence Goal**

Students know

- essential structural properties of Riemann surfaces,
- topological, analytic and algebraic methods for the investigation of Riemann surfaces, and are able to apply them.

**Content**

- Definition of Riemann surfaces
- holomorphic and meromorphic functions on Riemann surfaces
- Compact Riemann surfaces
- The Riemann-Roch theorem
- Uniformization, Fuchsian groups and hyperbolic metric
- Classification of compact Riemann surfaces

**Module grade calculation**

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

**Workload**

Total workload: 240 hours

- Attendance: 90 h
  - lectures, problem classes and examination

- Self studies: 150 h
  - follow-up and deepening of the course content,
  - work on problem sheets,
  - literature study and internet research on the course content,
  - preparation for the module examination

**Recommendation**

Some knowledge of complex analysis (e.g. "Analysis 4") is strongly recommended as well as the modules "Elementary Geometry" and "Introduction to Algebra and Number Theory".
### Module: Ruin Theory [M-MATH-104055]

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

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#### Mandatory

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<td>Ruin Theory</td>
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<td>CR</td>
<td>Fasen-Hartmann</td>
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</table>

**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

<table>
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<td>T-MATH-105855</td>
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</table>
Module: Selected Methods in Fluids and Kinetic Equations [M-MATH-105897]

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

**Organisation:** KIT Department of Mathematics

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

**Elective Field**

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**Mandatory**

| T-MATH-111853 | Selected Methods in Fluids and Kinetic Equations | 3 CR |

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

**Prerequisites**
none

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

**Content**
In this lecture we discuss selected techniques and tools that have lead to significant progress in the analysis of fluids and kinetic equations. These, for instance, include:
- energy methods and local well-posedness results (e.g. fixed point results, Osgood lemma)
- Newton iteration
- Cauchy-Kowalewskaya and ghost energy approaches

No prior knowledge of fluids or kinetic equations is required.

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

**Workload**
The total workload: 90 hours

- **Attendance:** 30 h
  - lectures and examination

- **Self studies:** 60 h
  - follow-up and deepening of the course content,
  - literature study and internet research on the course content,
  - preparation for the module examination

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

**Responsible:** Prof. Dr. Dirk Hundertmark

**Organisation:** KIT Department of Mathematics

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

**Elective Field**

**Credits** 3

**Grading scale** Grade to a tenth

**Recurrence** Irregular

**Duration** 1 term

**Level** 4

**Version** 1

**Mandatory**

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

**Prerequisites**

None

**Competence Goal**

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

**Content**

- Calderon-Zygumund 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
Module: Seminar [M-MATH-102730]

**Responsible:** PD Dr. Stefan Kühnlein

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Seminar

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

| T-MATH-105686 | Seminar Mathematics | 3 CR | Kühnlein |
3.150 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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Wahlpflichtangebot (Election: 3 credits)

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<td>Seminar in Informatics A (Master)</td>
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<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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</table>

Competence Certificate

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

Prerequisites

None.

Competence Goal

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

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

Content

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

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

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

Annotation

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

Recommendation

None.
3.151 Module: Seminar [M-WWI-102971]

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

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

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

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**Wahlpflichtangebot (Election: 3 credits)**

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<td>T-WWI-103478</td>
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**Compence Certificate**
The modul examination consists of one seminar (according to §4 (3), 3 of the examintaion regulation). A detailed description of the assessment is given in the specific course characterization.

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

**Prerequisites**
None.

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

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

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

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

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

**Recommendation**
None.
### Module: Seminar [M-WIWI-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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<tr>
<th>Credits</th>
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**Wahlplflichtangebot (Election: 1 item)**

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

**Prerequisites**
None.

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

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

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

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

**Workload**
The total workload for this module is approximately 90 hours.
Module: Seminar [M-WIWI-102974]

3.153 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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Wahlpflichtangebot (Election: 1 item)

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<td>Seminar in Informatics B (Master)</td>
<td>3 CR Professorenschaft des Instituts AIFB</td>
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<tr>
<td>T-WIWI-103482</td>
<td>Seminar in Operations Research B (Master)</td>
<td>3 CR Nickel, Rebennack, Stein</td>
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</table>

Competence Certificate

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

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

Prerequisites

None.

Competence Goal

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

Content

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

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

Annotation

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

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

Workload

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

**3.154 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

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

Students who choose the module in the field "compulsory elective modules" may select any two courses of the module.

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

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

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<td>T-MACH-112213</td>
<td>Applied material flow simulation</td>
<td>4.5 CR</td>
<td>Baumann</td>
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<td>T-WIWI-102872</td>
<td>Challenges in Supply Chain Management</td>
<td>4.5 CR</td>
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<td>T-WIWI-110971</td>
<td>Demand-Driven Supply Chain Planning</td>
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**Compétence Certificate**
The assessment is carried out as partial exams (according to Section 4 (2), 1-3 SPO), whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately. The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

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

**Compétence 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

**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.

Econmathematics M.Sc.
Module Handbook as of 04/09/2023
Annotation
This module is part of the KSRI teaching profile "Digital Service Systems". Further information on a service-specific profiling is available under www.ksri.kit.edu/teaching.

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

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

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

<table>
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**Mandatory**

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Module: Space and Time Discretization of Nonlinear Wave Equations [M-MATH-105966]

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

**Organisation:** KIT Department of Mathematics

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

**Elective Field**

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Hochbruck
### 3.157 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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<td>Spatial Stochastics</td>
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**Prerequisites**

none

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

**Content**

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

**Recommendation**

It is recommended to attend the following modules beforehand: Probability Theory
Module: Special 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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<td>Special Topics of Numerical Linear Algebra</td>
<td>8 CR</td>
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**Prerequisites**

none
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

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

Mandatory

| T-MATH-103414 | Spectral Theory - Exam | 8 CR | Frey, Herzog, Kunstmann, Schnaubelt, Tolksdorf |

Competence Certificate
Oral examination of approx. 30 minutes.

Prerequisites
none

Competence Goal
After participation, students

- understand the concepts of spectrum and resolvent of closed operators on Banach spaces.
- know their basic properties and are able to explain them in simple examples.
- can explain and justify the special features of compact operators and the Fredholm Alternative.
- can deduce algebraic identities and norm bounds for operators by means of the Dunford functional calculus and the spectral calculus for self-adjoint operators. This in particular includes spectral projections and spectral mapping theorems.
- are able to apply this general theory to integral and differential equations, and recognize the importance of spectral theoretic methods in Analysis.

Content

- Closed operators on Banach spaces,
- Spectrum and resolvent,
- Compact operators and Fredholm alternative,
- Dunford functional calculus, spectral projections,
- Fourier transform,
- Unbounded self-adjoint operators on Hilbert spaces,
- Spectral theorem,
- Sesquilinear forms and sectorial operators,
- Applications to partial differential equations.

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

Workload
Total workload: 240 hours

Attendance: 90 h

- lectures, problem classes and examination

Self studies: 150 h

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

Recommendation
The module „Functional Analysis“ is strongly recommended.
### 3.160 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**

<table>
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**Mandatory**

| T-MATH-105932 | Spin Manifolds, Alpha Invariant and Positive Scalar Curvature | 5 CR | Klaus, Tuschmann |

**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
3.162 Module: Statistical Learning [M-MATH-105840]

Responsible: Prof. Dr. Mathias Trabs
Organisation: KIT Department of Mathematics
Part of: Mathematical Methods (Stochastics)
Elective Field

<table>
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<td>Statistical Learning</td>
<td>8 CR</td>
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Competence Certificate
The module will be completed with an oral exam (approx. 30 min).

Prerequisites
none

Competence Goal
The students will

- know the fundamental principles and problems of machine learning and can relate learning methods to these principles,
- be able to explain how certain learning methods work and can apply them,
- be able to develop and to discuss a statistical analysis of certain learning methods,
- be able to understand independently and to apply new learning methods.

Content
1 Regression
1.1 Empirical risk minimization
1.2 Lasso
1.3 Random forests
1.4 Neuronal networks
2 Classification
2.1 Bayes classifier
2.2 Logistic regression
2.3 Discriminant analysis
2.4 k nearest neighbour
2.5 Support vector machines
3 Unsupervised learning
3.1 Principal component analysis
3.2 Generative networks

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

Workload
Total effort: 240 hours
The workload consists of:

- attendance time in lectures (including the exam): 90 hours
- self-study (including preparation and post-processing of lectures, solving of weekly exercises, preparation for the exam): 150 hours

Recommendation
The module "Probability Theory" is strongly recommended. The module "Statistics" (M-MATH-103220) is recommended.
3.163 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**

<table>
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**Mandatory**

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

**Prerequisites**

None
3.164 Module: Stochastic Control [M-MATH-102908]

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

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Mandatory

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

Prerequisites

none
3.165 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)

<table>
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<td>Stochastic Differential Equations</td>
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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
### 3.166 Module: Stochastic Geometry [M-MATH-102865]

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

<table>
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**Mandatory**  
| T-MATH-105840 | Stochastic Geometry | 8 CR | Hug, Last, Winter |

**Competence Goal**  
The students  
- know the fundamental geometric models and characteristics in stochastic geometry,  
- are familiar with properties of Poisson processes of geometric objects,  
- know examples of applications of models of stochastic geometry,  
- know how to work self-organised and self-reflexive.

**Content**  
- Random Sets  
- Geometric Point Processes  
- Stationarity and Isotropy  
- Germ Grain Models  
- Boolean Models  
- Foundations of Integral Geometry  
- Geometric densities and characteristics  
- Random Tessellations

**Recommendation**  
It is recommended to attend the module 'Spatial Stochastics' beforehand.
3.167 Module: Stochastic Optimization [M-WIWI-103289]

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

Credits: 9
Grading scale: Grade to a tenth
Recurrence: Each term
Duration: 1 term
Language: German/English
Level: 4
Version: 10

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

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Supplementary Courses (Election: at most 1 item)

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<th>Course Number</th>
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<td>Graph Theory and Advanced Location Models</td>
<td>4,5 CR</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 seperately.

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

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

Competence Goal
The student
- names and describes basic notions for advanced stochastic optimization methods, in particular, ways to algorithmically exploit the special model structures,
- knows the indispensable methods and models for quantitative analysis of stochastic optimization problems,
- models and classifies stochastic optimization problems and chooses the appropriate solution methods to solve also challenging stochastic optimization problems independently and, if necessary, with the aid of a computer,
- validates, illustrates and interprets the obtained solutions,
- identifies drawbacks of the solution methods and, if necessary, is able to makes suggestions to adapt them to practical problems.

Content
The module focuses on the modeling as well as the imparting of theoretical principles and solution methods for optimization problems with special structure, which occur for example in the stochastic optimization.

Annotation
The courses are sometimes offered irregularly. The curriculum, planned for three years in advance, can be found on the Internet at http://sop.iwr.kit.edu/28.php.
Workload
The total workload for this module is approximately 270 hours (9 credits). The allocation is made according to the credit points of the courses of the module. The total number of hours per course is determined by the amount of time spent attending the lectures and exercises, as well as the exam times and the time required to achieve the module's learning objectives for an average student for an average performance.

Recommendation
It is recommended to listen to the lecture "Introduction to Stochastic Optimization" before the lecture "Advanced Stochastic Optimization" is visited.
3.168 Module: Stochastic Simulation [M-MATH-106053]

**Responsible:** TT-Prof. Dr. Sebastian Krumscheid

**Organisation:** KIT Department of Mathematics

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

**Elective Field**

<table>
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<th>Credits</th>
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**Mandatory**

| T-MATH-112242 | Stochastic Simulation | 5 CR | Krumscheid |

**Competence Certificate**

oral exam of ca. 30 min

**Prerequisites**

None

**Competence Goal**

After successfully taking part in the module's classes and the exam, students will be acquainted with sampling-based computational tools used to analyze systems with uncertainty arising in engineering, physics, chemistry, and economics. Specifically, by the end of this course, students will be able to analyze the convergence of sampling algorithms and implement the discussed sampling methods for different stochastic processes as computer codes. Understanding the advantages and disadvantages of different sampling-based methods, the students can, in particular, choose appropriate stochastic simulation techniques and propose efficient sampling methods for a specific stochastic problem. In particular, they can name and discuss essential theoretical concepts, and understand the structure of the sampling-based computational methods. Finally, the course prepares students to write a thesis in the field of Uncertainty Quantification.

**Content**

The course covers mathematical concepts and computational tools used to analyze systems with uncertainty arising across various application domains. First, we will address stochastic modelling strategies to represent uncertainty in such systems. Then we will discuss sampling-based methods to assess uncertain system outputs via stochastic simulation techniques. The focus of this course will be on the theoretical foundations of the discussed techniques, as well as their methodological realization as efficient computational tools. Topics covered include:

- Random variable generation
- Simulation of random processes
- Simulation of Gaussian random fields
- Monte Carlo method; output analysis
- Variance reduction techniques
- Rare event simulations
- Quasi Monte Carlo methods
- Markov Chain Monte Carlo methods (Metropolis-Hasting, Gibbs sampler)

**Module grade calculation**

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

**Workload**

total workload: 150 hours

**Recommendation**

The contents of the modules 'M-MATH-101321 - Introduction to Stochastics' and 'M-MATH-103214 – Numerical Mathematics 1+2' are recommended.
Module: Structural Graph Theory [M-MATH-105463]

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

**Organisation:** KIT Department of Mathematics

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

**Elective Field**

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**Mandatory**

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

**Prerequisites**

None

**Competence Goal**

After successful completion of the course, the participants should be able to present and analyse main results in Structural Graph Theory. They should be able to establish connections between graph minors and other graph parameters, give examples, and apply fundamental results to related problems.

**Content**

The purpose of this course is to provide an introduction to some of the central results and methods of structural graph theory. Our main point of emphasis will be on graph minor theory and the concepts devised in Robertson and Seymour’s intricate proof of the Graph Minor Theorem: in every infinite set of graphs there are two graphs such that one is a minor of the other.

Our second point of emphasis (time permitting) will be on Hadwiger’s conjecture: that every graph with chromatic number at least r has a $K_r$ minor. We shall survey what is known about this conjecture, including some very recent progress.

**Recommendation**

A solid background in the fundamentals of graph theory.
3.170 Module: Time Series Analysis [M-MATH-102911]

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

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Mandatory

| T-MATH-105874 | Time Series Analysis | 4 CR | Ebner, Fasen-Hartmann, Gneiting, Klar, Trabs |

Prerequisites
None
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<td>Topological Data Analysis</td>
<td>6 CR</td>
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**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
3.172 Module: Topological Genomics [M-MATH-106064]

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

| Credits | 3  | Grading scale | Grade to a tenth | Recurrence | Irregular | Duration | 1 term | Language | German | Level | 4 | Version | 1 |

Mandatory

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<td>Topological Genomics</td>
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Competence Certificate
oral exam of ca. 20 min

Prerequisites
None

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

Workload
total workload: 90 hours
# 3.173 Module: Topological Groups [M-MATH-105323]

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

**Organisation:** KIT Department of Mathematics  

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

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<td>Dahmen, Tuschmann</td>
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**Prerequisites**

None
### 3.174 Module: Translation Surfaces [M-MATH-105973]

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<th>Responsible</th>
<th>Prof. Dr. Frank Herrlich</th>
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| Mandatory | Translation Surfaces | 8 CR | Herrlich |

**Prerequisites**

None
3.175 Module: Traveling Waves [M-MATH-102927]

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

**Organisation:** KIT Department of Mathematics

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

**Elective Field**

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**Mandatory**

| T-MATH-105897 | Traveling Waves | 6 CR | de Rijk, Reichel |

**Competence Certificate**

The module examination takes place in form of an oral exam of about 30 minutes. Please see under "Modulnote" for more information about the bonus regulation.

**Prerequisites**

none

**Competence Goal**

After successful completion of this module students:

- can explain the significance of traveling waves and their dynamic stability;
- know basic methods to study the existence of traveling waves;
- outline the main steps in a stability analysis and address potential complications;
- have acquired several mathematical tools to compute or approximate the spectrum;
- master several techniques to derive (in)stability of the wave from spectral information;
- understand how spectrum and stability might depend on the class of perturbations.

**Content**

Traveling waves are solutions to nonlinear partial differential equations (PDEs) that propagate over time with a fixed speed without changing their profiles. These special solutions arise in many applied problems where they model, for instance, water waves, nerve impulses in axons or light in optical fibers. Therefore, their existence and the naturally associated question of their dynamic stability is of interest, because only those waves which are stable can be observed in practice.

The first step in the stability analysis is to linearize the underlying PDE about the wave and compute the associated spectrum, which is in general a nontrivial task. To approximate spectra associated with various waves, such as fronts, pulses and periodic wave trains, we introduce the following tools:

- Sturm-Liouville theory
- exponential dichotomies
- Fredholm theory
- the Evans function
- parity arguments
- essential spectrum, point spectrum and absolute spectrum
- exponential weights

The next step is to derive useful bounds on the linear solution operator, or semigroup, based on the spectral information. A complicating factor is that any non-constant traveling wave possesses spectrum up to the imaginary axis. For various dissipative PDEs, such as reaction-diffusion systems, we employ the bounds on the linear solution operator to close a nonlinear argument via iterative estimates on the Duhamel formula. For traveling waves in Hamiltonian PDEs, such as the NLS or KdV equation, we describe a different route towards stability based on the variational arguments of Grillakis, Shatah and Strauss.

**Module grade calculation**

After passing the oral exam at the end of the semester, the final grade is \(\min(0.7X + 0.3Y, X)\), where \(X\) is the grade for the oral exam and \(Y\) is the grade obtained by voluntarily working out and presenting a model problem during one of the exercise classes.

**Recommendation**

The following background is strongly recommended: Analysis 1-4.

**Literature**

### Module: Uncertainty Quantification [M-MATH-104054]

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

<table>
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<td>Each summer term</td>
<td>1 term</td>
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</table>

**Prerequisites**  
None

**Competence Goal**  
After successfully taking part in the module's classes and exams, students have gained knowledge and abilities as described in the "Inhalt" section.

Specifically, students know several parametrization methods for uncertainties. Furthermore, students are able to describe the basics of several solution methods (stochastic collocation, stochastic Galerkin, Monte-Carlo). Students can explain the so-called curse of dimensionality.

Students are able to apply numerical methods to solve engineering problems formulated as algebraic or differential equations with uncertainties. They can name the advantages and disadvantages of each method. Students can judge whether specific methods are applicable to the specific problem and discuss their results with specialists and colleagues. Finally, students are able to implement the above methods in computer codes.

**Content**  
In this class, we learn to propagate uncertain input parameters through differential equation models, a field called Uncertainty Quantification (UQ). Given uncertain input (parameter values, initial or boundary conditions), how uncertain is the output? The first part of the course ("how to do it") gives an overview on techniques that are used. Among these are:

- Sensitivity analysis  
- Monte-Carlo methods  
- Spectral expansions  
- Stochastic Galerkin method  
- Collocation methods, sparse grids

The second part of the course ("why to do it like this") deals with the theoretical foundations of these methods. The so-called "curse of dimensionality" leads us to questions from approximation theory. We look back at the very standard numerical algorithms of interpolation and quadrature, and ask how they perform in many dimensions.

**Recommendation**  
Numerical methods for differential equations
### 3.177 Module: Variational Methods [M-MATH-105093]

<table>
<thead>
<tr>
<th>Responsible</th>
<th>Prof. Dr. Wolfgang Reichel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organisation</td>
<td>KIT Department of Mathematics</td>
</tr>
<tr>
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#### Mandatory

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<th>T-MATH-110302</th>
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Economathematics M.Sc.
Module Handbook as of 04/09/2023
## 3.178 Module: Wave Propagation in Periodic Waveguides [M-MATH-105462]

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

<table>
<thead>
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### Mandatory

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

### Prerequisites

None
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**Mandatory**

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<td>T-MATH-105838</td>
<td>Wavelets</td>
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**Prerequisites**

none
### 4.1 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
4.2 Course: Advanced Empirical Asset Pricing [T-WIWI-110513]

**Responsible:** TT-Prof. Dr. Julian Thimme

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

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

**Events**

<table>
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<td>Each winter term</td>
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**WT 23/24**
- 2530569: Advanced Empirical Asset Pricing (2 SWS, Lecture / 📔)
- 2530570: Übung zu Advanced Empirical Asset Pricing (1 SWS, Practice / 📔)

**Legend:** 📔 Online, 🧩 Blended (On-Site/Online), ⚄ On-Site, ❌ Cancelled

**Competence Certificate**

The success control takes place in form of a written examination (60 min) during the semester break. If the number of participants is low, an oral examination may also be offered. The examination is offered every semester and can be repeated at any regular examination date.

A bonus can be acquired by submitting exercise solutions to 80% of the assigned exercise tasks. If the grade of the written examination is between 4.0 and 1.3, the bonus improves the grade by up to one grade level (0.3 or 0.4). Details will be announced in the lecture.

**Recommendation**

We strongly recommend knowledge of the basic topics in investments (bachelor course), which will be necessary to be able to follow the course. In addition, prior participation in the Asset Pricing Master course is strongly recommended.

**Annotation**

New course from winter semester 2019/2020.

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

**Advanced Empirical Asset Pricing**
- 2530569, WS 23/24, 2 SWS, Language: English, Open in study portal
- Lecture (V)
- Blended (On-Site/Online)

**Content**

In this course we will discuss the fundamentals of Asset Pricing and how to test them. Although this is an Empirical Asset Pricing course, we deal with some concepts from Asset Pricing Theory that we can test afterwards (CAPM, ICAPM, CCAPM, recursive utility). Besides, the course will cover the most important empirical methods to do so. For that purpose, we will discuss the overarching tool Generalized Method of Moments, and the special cases of OLS and FMB regressions. Every second week, we will meet for a programming 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. Programming skills are not required but helpful.

We start with a review of the Stochastic Discount Factor, which is already known from the course „Asset Pricing“. We then derive the CAPM and the Consumption-CAPM as special cases from the general consumption-savings optimization problem of the rational investor. In the first part of the course we discuss the CAPM and, as natural extensions, models with multiple factors. Prominent phenomena such as the value premium and momentum are discussed. In the second part of the lecture we will study extensions of Consumption-CAPM and study the implications of exotic preferences.

**Organizational issues**

Die Veranstaltung findet montags um 9:45-11:15 im Raum 209 am Campus B (Geb. 09.21) statt und endet nach ersten Semesterhälfte.
Literature

Basisliteratur

zur Vertiefung/ Wiederholung
Course: Advanced Game Theory [T-WIWI-102861]

**Responsible:** Prof. Dr. Karl-Martin Ehrhart  
Prof. Dr. Clemens Puppe  
Prof. Dr. Johannes Philipp Reiß

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

**Part of:**  
M-WIWI-101500 - Microeconomic Theory  
M-WIWI-101502 - Economic Theory and its Application in Finance  
M-WIWI-102970 - Decision and Game Theory

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

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<th>SWS</th>
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<td>Advanced Game Theory</td>
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<td>Practice / 🗣</td>
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<td>Reiß, Peters</td>
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</table>

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

**Competence Certificate**
The assessment consists of a written exam (60 minutes) (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 23/24, 2 SWS, Language: English, [Open in study portal](#)
4.4 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
4.5 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>4,5</td>
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<td>Each term</td>
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**Events**

| WT 23/24 | 2512403 | Advanced Lab Blockchain Hackathon (Bachelor) | Practical course / 🖥 | Sunyaev, Kannengießer, Sturm, Beyene |

**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
4.6 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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<td>ST 2023</td>
<td>2512205</td>
<td>Lab Realisation of innovative services (Master)</td>
<td>3</td>
<td>Practical course</td>
<td>Schiefer, Schüler, Toussaint</td>
</tr>
<tr>
<td>ST 2023</td>
<td>2512207</td>
<td>Lab Automation in Everyday Life (Master)</td>
<td>3</td>
<td>Practical course</td>
<td>Oberweis, Forell, Fristet, Schiefer</td>
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<tr>
<td>ST 2023</td>
<td>2512401</td>
<td>Advanced Lab Development of Sociotechnical Information Systems (Master)</td>
<td>3</td>
<td>Practical course</td>
<td>Sunyaev, Pandl, Goram, Leiser</td>
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<td>2512403</td>
<td>Advanced Lab Blockchain Hackathon (Master)</td>
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<td>ST 2023</td>
<td>2512500</td>
<td>Project Lab Machine Learning</td>
<td>3</td>
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<td>3</td>
<td>Practical course</td>
<td>Oberweis, Toussaint, Schiefer</td>
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<td>2512401</td>
<td>Practical Course Sociotechnical Information Systems Development (Master)</td>
<td>3</td>
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<td>WT 23/24</td>
<td>2512501</td>
<td>Practical Course Cognitive automobiles and robots (Master)</td>
<td>3</td>
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<td>WT 23/24</td>
<td>2512600</td>
<td>Project lab Information Service Engineering (Master)</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
- 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 2023, 3 SWS, Language: German, [Open in study portal](https://portal.wiwi.kit.edu)
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 2023, 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.

Advanced Lab Development of Sociotechnical Information Systems (Master)
2512401, SS 2023, 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 2023, 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.
Content
As part of the lab, the participants should work together in small groups to realize innovative services (mainly for students).
Further information can be found on the ILIAS page of the lab.

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

Practical Course Cognitive automobiles and robots (Master)
2512501, WS 23/24, 3 SWS, Language: German/English, Open in study portal

Content
The lab is intended as a practical supplement to courses such as "Machine Learning 1/2".
Scientific topics, mostly in the area of autonomous driving and robotics, will be addressed in joint work with ML/KI methods. The goal of the internship is for participants to design, develop, and evaluate ML Software system.
In addition to the scientific goals, such as the study and application of methods, the aspects of project-specific teamwork in research (from specification to presentation of results) are also worked on in this internship.
The individual projects require the analysis of the set task, selection of appropriate methods, specification and implementation and evaluation of the solution approach. Finally, the selected solution is to be documented and presented in a short lecture.

Learning Objectives:
- Students will be able to practically apply theoretical knowledge from lectures on machine learning to a selected area of current research.
- Students will be proficient in analyzing and solving thematic problems.
- Students will be able to evaluate, document, and present their concepts and results.

Recommendations:
- Theoretical knowledge of machine learning and/or AI.
- Python knowledge
- Initial experience with deep learning frameworks such as PyTorch/Jax/Tensorflow may be beneficial.

Workload:
The workload of 5 credit points consists of practical implementation of the selected solution, as well as time for literature research and planning/specification of the selected solution. In addition, a short report and presentation of the work performed 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 23/24, 3 SWS, Language: English, Open in study portal
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 16 students.

Participation in the lecture "Information Service Engineering" (summer semester) is required. There are video recordings on our youtube channel.

ISE Tutor Team:

- Dr. Genet Asefa Gesese
- M. Sc. Mirza Mohtasim Alam
- M. Sc. Oleksandra Bruns
- M. Sc. Ebrahim Norouzi
- M. Sc. Mary Ann Tan
- B. Sc. Tabea Tietz
- M. Sc. Mahsa Vafaie

WS 2023/24 Tasks List:

- **Task 1: Zero-shot Ultrafine Typing of Named Entities.** Use Pre-trained Language Models to assign predefined labels to entity mentions in a given context. Evaluate approaches which require no training data on a standard benchmark, i.e. UFET.

- **Task 2: Object Detection on Historical Theatre Photographs.** Use Pre-trained DL models to detect and identify objects in historical theatre photographs and integrate the results into an existing Knowledge Graph.

- **Task 3: Automatically Generate Ontologies from Competency Questions using Language Models.** Competency questions (CQs) define the scope of knowledge represented in an ontology and are used to evaluate an ontology based on its ability to answer each question. In this task, we are investigating the benefit of Large Language Models to generate and evaluate ontologies from a set of competency questions.

- **Task 4: Boosting the Performance of Large Language Models for Question Answering with Knowledge Graph Integration.** Often, large language models hallucinate users with wrong or confusing answers. In order to generate relevant answers, knowledge graphs can help in many ways. The goal of this task is to utilize a knowledge graph to provide context and factual information to a language model, thereby improving the relevance and accuracy of its responses.

- **Task 5:Information Extraction and Knowledge Graph Engineering on the Use Case of Historical Political Flyers**
  Information extraction and Knowledge Graph construction from digitized political leaflets of the Weimar Republic.

- **Task 6: Sentiment Analysis on Multilingual Wikipedia.** Analyse how different language Versions of Wikipedia differ in terms of Sentiment Bias.
  - of a Knowledge Graph from 1.3 Mio Archival Objects from the German Digital Library

Literature
ISE video channel on youtube: https://www.youtube.com/channel/UCjkkhNSNuXrJpMYZoeSBw6Q/
4 COURSES

Course: Advanced Lab Realization of Innovative Services (Master) [T-WIWI-112914]

4.7 Course: Advanced Lab Realization of Innovative Services (Master) [T-WIWI-112914]

Responsible: Prof. Dr. Andreas Oberweis
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101472 - Informatics

<table>
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Events

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<td>3 SWS</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 📚 On-Site, × Cancelled

Competence Certificate
The alternative exam assessment consists of:

- a practical work
- a presentation and
- a written seminar thesis

Practical work, presentation and written thesis are weighted according to the course.

Annotation
As part of the lab, the participants should work together in small groups to produce innovative services (mainly for students).

Further information can be found on the ILIAS page of the lab.

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

V Lab Realisation of innovative services (Master)
2512205, SS 2023, 3 SWS, Language: German, Open in study portal

Practical course (P) Blended (On-Site/Online)

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.
4.8 Course: Advanced Lab Security [T-WIWI-109786]

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

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**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.
4 COURSES

Course: Advanced Lab Security, Usability and Society [T-WIWI-108439]

4.9 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>
<thead>
<tr>
<th>Type</th>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
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<td>Grade to a third</td>
<td>see Annotations</td>
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**Events**

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<tr>
<th>WT 23/24</th>
<th>2512554</th>
<th>Praktikum Security, Usability and Society (Bachelor)</th>
<th>3 SWS</th>
<th>Practical course / Online</th>
<th>Volkamer, Mayer, Berens, Mossano, Ballreich</th>
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</thead>
<tbody>
<tr>
<td>WT 23/24</td>
<td>2512555</td>
<td>Praktikum Security, Usability and Society (Master)</td>
<td>3 SWS</td>
<td>Practical course / Online</td>
<td>Volkamer, Mayer, Berens, Mossano, Ballreich</td>
</tr>
</tbody>
</table>

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

**Competence Certificate**
The alternative exam assessment consists of:
- a practical work
- a presentation and possibly
- a written seminar thesis

Practical work, presentation and written thesis are weighted according to the course.

**Prerequisites**
None

**Recommendation**
Knowledge from the lecture "Information Security" is recommended.

**Annotation**
The course will not be offered in the summer semester 2023.

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

<table>
<thead>
<tr>
<th>Praktikum Security, Usability and Society (Bachelor)</th>
<th>Practical course (P)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2512554, WS 23/24, 3 SWS, Language: German/English</td>
<td>Online</td>
</tr>
</tbody>
</table>
Content
The Praktikum "Security, Usability and Society" will cover topics both of usable security and privacy programming, and how to conduct user studies. To reserve a place, please, register on the WiWi portal and send an email with your chosen topic, plus a back-up one, to mattia.mosiano@kit.edu. Topics are assigned first-come-first-served until all of them are filled. The deadline for the first round is 18.07.2022. Topics in italics have been already assigned.

Important dates:
- Kick-off: 13.10.2022, 10:00 AM CET in Big Blue Button - Link
- Report + code submission: 30.01.2023 23:59 CET
- Presentation deadline: 30.01.2023, 23:59 CET
- Presentation day: 01.02.2023

Topics:

Programming Usable Security Intervention
In this subject, students develop a part of coding, an extension, or another programming task dealing with various usable security interventions, eg as an extension. Eg TORPEDO (https://secuso.aifb.kit.edu/english/TORPEDO.php) or PassSec + (https://secuso.aifb.kit.edu/english/PassSecPlus.php). Just as before, students are provided with a point list of goals, containing both basic features mandatory to pass the course and more advanced ones that heighten the final grade.

Title: Portfolio Graphical Recognition-Based PWDs with Gamepads
Number of students: 2 Bachelor or Master level
Description: Graphical passwords use graphical elements as passwords and they are usually easier to remember than textual passwords. Moreover, they can be combined with "portfolio authentication" techniques to make them shoulder surfing resistant. The goal of this topic is to implement a graphical portfolio authentication scheme for gamepads, based on previous textual schemes implementations.

Title: Development of a secure web interface with a ticket system for the Hashcat Password Cracker
Number of students: 2 Bachelor or Master level
Description: Hashcat is a console application which allows to crack passwords using a given wordlist or password pattern. In order to allow multiple not necessarily trustworthy users to register a password cracking job with the specified parameters in parallel, a web platform with a ticket system should be developed within the framework of this laboratory topic. Therefore a frontend and backend should be implemented separately and a clear description of the interface between is essential part of this work. Python with Flask Web Framework can be used to implement the backend. Good knowledge in programming, APIs and web security are required.

Designing Security User studies
These topics are related to how to set up and conducting user studies of various types. This year, due to the Corona outbreak, we decided to conduct online studies only; otherwise, interviews and in lab studies would have been possible. At the end of the semester, the students present a report / paper and a talk in which they present their results.

Title: NoPhish Cardgame
Number of students: 1/2 Bachelor level
Description: Das NoPhish Konzept findet bereits in vielen Formen Anwendung. Es hilft dabei betrügerische Nachrichten von legitimen zu unterscheiden. Die neueste Form ist ein Cardgame bei dem man spielerisch lernen kann Phishing zu erkennen. Hierbei wird sowohl grundlegendes Wissen, als auch konkretes Wissen vermittelt. Aufgabe: Erheben von Daten (Studiendesign ist bereits vorhanden) und Auswertung bestehender Daten mit neu erhobenen Daten

Title: Analysing the perceptions on email subject extensions like 'Caution - This e-mail is sent from someone outside the company'
Number of students: 1/2 Bachelor or Master level
Description: Email subject extensions are used in my organisation to reduce the risk to become a victim of a phishing email - why should your boss e.g. send you an external email? Likely to be a phish! The idea is to develop the study protocol and to collect first data which should be analysed.

Title: Benutzerstudie zur Erkennung von Angriffen auf die E-Mail Absicherung mit S/MIME-Zertifikaten
Number of students: 2 Bachelor or Master level

Title: Evaluation of the Sudoku Privacy Friendly App usability for users with rheumatoid arthritis (English only)
Number of students: 1 Bachelor or Master level
Description: The Privacy Friendly Apps are a set of applications developed by the SECUSO group that do not contain any advertisement or tracking mechanism, hence preserving the privacy of their users (https://secuso.aifb.kit.edu/english/105.php). One of these apps is "Sudoku", available for Android on both the Google Store and F-Droid. Although the app is friendlier to privacy that other alternatives, it requires multiple tactile interactions with the mobile device. This can be an issue for users with reduced hand mobility, such as those suffering from rheumatoid arthritis. To approximate the reduced mobility caused by rheumatoid arthritis in healthy users, it is common to use arthritis simulation gloves (e.g., https://idarinstitute.com/products/arthritis-simulation-gloves). The task of the student is to design a lab study involving arthritis simulation gloves that evaluates the Sudoku app usability for users suffering from rheumatoid arthritis.
Title: Replication and extension of "What is this URL's destination?" (English only)
Number of students: 1 Bachelor level
Description: Replication of studies is a fundamental part of the scientific process: it allows to confirm or deny experimental results and can open new lines of research. This topic is a replication of the study presented in Albakry, S., Vansea, K. & Wolters, M.K. (2020) What is this URL's destination? Empirical Evaluation of Users' URL Reading (https://doi.org/10.1145/3313831.3376168). The student will re-implement the study following the precise description from the original authors, run it and then compare the results with the previous iteration.

Title: Password Generator Defaults
Number of students: 2 Bachelor or Master level
Description: Password Managers are useful tools that help the use of complex passwords and avoid the password recycle practice. Moreover, they support users by providing password generator tools, that create random password of specific length. However, the defaults settings might be at odds with the password policies of popular websites, e.g., they can contain forbidden characters or be too long/short. Moreover, we need to understand if Password Managers users change the default settings to generate passwords, in how many cases and for what reasons. The students task is therefore two-folds: (1) compare the default settings of several Password Managers to the privacy policies of popular websites; (2) design and implement a survey to collect the behavior of Password Managers users with regard to the password generator tools.

Title: Benutzerstudie zur Auswertung der PassSec+ Browser Extension mittels Eye-Tracking
Number of students: 1/2 Bachelor or Master level

This event counts towards the KASTEL certificate. Further information on how to obtain the certificate can be found on the SECUSO website https://secuso.aifb.kit.edu/Studium_und_Lehre.php.

Praktikum Security, Usability and Society (Master)
2512555, WS 23/24, 3 SWS, Language: German/English, Open in study portal
Content
The Praktikum "Security, Usability and Society" will cover topics both of usable security and privacy programming, and how to conduct user studies. To reserve a place, please, register on the WiWi portal and send an email with your chosen topic, plus a back-up one, to mattia.mossano@kit.edu. Topics are assigned first-come-first-served until all of them are filled. The deadline for the first round is 18.07.2022. Topics in italics have been already assigned.

WiWi portal: https://portal.wiwi.kit.edu/ys/6273

Important dates:
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Title: Analysing the perceptions on email subject extensions like 'Caution - This e-mail is sent from someone outside the company'
Number of students: 1/2 Bachelor or Master level
Description: Email subject extensions are used by spammers to make it more likely that users will open the email. They can potentially be used to make users more aware of phishing. The goal of this topic is to implement a graphical portfolio authentication scheme for gamepads, based on previous textual schemes implementations.

Title: Benutzerstudie zur Erkennung von Angriffen auf die E-Mail Absicherung mit S/MIME-Zertifikaten
Number of students: 2 Bachelor or Master level

Title: Evaluation of the Sudoku Privacy Friendly App usability for users with rheumatoid arthritis (English only)
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Title: Benutzerstudie zur Auswertung der PassSec+ Browser Extension mittels Eye-Tracking
Number of students: 1/2 Bachelor or Master level

Title: User study on user’s knowledge about brainwaves verification
Number of students: 1 Master level
Description: Brainwaves can be used to authenticate users. However, several questions are left unanswered regarding the users’ stance on this: What is the prior knowledge of users about verification and brainwaves? Are they comfortable wearing a device to record their brainwaves? How are they feeling regarding storing their brainwaves samples? Which kind of information can be extracted from the smaples? How secure would such an authentication scheme be? The task of the student is to design, implement an pre-test a user study investigating these questions.

This event counts towards the KASTEL certificate. Further information on how to obtain the certificate can be found on the SECUSO website https://secuso.aifb.kit.edu/Studium_und_Lehre.php.
4.10 Course: Advanced Lab Sociotechnical Information Systems Development (Master) [T-WIWI-111125]

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

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

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

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<th>Recurrence</th>
<th>Version</th>
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**Events**

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<th>Credits</th>
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<td>Each term</td>
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**Prerequisites**
None

**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.
4 COURSES

Course: Advanced Machine Learning and Data Science [T-WIWI-111305]

4.11 Course: Advanced Machine Learning and Data Science [T-WIWI-111305]

<table>
<thead>
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<th>Responsible</th>
<th>Prof. Dr. Maxim Ulrich</th>
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<tr>
<td>Organisation</td>
<td>KIT Department of Economics and Management</td>
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<td>Part of</td>
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<th>Type</th>
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<td>Recurrence</td>
<td>Each term</td>
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<td>Version</td>
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Competence Certificate
Due to the professor's research sabbatical, the BSc module "Financial Data Science" and MSc module "Foundations for Advanced Financial -Quant and -Machine Learning Research" and the MSc module "Advanced Machine Learning and Data Science" along with the respective examinations will not be offered in SS2023. Bachelor and Master thesis projects are not affected and will be supervised.

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.

An online meetup will be offered at 14:00 on Tuesday of the first week of summer semester 2022 (i.e., 19.04.2022).
4 COURSES

4.12 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

Type: Written examination
Credits: 4,5
Grading scale: Grade to a third
Recurrence: Each winter term
Version: 1

Competence Certificate
The assessment of this course is a written examination (60 min) according to §4(2), 1 of the examination regulation. The exam is offered every semester. Re-examinations are offered only for repeaters.

Prerequisites
None
4.13 Course: Advanced Stochastic Optimization [T-WIWI-106548]

Responsible: Prof. Dr. Steffen Rebennack
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101473 - Mathematical Programming
         M-WIWI-103289 - Stochastic Optimization

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<td>Irregular</td>
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Competence Certificate
The assessment consists of an oral exam (20 minutes). The exam is offered every semester.

Prerequisites
None.
4.14 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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**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.
4.15 Course: Algebra [T-MATH-102253]

**Responsible:**  
PD Dr. Stefan Kühnlein  
Prof. Dr. Roman Sauer

**Organisation:**  
KIT Department of Mathematics

**Part of:**  
M-MATH-101315 - Algebra

<table>
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<th>Lecture / Online</th>
<th>Sauer</th>
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<td>0102210</td>
<td>Übungen zu 0102200 (Algebra)</td>
<td>2 SWS</td>
<td>Practice / On-Site</td>
<td>Sauer</td>
</tr>
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</table>

Legend: 🖥 Online, ☑ Blended (On-Site/Online), 🔃 On-Site, ❌ Cancelled
4.16 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

<table>
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<td>Grade to a third</td>
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</table>
4.17 Course: Algebraic Number Theory [T-MATH-103346]

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

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-101725 - Algebraic Number Theory

<table>
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<td>Oral examination</td>
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**Competence Certificate**
oral examination of ca. 30 minutes

**Prerequisites**
none
### 4.18 Course: Algebraic Topology [T-MATH-105915]

**Responsible:** TT-Prof. Dr. Manuel Krannich  
Prof. Dr. Roman Sauer

**Organisation:** KIT Department of Mathematics

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

<table>
<thead>
<tr>
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**Prerequisites**  
none
4.19 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

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<td>Written exam</td>
<td>8</td>
<td>Grade to a third</td>
<td>Irregular</td>
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</table>

**Prerequisites**

none
4.20 Course: Analytic and Algebraic Aspects of Group Rings [T-MATH-112777]

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

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-106305 - Analytic and Algebraic Aspects of Group Rings

<table>
<thead>
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<th>Type</th>
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<tr>
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<td>Grade to a third</td>
<td>1 terms</td>
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</table>

**Competence Certificate**
oral examination of ca. 30 minutes

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

<table>
<thead>
<tr>
<th>Type</th>
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<th>Grading scale</th>
<th>Recurrence</th>
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<td>Oral examination</td>
<td>6</td>
<td>Grade to a third</td>
<td>Irregular</td>
<td>1</td>
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</table>

**Responsible:** Prof. Dr. Marlis Hochbruck  
TT-Prof. Dr. Roland Maier  

**Organisation:** KIT Department of Mathematics  

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

#### Events

<table>
<thead>
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<th>WT 23/24</th>
<th>0100046</th>
<th>Analytical and numerical homogenization</th>
<th>3 SWS</th>
<th>Lecture</th>
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</thead>
</table>

**Prerequisites**  
none
4.22 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

<table>
<thead>
<tr>
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<tr>
<td>Oral exam</td>
<td>4</td>
<td>Grade to a third</td>
<td>Irregular</td>
<td>1</td>
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</table>

**Prerequisites**
none
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

Type: Written examination
Credits: 4.5
Grading scale: Grade to a third
Recurrence: Each winter term
Version: 2

Events
| WT 23/24  | 2520020 | Applied Econometrics | 2 SWS | Lecture / 🗣 | Krüger, Eberl |
| WT 23/24  | 2520021 | Tutorial in Applied Econometrics | 2 SWS | Practice / 🗣 | Eberl, Koster |

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

Competence Certificate
The assessment of this course is a written examination (90 min) according to §4(2), 1 of the examination regulation. A bonus can be acquired by successful completion of an assignment (written report + short in-class presentation) during the semester. If the grade of the written examination is between 4.0 and 1.3, the bonus improves the grade by one grade level (0.3 or 0.4).

Prerequisites
None

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

Applied Econometrics
2520020, WS 23/24, 2 SWS, Language: English, Open in study portal

Content
Content:
The course covers two econometric topics: (1) Conditional expectation and regression, and (2) Causal inference. Part (1) reviews foundations like the best linear predictor, least squares estimation, and robust covariance estimation. Part (2) introduces the potential outcomes framework for studying causal, what-if type questions such as ‘How does an internship affect a person’s future wage?’. It then presents research strategies like randomized trials, instrumental variables, and regression discontinuity.

For each part, we discuss econometric methods and theory, empirical examples (including recent research papers), and R implementation.

Learning goal:
Students are able to assess the properties of various econometric estimators and research designs, and to implement econometric estimators using R software.

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

Literature
4 COURSES


**T**


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

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

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

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<td>Applied Informatics - Internet Computing</td>
<td>Lecture / 🗣</td>
<td>Sunyaev</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Canceled

**Competence Certificate**

The assessment consists of a written exam (60 min) according to Section 4(2), 1 of the examination regulation. The successful completion of the exercises is recommended for the written exam, which is offered at the end of the winter semester and at the end of the summer semester.

Successful participation in the exercise by submitting correct solutions to 50% of the exercises can earn a grade bonus. If the grade of the written exam is at least 4.0 and at most 1.3, the bonus will improve it by one grade level (i.e. by 0.3 or 0.4).

**Prerequisites**

None

**Annotation**

Replaces from winter semester 2019/2020 T-WIWI-109445 "Applied Informatics - Internet Computing".

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

**Applied Informatics - Internet Computing**

2511032, SS 2023, 2 SWS, Language: German, Open in study portal

**Content**

The lecture Applied Computer Science - Internet Computing provides insights into fundamental concepts and future technologies of distributed systems and Internet computing. Students should be able to select, design and apply the presented concepts and technologies. The course first introduces basic concepts of distributed systems (e.g. design of architectures for distributed systems, internet architectures, web services, middleware).

In the second part of the course, emerging technologies of Internet computing will be examined in depth. These include, among others:

- Cloud Computing
- Edge & Fog Computing
- Internet of Things
- Blockchain
- Artificial Intelligence

**Learning objectives:**

The student learns about basic concepts and emerging technologies of distributed systems and internet computing. Practical topics will be deepened in lab classes.

**Recommendations:**

Knowledge of content of the module [WI1INFO].

**Workload:**

The total workload for this course is approximately 135-150 hours.
Literatur
Wird in der Vorlesung bekannt gegeben
4.25 Course: Applied material flow simulation [T-MACH-112213]

**Responsible:** Dr.-Ing. Marion Baumann  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-WIWI-102805 - Service Operations  
M-WIWI-102832 - Operations Research in Supply Chain Management

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**Events**

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

**Competence Certificate**  
The assessment consists of an oral exam (20 min.) taking place in the recess period according to § 4 paragraph 2 Nr. 2 of the examination regulation.

**Prerequisites**  
None

**Recommendation**
- Basic statistical knowledge and understanding
- Knowledge of a common programming language (Java, Python, ...)
- Recommended course: T-WIWI-102718 - Discrete Event Simulation in Production and Logistics

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

Learning Content:

- Methods of modeling a simulation such as:
  - Discrete-event simulation
  - Agent based simulation
- Design of a simulation model of a material flow system
- Data exchange in simulation models
- Verification and validation of simulation models
- Execution of simulation studies
- Statistical evaluation and parameter study

This is an application-oriented course in which the course contents are applied and deepened using the Anylogic software.

Learning Goals:

Students are able to:

- select the appropriate simulation modeling method depending on a modeling objective and build a suitable simulation model for material flow systems,
- extend a simulation model in a meaningful way with data import and export,
- verify and validate a simulation model,
- conduct a simulation study efficiently and with meaningful results, and
- design and conduct a parameter study and statistically analyze and evaluate the results.

Recommendations:

- Basic statistical skills
- Prior knowledge of a common programming language (Java, Python,...).
- Recommended course: T-WIWI-102718 - Discrete Event Simulation in Production and Logistics

Workload for 4,5 ECTS (135 h):

- regular attendance: 21 hours
- self-study: 114 hours

Organizational issues

- Im Wintersemester 2023/2024 ist die Veranstaltung auf maximal 30 Teilnehmer beschränkt.
- Die Anmeldung ist durch Beitritt zum ILIAS-Kurs und Ausfüllen des Anmeldungsformulars (erforderliche Felder beim Beitritt zum ILIAS-Kurs) möglich.
- Die Anmeldung ist vom 01.09.2023 bis zum 30.09.2023 möglich.

Literature


4.26 Course: Asset Pricing [T-WIWI-102647]

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

Organisation: KIT Department of Economics and Management

Part of:  
M-WIWI-101480 - Finance 3  
M-WIWI-101482 - Finance 1  
M-WIWI-101483 - Finance 2  
M-WIWI-101502 - Economic Theory and its Application in Finance

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<td>2 SWS</td>
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<td>Practice / 🗣</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 or as an open-book examination (alternative exam assessment).

A bonus can be earned by correctly solving at least 50% of the posed bonus exercises. If the grade of the written examination is between 4.0 and 1.3, the bonus improves the grade by up to one grade level (0.3 or 0.4). Details will be announced in the lecture.

Prerequisites

None

Recommendation

We strongly recommend knowledge of the basic topics in investments (bachelor course), which will be necessary to be able to follow the course.

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

Asset Pricing

2530556, SS 2023, 1 SWS, Language: German, Open in study portal

Practice (Ü)  
On-Site

Literature

4.27 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

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<td>WT 23/24</td>
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**Competence Certificate**
The assessment of this course is a written examination (following §4(2), 1 SPO) of 60 mins. The exam is offered each semester.

**Prerequisites**
None

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

**V Auktionstheorie**
2520408, WS 23/24, 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
4.28 Course: Bayesian Inverse Problems with Connections to Machine Learning [T-MATH-112842]

**Responsible:** TT-Prof. Dr. Sebastian Krumscheid

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-106328 - Bayesian Inverse Problems with Connections to Machine Learning

**Type**
Oral examination

**Credits**
4

**Grading scale**
Grade to a third

**Recurrence**
Each summer term

**Expansion**
1 terms

**Version**
1

**Competence Certificate**
Oral exam of ca. 30 min

**Prerequisites**
None
4.29 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
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

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**Competence Certificate**
The examination is offered for the last time in winter semester 20/21 for first-time writers and then again for second attempts. The assessment consists of a written exam (75 min).

A bonus can be earned by correctly solving at least 50% of the posed bonus exercises. If the grade of the written examination is between 4.0 and 1.3, the bonus improves the grade by up to one grade level (0.3 or 0.4). Details will be announced in the lecture.

Depending on further pandemic developments, the examination will be offered as an open-book examination (alternative exam assessment).

**Prerequisites**
None

**Recommendation**
None

**Annotation**
The lecture is currently not offered.
4.31 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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<td>Uhrig-Homburg, Müller, Molnar</td>
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**Competence Certificate**
The assessment consists of a written exam (75 min.)

A bonus can be earned by correctly solving at least 50% of the posed bonus exercises. If the grade of the written examination is between 4.0 and 1.3, the bonus improves the grade by up to one level (0.3 or 0.4). The examination is offered in each semester and can be repeated at any regular examination date.

Depending on further pandemic developments, the examination will be offered as an open-book examination (alternative exam assessment).

**Annotation**
This course will be held in English.

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

**Bond Markets**
2530560, WS 23/24, 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 (75 min.) (according to §4(2), 1 SPO). A bonus can be earned by correctly solving at least 50% of the posed bonus exercises. If the grade of the written examination is between 4.0 and 1.3, the bonus improves the grade by up to one level (0.3 or 0.4). The examination is offered in each semester and can be repeated at any regular examination date.

Students deepen their knowledge of national and international bond markets. They gain knowledge of the traded instruments and their key figures for describing default risk such as ratings, default probabilities or credit spreads.

**Organizational issues**
Die Veranstaltung wird in der ersten Semesterhälfte an sechs Freitagen am Campus B (Geb. 09.21) im Raum 124 angeboten. Die Klausur findet dann direkt im Anschluss statt.
Course: Bond Markets - Models & Derivatives [T-WIWI-110997]

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

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

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**Competence Certificate**
The assessment of success consists in equal parts of a written thesis and an oral exam including a discussion of one's own work. The main examination is offered once a year, re-examinations every semester.

**Recommendation**
Knowledge of "Bond Markets" and "Derivatives" courses is very helpful.

**Annotation**
This course will be held in English.

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

---

**Content**
- **Competence Certificate:** The assessment of success consists in equal parts of a written thesis and an oral exam (according to §4(2), 3 SPO) including a discussion of one's own work. The main examination is offered once a year, re-examinations every semester.
- **Competence Goal:** Students deepen their knowledge of national and international bond markets. They are able to apply the knowledge they have gained about traded instruments and common valuation models for pricing derivative financial instruments.
- **Prerequisites:**
- **Content:** The lecture "Bond Markets – Models & Derivatives" deepens the content of the lecture "Bond Markets". The modelling of the dynamics of yield curves and the management of credit risks forms the theoretical foundation for the valuation of interest rate and credit derivatives to be discussed. In this course, students deal intensively with selected topics and acquire the relevant knowledge on their own.
- **Recommendation:** Knowledge of "Bond Markets" and "Derivatives" courses is very helpful.
- **Workload:** The total workload for this course is approximately 90 hours (3.0 credits).

**Organizational issues**
Die Veranstaltung startet in der zweiten Semesterhälfte (Kickoff am 08.12.23) und hat Seminarcharakter - mit dem Ziel, ein selbstgewähltes Themenfeld in Form einer schriftlichen Ausarbeitung eigenständig zu erarbeiten.
4.33 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**

| WT 23/24 | 2530562 | Bond Markets - Tools & Applications | 1 SWS | Block / On-Site | Uhrig-Homburg, Grauer |

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

**Competence Certificate**

The assessment consists of an empirical case study with written elaboration and presentation. The main examination is offered once a year, re-examinations every semester.

**Recommendation**

Knowledge of the "Bond Markets" course is very helpful.

**Annotation**

This course will be held in English.

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

**Content**

- **Competence Certificate:** The assessment consists of an empirical case study with written elaboration and presentation (according to §4(2), 3 SPO). The main examination is offered once a year, re-examinations every semester.
- **Competence Goal:** The students apply various methods in practice within the framework of a project-related case study. They are able to deal with empirical data and analyze them in a targeted manner.
- **Content:** The course "Bond Markets – Tools & Applications" includes a hands-on project in the field of national and international bond markets. Using empirical datasets, the students have to apply practical methods in order to analyze the data in a targeted manner.
- **Recommendation:** Knowledge of the "Bond Markets" course is very helpful.
- **Workload:** The total workload for this course is approximately 45 hours (1.5 credits).

**Organizational issues**

Die Veranstaltung findet in der ersten Semesterhälfte statt (Kickoff am 10.11.23) und beinhaltet eine eigenständige Projektarbeit im Umgang mit realen Bond Daten. Die Erfolgskontrolle erfolgt anhand einer schriftlichen Ausarbeitung und einer kurzen Präsentation.
4.34 Course: Bott Periodicity [T-MATH-108905]

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

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-104349 - Bott Periodicity

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**Prerequisites**

none
### 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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Course: Boundary Element Methods [T-MATH-109851]

4.36 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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<td>8</td>
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Prerequisites
none
4.37 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

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<td>Brownsche Bewegung</td>
<td>Lecture</td>
<td>Bäuerle</td>
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<td>Practice</td>
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</table>

**Prerequisites**  
none
4.38 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

**Events**

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<td>3 SWS</td>
<td>Grade to a third</td>
<td>Each winter term</td>
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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.

**Content**

In most modern enterprises, Business Intelligence & Analytics (BI&A) Systems represent a core enabler of decision-making in that they are supplying up-to-date and accurate information about all relevant aspects of a company’s planning and operations: from stock levels to sales volumes, from process cycle times to key indicators of corporate performance. Modern BI&A systems leverage beyond reporting and dashboards also advanced analytical functions. Thus, today they also play a major role in enabling data-driven products and services. The aim of this course is to introduce theoretical foundations, concepts, tools, and current practice of BI&A Systems from a managerial and technical perspective.

The course is complemented with an engineering capstone project, where students work in a team with real-world use cases and data in order to create running Business intelligence & Analytics system prototypes.

**Learning objectives**

- Understand the theoretical foundations of key Business Intelligence & Analytics concepts supporting decision-making
- Explore key capabilities of state-of-the-art Business Intelligence & Analytics Systems
- Learn how to successfully implement and run Business Intelligence & Analytics Systems from multiple perspectives, e.g. architecture, data management, consumption, analytics
- Get hands-on experience by working with Business Intelligence & Analytics Systems with real-world use cases and data

**Prerequisites**

This course is limited to a capacity of 50 places. The capacity limitation is due to the attractive format of the accompanying engineering capstone project. Strong analytical abilities and profound skills in SQL as well as Python and/or R are required. Students have to apply with their CV and transcript of records. All organizational details and the underlying registration process of the lecture and the capstone project will be presented in the first lecture. The teaching language is English.
Literature

- Economist Intelligence Unit. 2015 “Big data evolution: Forging new corporate capabilities for the long term”

Further literature will be made available in the lecture.
**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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<td>Exercise Business Process Modelling</td>
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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 23/24, 2 SWS, Language: German, [Open in study portal](#)

**Content**
The proper modeling of relevant aspects of business processes is essential for an efficient and effective design and implementation of processes. This lecture presents different classes of modeling languages and discusses the respective advantages and disadvantages of using actual application scenarios. For that simulative and analytical methods for process analysis are introduced. In the accompanying exercise the use of process modeling tools is practiced.

**Learning objectives:**
Students
- describe goals of business process modeling and apply different modeling languages,
- choose the appropriate modeling language according to a given context,
- use suitable tools for modeling business processes,
- apply methods for analysing and assessing process models to evaluate specific quality characteristics of the process model.

**Recommendations:**
Knowledge of course Applied Informatics I - Modelling is expected.

**Workload:**
- Lecture 30h
- Exercise 15h
- Preparation of lecture 24h
- Preparation of exercises 25h
- Exam preparation 40h
- Exam 1h

**Literature**

Weitere Literatur wird in der Vorlesung bekannt gegeben.
4.40 Course: Business Strategies of Banks [T-WIWI-102626]

**Responsible:** Prof. Dr. Wolfgang Müller

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

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

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**Competence Certificate**
The lecture will be offered for the last time in the winter semester 2021/22. The exam will take place for the last time in the summer semester 2022 (only for repeaters).

**Prerequisites**
None

**Recommendation**
None

**Annotation**
The lecture will be offered for the last time in the winter semester 2021/22.
4.41 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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**Events**

| ST 2023 | 2550494 | Challenges in Supply Chain Management | 3 SWS | Lecture / 🧩 | Mohr |

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

**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 2023, 3 SWS, Language: German, [Open in study portal](http://go.wiwi.kit.edu/ChallengesSCM)

**Content**

The course consists of case studies of BASF which cover future challenges of supply chain management. Thus, the course aims at a case-study based presentation, critical evaluation and exemplary discussion of recent questions in supply chain management. The focus lies on future challenges and trends, also with regard to their applicability in practical cases (especially in the chemical industry).

The main part of the course is working on a project together with BASF in Ludwigshafen. The students get in touch with scientific working: The in-depth work with a special scientific topic makes the students familiar with scientific literature research and argumentation methods. As a further aspect of scientific work, especially for Master students the emphasis is put on a critical discussion of the project topic.

This course will include working on cutting edge supply chain topics like Industry 4.0 / ”Internet of Everything in production“, supply chain analytics, risk management, procurement and production in SCM. The team essays / project reports will be linked to industry-related challenges as well as to upcoming theoretical concepts. The topics of the seminar will be announced at the beginning of the term in a preliminary meeting.

**Organizational issues**

Bewerbung über das Wiwi-Portal möglich:

http://go.wiwi.kit.edu/ChallengesSCM

**Literature**

Wird in Abhängigkeit vom Thema in den Projektteams bekanntgegeben.
### 4.42 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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**Events**

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<td>Tutorial for 0105300 (Classical Methods for Partial Differential Equations)</td>
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4.43 Course: Combinatorics [T-MATH-105916]

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

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102950 - Combinatorics

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**Prerequisites**
none

**Annotation**
The course is offered every second year.
4.44 Course: Commutative Algebra [T-MATH-108398]

**Responsible:** Prof. Dr. Frank Herrlich  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-104053 - Commutative Algebra

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**Prerequisites**
none
4.45 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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</table>

**Prerequisites**
Keine
4.46 Course: Complex Analysis [T-MATH-105849]

**Responsible:**
PD Dr. Gerd Herzog
Prof. Dr. Michael Plum
Prof. Dr. Wolfgang Reichel
Prof. Dr. Roland Schnaubelt
Dr. rer. nat. Patrick Tolksdorf

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102878 - Complex Analysis

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**Course: Compressive Sensing [T-MATH-105894]**

**Responsible:** Prof. Dr. Andreas Rieder  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-102935 - Compressive Sensing
4.48 Course: Computational Economics [T-WIWI-102680]

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

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Events

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<th>Type</th>
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<td>Shukla</td>
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Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
The assessment consists of a written exam (60 min) (according to §4(2), 1 of the examination 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 23/24, 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:

4.49 Course: Computational Group Theory exam [T-MATH-112669]

**Responsible:** Dr. Marek Kaluba

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-106240 - Computational Group Theory

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**Competence Certificate**
oral exam of ca. 20 minutes

**Prerequisites**
none
### 4.50 Course: Computational Group Theory Tutorial [T-MATH-112670]

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**Responsible:** Dr. Marek Kaluba  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-106240 - Computational Group Theory

**Competence Certificate**  

**Prerequisites**  
none
4.51 Course: Computer-Assisted Analytical Methods for Boundary and Eigenvalue Problems [T-MATH-105854]

- **Responsible:** Prof. Dr. Michael Plum
- **Organisation:** KIT Department of Mathematics
- **Part of:** M-MATH-102883 - Computer-Assisted Analytical Methods for Boundary and Eigenvalue Problems

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</table>
4.52 Course: Continuous Time Finance [T-MATH-105930]

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

**Organisation:** KIT Department of Mathematics

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

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**Events**

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**Competence Certificate**
oral exam of ca. 30 minutes

**Prerequisites**
none
## 4.53 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
**4.54 Course: Convex Analysis [T-WIWI-102856]**

**Responsible:** Prof. Dr. Oliver Stein  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-101473 - Mathematical Programming

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**Competence Certificate**

The assessment of the lecture is a written examination (60 minutes) according to §4(2), 1 of the examination regulation. The successful completion of the exercises is required for admission to the written exam. The examination is held in the semester of the lecture and in the following semester.

**Prerequisites**

None

**Recommendation**

It is strongly recommended to visit at least one lecture from the Bachelor program of this chair before attending this course.

**Annotation**

The lecture is offered irregularly. The curriculum of the next three years is available online (www.ior.kit.edu).

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

**Convex Analysis**

2550120, SS 2023, 2 SWS, Language: German, [Open in study portal](#)

**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

4.55 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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<tr>
<td>Oral examination</td>
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<td>Grade to a third</td>
<td>1</td>
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</table>
4.56 Course: Cooperative Autonomous Vehicles [T-WIWI-112690]

**Responsible:** Prof. Dr. Alexey Vinel
**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 2023</td>
<td>2511450</td>
<td>Cooperative Autonomous Vehicles</td>
<td>2 SWS</td>
<td>Lecture / 🗣️</td>
<td>Vinel</td>
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<td>ST 2023</td>
<td>2511451</td>
<td>Exercise Cooperative Autonomous Vehicles</td>
<td>1 SWS</td>
<td>Practice / 🗣️</td>
<td>Vinel</td>
</tr>
</tbody>
</table>

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

**Competence Certificate**
The assessment of this course is a written examination (60 min) or an oral exam (20 min).
The exam takes place every semester and can be repeated at every regular examination date.

**Prerequisites**
None
Course: Corporate Financial Policy [T-WIWI-102622]

Responsible: Prof. Dr. Martin Ruckes
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101480 - Finance 3
M-WIWI-101483 - Finance 2
M-WIWI-101502 - Economic Theory and its Application in Finance

<table>
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Events

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<td>1 SWS</td>
<td>Grade to a third</td>
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</tbody>
</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:

Corporate Financial Policy
2530214, SS 2023, 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.
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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<table>
<thead>
<tr>
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<th>Grading scale</th>
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<tr>
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<td>4.5</td>
<td>Grade to a third</td>
<td>Each summer term</td>
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</table>

**Competence Certificate**
The assessment consists of a written exam (60 min.) according to § 4 paragraph 2 Nr. 1 of the examination regulation. If there are only a small number of participants registered for the exam, we reserve the right to hold an oral examination instead of a written one.

Please note that the exam is only offered in the semester of the lecture as well as in the following semester.

**Prerequisites**
None

**Recommendation**
None

**Annotation**
The course will be held again in the summer term 2023 at the earliest. Please pay attention to the announcements on our website.
4.59 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>
<thead>
<tr>
<th>Events</th>
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<th>Grading scale</th>
<th>Recurrence</th>
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<td>Critical Information Infrastructures</td>
<td>2 SWS</td>
<td>Grade to a third</td>
<td>Each winter term</td>
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<tr>
<td>WT 23/24</td>
<td>Exercises to Critical Information Infrastructures</td>
<td>1 SWS</td>
<td>Grade to a third</td>
<td>Each winter term</td>
<td></td>
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</table>

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

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
4.60 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

<table>
<thead>
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**Events**

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<td>WT 23/24</td>
<td>2511202</td>
<td>Database Systems and XML</td>
<td>2</td>
<td>Lecture / 📚</td>
<td>Oberweis</td>
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<td>WT 23/24</td>
<td>2511203</td>
<td>Exercises Database Systems and XML</td>
<td>1</td>
<td>Practice / 🗣</td>
<td>Oberweis, Fritsch</td>
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</tbody>
</table>

**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 23/24, 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.

**Note on the event format:**
The course Database Systems and XML will be held in WS 23/24 in a "Flipped Classroom" format. Videos and supporting materials are provided for the lecture content, which students can work through independently and at their own pace. During the semester, interactive classroom sessions are held at regular intervals to practice and reinforce the lecture content.

**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.
4.61 Course: Demand-Driven Supply Chain Planning [T-WIWI-110971]

**Responsible:** Dr. Josef Packowski

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

**Part of:** M-WIWI-102805 - Service Operations

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

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<th>Lecture / 🗣</th>
<th>Packowski</th>
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</table>

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

**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.
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

<table>
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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>2530550</th>
<th>Derivatives</th>
<th>2 SWS</th>
<th>Lecture / 👤</th>
<th>Uhrig-Homburg</th>
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<td>ST 2023</td>
<td>2530551</td>
<td>Übung zu Derivate</td>
<td>1 SWS</td>
<td>Practice / 👤</td>
<td>Eska, Uhrig-Homburg</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 or as an open-book examination (alternative exam assessment).

A bonus can be earned by correctly solving at least 50% of the posed bonus exercises. If the grade of the written examination is between 4.0 and 1.3, the bonus improves the grade by up to one grade level (0.3 or 0.4). Details will be announced in the lecture.

**Prerequisites**

None

**Recommendation**

None

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

**Derivatives**

2530550, SS 2023, 2 SWS, Language: German,

Open in study portal

**Literature**


**Weiterführende Literatur:**

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

**Competence Certificate**

Alternative exam assessment. The assessment consists of a one-hour exam and the implementation of a Capstone project. Details will be announced at the beginning of the course.

**Annotation**

The course is held in english.

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

**Designing Interactive Systems**

2540558, SS 2023, 3 SWS, Language: English, Open in study portal

**Lecture (V)**

Blended (On-Site/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 system are socio-technical systems in which users perform tasks by interacting with technology in a specific context in order to achieve specified goals and outcomes.

The aim of this course is to introduce advanced concepts and theories, interaction technologies as well as current practice of contemporary interactive systems.

The course is complemented with a design capstone project, where students in a team select and apply design methods & techniques in order to create an interactive prototype.

**Learning objectives**

- Get an advanced understanding of conceptual foundations of interactive systems from a human and computer perspective
- explore the theoretical grounding of Interactive Systems leveraging theories from reference disciplines such as psychology
- know specific design principles for the design of advanced interactive systems
- get hands-on experience in conceptualizing and designing advanced Interactive Systems to solve a real-world challenge from an industry partner by applying the lecture contents.

**Prerequisites**

No specific prerequisites are required for the lecture
Literatur
Die Vorlesung basiert zu einem großen Teil auf


Weiterführende Literatur wird in der Vorlesung bereitgestellt.
## 4.64 Course: Differential Geometry [T-MATH-102275]

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

**Organisation:** KIT Department of Mathematics  

**Part of:** M-MATH-101317 - Differential Geometry

<table>
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<td>Tuschmann</td>
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<td>ST 2023</td>
<td>0100310</td>
<td><strong>Tutorial for 0100300 (Differential Geometry)</strong></td>
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<td>Practice</td>
<td>Tuschmann, Kupper</td>
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</table>
**Course: Digital Health [T-WIWI-109246]**

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

<table>
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<tr>
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<td>Grade to a third</td>
<td>Each winter term</td>
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</table>

**Events**

| WT 23/24 | 2511402 | Digital Health | 2 SWS | Lecture / 🧩 | Sunyaev, Thiebes, Schmidt-Kraepelin |

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

**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.
4.66 Course: Digital Marketing [T-WIWI-112693]

**Responsible:** Prof. Dr. Ann-Kristin Kupfer  
**Organisation:** KIT Department of Economics and Management  
**Part of:**  
  - M-WIWI-105312 - Marketing and Sales Management  
  - M-WIWI-106258 - Digital Marketing

<table>
<thead>
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**Events**

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<td>2 SWS</td>
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<td>Digital Marketing Exercise</td>
<td>1 SWS</td>
<td>Practice</td>
<td>Mitarbeiter</td>
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</table>

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

**Competence Certificate**  
The control of success is done by the elaboration and presentation of a group task as well as a written exam. Further details on the design of the performance review will be announced during the lecture.

**Prerequisites**  
None

**Recommendation**  
Students are highly encouraged to actively participate in class.

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

**Digital Marketing**  
2571185, SS 2023, 2 SWS, Language: English, [Open in study portal]

**Content**  
Students learn the theoretical foundations of digital marketing and its most important concepts. They develop an understanding both for the digital consumer and the digital environment. Special emphasis will be given to digital marketing strategies and practices, such as content marketing and influencer marketing. A tutorial offers the opportunity to apply the key learnings of the lecture as part of a group work.

The learning objectives are as follows:

- Getting to know the theoretical foundations of digital marketing
- Evaluating digital marketing strategies and practices (e.g., in the context of content marketing and influencer marketing)
- Fostering critical and analytical thinking skills and the application of knowledge to marketing problems
- Improving English skills

Total time required for 4.5 credit points: approx. 135 hours  
Attendance time: 30 hours  
Self-study: 105 hours

**Organizational issues**  
Termine werden bekannt gegeben.
4.67 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  
M-WIWI-106258 - Digital Marketing

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

**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**  
This course will not take place in the summer term 2023, but is expected to be offered again on a regular basis starting in the summer term 2024.  
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.
4.68 Course: Discrete Dynamical Systems [T-MATH-110952]

**Responsible:** PD Dr. Gerd Herzog  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-105432 - Discrete Dynamical Systems

<table>
<thead>
<tr>
<th>Type</th>
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**Prerequisites**  
none
4.69 Course: Discrete Time Finance [T-MATH-105839]

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

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102919 - Discrete Time Finance

### Events

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<td>2 SWS</td>
<td>Practice</td>
<td>Each winter term</td>
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</table>

**Competence Certificate**  
Written exam of 2h.

**Prerequisites**  
none

**Recommendation**  
The contents of the module „Probability theory“ are strongly recommended.
Course: Discrete-Event Simulation in Production and Logistics [T-WIWI-102718]

**Responsibility:** Hon.-Prof. Dr. Sven Spieckermann

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

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

**Events**

<table>
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<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
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</thead>
<tbody>
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<td>Grade to a third</td>
<td>Each summer term</td>
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</table>

**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**

<table>
<thead>
<tr>
<th>Event Code</th>
<th>ISRN</th>
<th>Language</th>
<th>Type</th>
<th>Credits</th>
<th>Grading scale</th>
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<td>2550488</td>
<td>German</td>
<td>Lecture</td>
<td>3</td>
<td>Grade to a third</td>
<td>Spieckermann</td>
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</table>

**Content**
Simulation of production and logistics systems is an interdisciplinary subject connecting expert knowledge from production management and operations research with mathematics/statistics as well as computer science and software engineering. With completion of this course, students know statistical foundations of discrete simulation, are able to classify and apply related software applications, and know the relation between simulation and optimization as well as a number of application examples. Furthermore, students are enabled to structure simulation studies and are aware of specific project scheduling issues.

**Organizational issues**
Den Bewerbungszeitraum finden Sie auf der Veranstaltungswebsite im Lehre-Bereich unter dol.io.r.kit.edu

**Literature**

4.71 Course: Dispersive Equations [T-MATH-109001]

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

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-104425 - Dispersive Equations

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

**Prerequisites**

none
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

<table>
<thead>
<tr>
<th>Event</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Type</th>
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<th>Grading Scale</th>
<th>Recurrence</th>
<th>Version</th>
</tr>
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<tbody>
<tr>
<td>WT 23/24</td>
<td>2560402</td>
<td>Dynamic Macroeconomics</td>
<td>Written examination</td>
<td>2 SWS</td>
<td>Grade to a third</td>
<td>Each winter term</td>
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<tr>
<td>WT 23/24</td>
<td>2560403</td>
<td>Übung zu Dynamic Macroeconomics</td>
<td>Lecture</td>
<td>1 SWS</td>
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</table>

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

**Competence Certificate**  
The assessment is a written exam (60 min.).

**Prerequisites**  
None.

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

**Dynamic Macroeconomics**  
2560402, WS 23/24, 2 SWS, Language: English, [Open in study portal](#)  
Lecture (V)  
Blended (On-Site/Online)

**Content**  
This course addresses macroeconomic questions on an advanced level. The main focus of this course is on dynamic programming and its fundamental role in modern macroeconomics. In the first part of the course, the necessary mathematical tools are introduced as well as basic applications in labor economics, economic growth and business cycle analysis. In the second part of the course, these basic models are expanded to incorporate household heterogeneity in various forms: Models of economic inequality to analyze the distributional impact of tax policies and models of overlapping generations to analyze the impact of social security reforms or changes in government debt. Finally, advanced methods based on sparse grids or neural nets are introduced to solve high-dimensional models. The course pursues a hands-on approach so that students not only gain theoretical insights but also learn numerical tools to solve dynamic economic models using the programming language Python.

**Literature**  
Literatur und Skripte werden in der Veranstaltung angegeben.
### 4.73 Course: Dynamical Systems [T-MATH-106114]

<table>
<thead>
<tr>
<th><strong>Responsible:</strong></th>
<th>Prof. Dr. Wolfgang Reichel</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organisation:</strong></td>
<td>KIT Department of Mathematics</td>
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<tr>
<td><strong>Part of:</strong></td>
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</table>

**Prerequisites**
- none


## 4.74 Course: Economics of Innovation [T-WWI-112822]

**Responsible:** Prof. Dr. Ingrid Ott  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-101478 - Innovation and Growth

<table>
<thead>
<tr>
<th>Events</th>
<th>Credits</th>
<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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<td>4,5</td>
<td>Grade to a third</td>
<td>Each summer term</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**

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:**

| Economics of Innovation  
| 2560236, SS 2023, 2 SWS, Language: English, Open in study portal | Lecture (V) On-Site |
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:

4.75 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

<table>
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**Events**

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<td>Efficient Energy Systems and Electric Mobility</td>
<td>2</td>
<td>Lecture / 🗣</td>
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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 2023, 2 SWS, Language: English, [Open in study portal]

**Content**

This lecture series combines two of the most central topics in the field of energy economics at present, namely energy efficiency and electric mobility. The objective of the lecture is to provide an introduction and overview to these two subject areas, including theoretical as well as practical aspects, such as the technologies, political framework conditions and broader implications of these for national and international energy systems.

- Understand the concept of energy efficiency as applied to specific systems
- Obtain an overview of the current trends in energy efficiency
- Be able to determine and evaluate alternative methods of energy efficiency improvement
- Overview of technical and economical stylized facts on electric mobility
- Judging economical, ecological and social impacts through electric mobility

**Organizational issues**

s. Institutsaushang

**Literature**

Wird in der Vorlesung bekanntgegeben.
**4.76 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

<table>
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**Events**

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<th>Grade</th>
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<td>eFinance: Information Systems for Securities Trading</td>
<td>Lecture</td>
<td>2</td>
<td>Weinhardt, Jaquart</td>
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<td></td>
<td>Übungen zu eFinance: Information Systems for Securities Trading</td>
<td>Practice</td>
<td>1</td>
<td>Motz</td>
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</table>

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

**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 23/24, 2 SWS, Language: English, [Open in study portal](#)

**Literature**


**Weiterführende Literatur:**

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

<table>
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Events

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<tbody>
<tr>
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<td>2513404</td>
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<tr>
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<td>2513405</td>
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</table>

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.
### 4.78 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

<table>
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**Events**

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<tr>
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<td>2 SWS</td>
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</table>

**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

<table>
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<th>Type</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>Term</th>
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<th>Type</th>
</tr>
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<tbody>
<tr>
<td>ST 23</td>
<td>2581003</td>
<td>Energy and Environment</td>
<td>2 SWS</td>
<td>Lecture / 🔴</td>
</tr>
<tr>
<td>ST 23</td>
<td>2581004</td>
<td>Übungen zu Energie und Umwelt</td>
<td>1 SWS</td>
<td>Practice / 🔴</td>
</tr>
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</table>

**Legend:** 🖥 Online, ⚪ Blended (On-Site/Online), 🔴 On-Site, ✗ Cancelled

#### Competence Certificate

The assessment consists of a written exam (60 minutes) (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 2023, 2 SWS, Language: German, Open in study portal**

**Lecture (V)**  
**On-Site**

#### Content

The lecture focuses on the environmental impacts arising from fossil fuels use and on the methods for the evaluation of such impacts. The first part of the lecture describes the environmental impacts of air pollutants and greenhouse gases as well as technical measures for emission control. The second part covers methods of impact assessment and their use in environmental communication as well as methods for the scientific support of emission control strategies.

The topics include:

- Fundamentals of energy conversion  
- Formation of air pollutants during combustion  
- Technical measures to control emissions from fossil-fuel combustion processes  
- External effects of energy supply (life cycle analyses of selected energy systems)  
- Environmental communication on energy services (e.g. electricity labelling, carbon footprint)  
- Integrated Assessment Modelling to support the European Clean Air Strategy  
- Cost-effectiveness analyses and cost-benefit analyses for emission control strategies  
- Monetary valuation of external effects (external costs)

#### Literature

Die Literaturhinweise sind in den Vorlesungsunterlagen enthalten (vgl. ILIAS)
4.80 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

<table>
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<tr>
<th>Events</th>
<th>Type</th>
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<th>Grading scale</th>
<th>Recurrence</th>
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<td>Each summer term</td>
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<td>Übung zu Energy Market Engineering</td>
<td>1 SWS</td>
<td>Practice</td>
<td>Weinhardt</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**  
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 2023, 2 SWS, Language: German, Open in study portal

**Literature**

4.81 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

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

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<th>2540494</th>
<th>Energy Networks and Regulation</th>
<th>2 SWS</th>
<th>Lecture / 🗣</th>
<th>Rogat, Miskiw</th>
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<tr>
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<td>Practice / 🗣</td>
<td>Rogat, Miskiw</td>
</tr>
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</table>

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

**Competence Certificate**
The assessment consists of a written exam according to Section 4 (2), 1 of the examination regulation. The exam is offered every semester. Re-examinations are offered on every ordinary examination date.

**Prerequisites**
None

**Recommendation**
None

**Annotation**
Former course title until summer term 2017: T-WIWI-103131 "Regulatory Management and Grid Management - Economic Efficiency of Network Operation"

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

**Energy Networks and Regulation**
2540494, WS 23/24, 2 SWS, Language: German, Open in study portal
Content

Learning Goals

The student,

- understands the business model of a network operator and knows its central tasks in the energy supply system,
- has a holistic overview of the interrelationships in the network economy,
- understands the regulatory and business interactions,
- is in particular familiar with the current model of incentive regulation with its essential components and understands its implications for the decisions of a network operator
- is able to analyse and assess controversial issues from the perspective of different stakeholders.

Content of teaching

The lecture “Energy Networks and Regulation” provides insights into the regulatory framework of electricity and gas. It touches upon the way the grids are operated and how regulation affects almost all grid activities. The lecture also addresses approaches of grid companies to cope with regulation on a managerial level. We analyze how the system influences managerial decisions and strategies such as investment or maintenance. Furthermore, we discuss how the system affects the operator’s abilities to deal with the massive challenges lying ahead ("Energiewende", redispatch, European grid integration, electric vehicles etc.). Finally, we look at current developments and major upcoming challenges, e.g., the smart meter rollout. Covered topics include:

- Grid operation as a heterogeneous landscape: big vs. small, urban vs. rural, TSO vs. DSO
- Objectives of regulation: Fair price calculation and high standard access conditions
- The functioning of incentive regulation
- First major amendment to the incentive regulation: its merits, its flaws
- The revenue cap and how it is adjusted according to certain exogenous factors
- Grid tariffs: How are they calculated, what is the underlying rationale, do we need a reform (and which)?
- Exogenous costs shifted (arbitrarily?) into the grid, e.g. feed-in tariffs for renewable energy or decentralized supply.

Literature


4.82 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

**Type**
- Written examination

**Credits**
- 3

**Grading scale**
- Grade to a third

**Recurrence**
- see Annotations

**Version**
- 1

**Competence Certificate**
As of winter semester 2023/24, the lecture will no longer be offered.

Examination offer for the lecture: last first attempt in winter semester 2023/24; last examination date for repeaters in summer semester 2024.

The assessment of success will take the form of a written examination (60 minutes).

**Prerequisites**
- None

**Recommendation**
- None

**Annotation**
As of the winter semester 2023/24, the lecture will no longer be offered.
4 COURSES

Course: Energy Trading and Risk Management [T-WIWI-112151]

4.83 Course: Energy Trading and Risk Management [T-WIWI-112151]

Responsible: N.N.
Organisation: KIT Department of Economics and Management

<table>
<thead>
<tr>
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<td>Each summer term</td>
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Events

| ST 2023 | 2581020 | Energy Trading and Risk Management | 2 SWS | Lecture / 🗣 | Kraft, Fichtner |

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

Competence Certificate

The lecture "Energiehandel und Risikomanagement" will be held in English under the title "Energy Trading and Risk Management" from the summer semester 2022. The examination for the English-language lecture will be offered in English from the summer semester 2022. The assessment consists of a written exam (60 minutes). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date. Depending on the respective pandemic situation, the exam may be offered as an open book exam (alternative exam assessment).

Prerequisites
None

Recommendation
None

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

Energy Trading and Risk Management
2581020, SS 2023, 2 SWS, Language: English, Open in study portal

Content

1. Introduction to Markets, Mechanisms and Interaction
2. Electricity Trading (platforms, products, mechanisms)
4. Coal Markets (reserves, supply, demand, and transport)
5. Investments and Capacity Markets
6. Oil and Gas Markets (supply, demand, trade, and players)
7. Trading Game
8. Risk Management in Energy Trading

Literature

Weiterführende Literatur:
www.riskglossary.com

Econmathematics M.Sc.
Module Handbook as of 04/09/2023
4.84 Course: Ergodic Theory [T-MATH-113086]

**Responsible:** Dr. Gabriele Link

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-106473 - Ergodic Theory

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</table>

**Competence Certificate**

Oral examination of ca. 20-30 minutes.

**Prerequisites**

none

**Recommendation**

Some basic knowledge of measure theory, topology, geometry, group theory and functional analysis is recommended.
# 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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### Events

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<th>Lecture</th>
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<td>0105910</td>
<td>Tutorial for 0105900 (Evolution Equations)</td>
<td>2 SWS</td>
<td>Practice</td>
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</table>
### 4.86 Course: Experimental Economics [T-WIWI-102614]

**Responsible:** Prof. Dr. Christof Weinhardt  
**Organisation:** KIT Department of Economics and Management  
**Part of:**  
- M-WIWI-101505 - Experimental Economics  
- M-WIWI-102970 - Decision and Game Theory

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</table>

**Competence Certificate**  
The assessment consists of a written exam (60 min).  
By successful completion of 70% of the maximum number of points in the exercise(s) a bonus can be obtained.  
If the grade of the written exam is at least 4.0 and at most 1.3, the bonus will improve it by one grade level (i.e. by 0.3 or 0.4). The exact criteria for the award of a bonus will be announced at the beginning of the lecture.

**Prerequisites**  
None

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

**V** Experimental Economics  
2540489, WS 23/24, 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.
### 4.87 Course: Exponential Integrators [T-MATH-107475]

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

**Organisation:** KIT Department of Mathematics  

**Part of:** M-MATH-103700 - Exponential Integrators

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**Prerequisites:**  
none
4.88 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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**Prerequisites**  
none
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<tr>
<th>Responsible</th>
<th>Prof. Dr. Vicky Fasen-Hartmann</th>
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<td>KIT Department of Mathematics</td>
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<tr>
<td>Part of</td>
<td>M-MATH-102939 - Extreme Value Theory</td>
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<td>Version</td>
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</table>
4.90 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

<table>
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<tr>
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<td>Facility Location and Strategic Supply Chain</td>
<td>Written examination</td>
<td>2 SWS</td>
<td>Grade to a third</td>
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<td>2550487</td>
<td>Übungen zu Standortplanung und strategisches SCM</td>
<td>Practice</td>
<td>1 SWS</td>
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</table>

Events:
- Lecture / On-Site

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

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 23/24, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Organizational issues
Für die Klausurzulassung müssen 4 von 5 Online-Tests bestanden sein.
Die Zulassung ist ein Jahr gültig, außer es handelt sich um einen Zweitversuch. In diesem Falle müssen die Online-Tests nicht erneut absolviert werden.

Literature
Weiterführende Literatur:

- Love, Morris, Wesołowsky: Facilities Location: Models and Methods, North Holland, 1988
4.91 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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<th>Language</th>
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<td>ST 2023</td>
<td>2530206</td>
<td>Übungen zu Financial Analysis</td>
<td>2</td>
<td>Practice / 🗣</td>
<td>German</td>
<td>Luedecke</td>
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</table>

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:*

<table>
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<th>V</th>
<th>Financial Analysis</th>
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**Literature**

4.92 Course: Financial Econometrics [T-WIWI-103064]

**Responsible:** Prof. Dr. Melanie Schienle

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

**Part of:**
- M-WIWI-101638 - Econometrics and Statistics I
- M-WIWI-101639 - Econometrics and Statistics II

<table>
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<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
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<td>4.5</td>
<td>Grade to a third</td>
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<td>WT 23/24 2520023</td>
<td>Übungen zu Financial Econometrics I</td>
<td>4.5</td>
<td>Grade to a third</td>
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</table>

**Type:** Written examination

**Recurrence:** Each winter term

**Credits:** 4.5

**Grading scale:** Grade to a third

**Version:** 2

**Events**

- **WT 23/24 2520022**
  - Financial Econometrics I
  - 2 SWS
  - Lecture / On-Site
  - Schienle, Buse

- **WT 23/24 2520023**
  - Übungen zu Financial Econometrics I
  - 2 SWS
  - Practice / On-Site
  - Schienle, Buse

**Legend:** ☩ Online, ☐ Blended (On-Site/Online), ☞ On-Site, ✗ Canceled

**Competence Certificate**
The assessment consists of a written exam (90 minutes) (following §4(2), 1 of the examination regulation).

**Prerequisites**
The course T-MATH-105874 "Time Series Analysis" may not be chosen.

**Recommendation**
Knowledge of the contents covered by the course "Economics III: Introduction in Econometrics" [2520016]

**Annotation**
The next lecture will take place in the winter semester 2022/23.

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

<table>
<thead>
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<th>Financial Econometrics I</th>
<th>Lecture (V) On-Site</th>
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<tbody>
<tr>
<td>2520022, WS 23/24, 2 SWS, Language: English, Open in study portal</td>
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</table>

**Content**

**Learning objectives:**
The student

- shows a broad knowledge of financial econometric estimation and testing techniques
- is able to apply his/her technical knowledge using software in order to critically assess empirical problems

**Content:**
ARMA, ARIMA, ARFIMA, (non)stationarity, causality, cointegration, ARCH/GARCH, stochastic volatility models, computer based exercises

**Requirements:**
It is recommended to attend the course Economics III: Introduction to Econometrics [2520016] prior to this course.

**Workload:**
- Total workload for 4.5 CP: approx. 135 hours
- Attendance: 30 hours
- Preparation and follow-up: 65 hours
- Exam preparation: 40 hours
**Literature**


Additional literature will be discussed in the lecture.
4.93 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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Events

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<td>Lecture / 🗣</td>
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<td>Buse, Schienle</td>
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Legend: 🖥 Online, Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

Competence Certificate
Written examination (90 minutes). If the number of participants is low, an oral examination will be held instead.

Prerequisites
None

Recommendation
Knowledge of the contents covered by the course "Financial Econometrics"

Annotation
Course language is English
The next lecture will take place in the summer semester of 2023.
**4.94 Course: Financial Intermediation [T-WIWI-102623]**

**Responsible:** Prof. Dr. Martin Ruckes  
**Organisation:** KIT Department of Economics and Management  
**Part of:**  
- M-WIWI-101480 - Finance 3  
- M-WIWI-101483 - Finance 2  
- M-WIWI-101502 - Economic Theory and its Application in Finance

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**Events**

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<td>1 SWS</td>
<td>Übung zu Finanzintermediation</td>
<td>German</td>
<td>Ruckes, Benz</td>
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</tbody>
</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:

**V Financial Intermediation**

2530232, WS 23/24, 2 SWS, Language: German, [Open in study portal](#)  

**Literature**

Weiterführende Literatur:

4.95 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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### 4.96 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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### 4.97 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 |

| **Type**       | Oral examination |
| **Credits**    | 3 |
| **Grading scale** | Grade to a third |
| **Recurrence** | Once |
| **Version**    | 1 |

**Prerequisites**

none
4.98 Course: Fourier Analysis and its Applications to PDEs [T-MATH-109850]

<table>
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<tr>
<th>Responsible</th>
<th>TT-Prof. Dr. Xian Liao</th>
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**Prerequisites**

none
4.99 Course: Fractal Geometry [T-MATH-111296]

<table>
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<tr>
<th>Responsible</th>
<th>PD Dr. Steffen Winter</th>
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<tr>
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Prerequisites
none
### Course: Functional Analysis [T-MATH-102255]

**Responsible:** Prof. Dr. Dorothee Frey  
PD Dr. Gerd Herzog  
Prof. Dr. Dirk Hundertmark  
Prof. Dr. Tobias Lamm  
TT-Prof. Dr. Xian Liao  
Prof. Dr. Wolfgang Reichel  
Prof. Dr. Roland Schnaubelt  
Dr. rer. nat. Patrick Tolksdorf  

**Organisation:** KIT Department of Mathematics  
Part of: M-MATH-101320 - Functional Analysis  

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**Events**

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<td><strong>Functional Analysis</strong></td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ☑ Cancelled

**Competence Certificate**  
Written examination of 120 minutes.

**Prerequisites**
None
Course: Functional Data Analysis [T-MATH-113102]

Responsible: Dr. rer. nat. Bruno Ebner
PD Dr. Bernhard Klar
Prof. Dr. Mathias Trabs

Organisation: KIT Department of Mathematics

Part of: M-MATH-106485 - Functional Data Analysis

Type: Oral examination
Credits: 4
Grading scale: Grade to a third
Recurrence: Irregular
Version: 1

Competence Certificate
Oral examination of ca. 25 minutes.

Prerequisites
none

Recommendation
The contents of the modules "Probability Theory" and "Mathematical Statistics" are strongly recommended.
### 4.102 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
### 4.103 Course: Functions of Operators [T-MATH-105905]

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Economathematics M.Sc.
Module Handbook as of 04/09/2023

- Responsible: Prof. Dr. Maxim Ulrich
- Organisation: KIT Department of Economics and Management

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<td>see Annotations</td>
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**Competence Certificate**

Due to the professor’s research sabbatical, the BSc module "Financial Data Science" and MSc module "Foundations for Advanced Financial -Quant and -Machine Learning Research" and the MSc module "Advanced Machine Learning and Data Science" along with the respective examinations will not be offered in SS2023. Bachelor and Master thesis projects are not affected and will be supervised.

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

The module-wide exam (all 4 worksheets) must be taken in the same semester.

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

**Recommendation**

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

**Annotation**

The course is offered every second year.
### 4.105 Course: Generalized Regression Models [T-MATH-105870]

**Responsible:** Dr. rer. nat. Bruno Ebner  
Prof. Dr. Vicky Fasen-Hartmann  
PD Dr. Bernhard Klar  
Prof. Dr. Mathias Trabs

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

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<td>Generalisierte Regressionsmodelle</td>
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<td>1 SWS</td>
<td>Practice</td>
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</table>
4.106 Course: Geometric Group Theory [T-MATH-105842]

Responsible: Prof. Dr. Frank Herrlich  
Prof. Dr. Enrico Leuzinger  
Dr. Gabriele Link  
Jun.-Prof. Dr. Claudio Llosa Isenrich  
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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<td>0153310</td>
<td>Tutorial for 0153300 (Geometric Group Theory)</td>
<td>2 SWS</td>
<td>Practice</td>
<td>Llosa Isenrich</td>
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</table>
4.107 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

**Type**
- Oral examination

**Credits**
- 6

**Grading scale**
- Grade to a third

**Version**
- 1

**Prerequisites**
- none
### 4.108 Course: Geometry of Schemes [T-MATH-105841]

| Responsible       | Prof. Dr. Frank Herrlich  
|                   | PD Dr. Stefan Kühnlein |
| Organisation      | KIT Department of Mathematics |
| Part of           | M-MATH-102866 - Geometry of Schemes |

| Type             | Oral examination |
| Credits          | 8 |
| Grading scale    | Grade to a third |
| Version          | 1 |
4.109 Course: Global Differential Geometry [T-MATH-105885]

**Responsible:** Prof. Dr. Wilderich Tuschmann  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-102912 - Global Differential Geometry

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**Prerequisites** none
4.110 Course: Global Optimization I [T-WIWI-102726]

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

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

**Part of:**
- M-WIWI-101413 - Applications of Operations Research
- M-WIWI-101414 - Methodical Foundations of OR
- M-WIWI-101473 - Mathematical Programming

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**Events**

| ST 2023 | 2550134 | Global Optimization I | 2 SWS | Lecture / 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:

**Global Optimization I**

2550134, SS 2023, 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
4.111 Course: Global Optimization I and II [T-WIWI-103638]

**Responsible:** Prof. Dr. Oliver Stein  
**Organisation:** KIT Department of Economics and Management

**Part of:**  
M-WIWI-101414 - Methodical Foundations of OR  
M-WIWI-101473 - Mathematical Programming

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**Events**

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<td>ST 2023</td>
<td>2550136</td>
<td>Global Optimization II</td>
<td>2 SWS</td>
<td>Lecture / 🗣</td>
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</table>

**Competence Certificate**  
The assessment of the lecture is a written examination (120 minutes) according to §4(2), 1 of the examination regulation. The successful completion of the exercises is required for admission to the written exam. The examination is held in the semester of the lecture and in the following semester.

**Prerequisites**  
None

**Recommendation**  
None

**Annotation**  
Part I and II of the lecture are held consecutively in the same semester.

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

**Global Optimization I**  
2550134, SS 2023, 2 SWS, Language: German, Open in study portal

**Lecture (V)**  
On-Site

**Content**  
In many optimization problems from economics, engineering and natural sciences, solution algorithms are only able to efficiently identify local optimizers, while it is much harder to find globally optimal points. This corresponds to the fact that by local search it is easy to find the summit of the closest mountain, but that the search for the summit of Mount Everest is rather elaborate.

The lecture treats methods for global optimization of convex functions under convex constraints. It is structured as follows:

- Introduction, examples, and terminology
- Existence results for optimal points
- Optimality in convex optimization
- Duality, bounds, and constraint qualifications
- Algorithms (Kelley’s cutting plane method, Frank-Wolfe method, primal-dual interior point methods)

The lecture is accompanied by exercises which, amongst others, offers the opportunity to implement and to test some of the methods on practically relevant examples.

**Remark:**  
The treatment of nonconvex optimization problems forms the contents of the lecture “Global Optimization II”. The lectures “Global Optimization I” and “Global Optimization II” are held consecutively in the same semester.

**Learning objectives:**

The student

- knows and understands the fundamentals of deterministic global optimization in the convex case,
- is able to choose, design and apply modern techniques of deterministic global optimization in the convex case in practice.
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
**4.112 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

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

| ST 2023 | 2550136 | Global Optimization II | 2 SWS | Lecture / Stein |

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

**Competence Certificate**

The assessment of the lecture is a written examination (60 minutes) according to §4(2), 1 of the examination regulation. The successful completion of the exercises is required for admission to the written exam.

The examination is held in the semester of the lecture and in the following semester.

The examination can also be combined with the examination of “Global optimization I”. In this case, the duration of the written examination takes 120 minutes.

**Prerequisites**

None

**Annotation**

Part I and II of the lecture are held consecutively in the same semester.

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

**Global Optimization II**  
2550136, SS 2023, 2 SWS, Language: German, Open in study portal  
Lecture (V)  
On-Site

**Content**

In many optimization problems from economics, engineering and natural sciences, solution algorithms are only able to efficiently identify local optimizers, while it is much harder to find globally optimal points. This corresponds to the fact that by local search it is easy to find the summit of the closest mountain, but that the search for the summit of Mount Everest is rather elaborate.

The lecture treats methods for global optimization of 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
4.113 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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<td>Graph Theory</td>
<td>4</td>
<td>Lecture</td>
<td>Aksenovich, Clemen, Winter</td>
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<td>WT 23/24</td>
<td>0104510</td>
<td>Tutorial for 0104500 (Graph Theory)</td>
<td>2</td>
<td>Practice</td>
<td>Aksenovich, Clemen</td>
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</table>

**Prerequisites**

None
4.114 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

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<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.
4.115 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

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**Prerequisites**
none
Course: Growth and Development [T-WIWI-112816]

**Responsible:** Prof. Dr. Ingrid Ott

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

**Part of:**
- M-WIWI-101478 - Innovation and Growth
- M-WIWI-101496 - Growth and Agglomeration

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**Events**

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<td>Lecture / 🗣️</td>
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<td>Exercise for Growth and Development</td>
<td>1</td>
<td>Practice / 🗣️</td>
<td>Völkle, Ott, Zoroglu</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 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.

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

**Growth and Development**

2561503, WS 23/24, 2 SWS, Language: German/English, [Open in study portal](#)

Lecture (V)

On-Site
Content
This course is intended as an introduction to the field of advanced macroeconomics with a special focus on economic growth. Lectures aim to deal with the theoretical foundations of exogenous and endogenous growth models. The importance of growth for nations and discussion of some (well-known) growth theories together with the role of innovation, human capital and environment will therefore be primary focuses of this course.

Learning objective:
Students shall be given the ability to understand, analyze and evaluate selected models of endogenous growth theory.

Course content:
- Intertemporal consumption decision
- Growth models with exogenous saving rates: Solow
- Growth models with endogenous saving rates: Ramsey
- Growth and environmental resources
- Basic models of endogenous growth
- Human capital and economic growth
- Modelling of technological progress
- Diversity Models
- Schumpeterian growth
- Directional technological progress
- Diffusion of technologies

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:
4.117 Course: Harmonic Analysis [T-MATH-111289]

**Responsible:** Prof. Dr. Dorothee Frey  
apl. Prof. Dr. Peer Kunstmann  
Prof. Dr. Roland Schnaubelt  
Dr. rer. nat. Patrick Tolksdorf

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

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<td>Grade to a third</td>
<td>1</td>
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4.18 Course: Harmonic Analysis 2 [T-MATH-113103]

**Responsible:** Prof. Dr. Dorothee Frey  
apl. Prof. Dr. Peer Kunstmann  
Dr. rer. nat. Patrick Tolksdorf

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-106486 - Harmonic Analysis 2

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<td>Grade to a third</td>
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**Competence Certificate**  
oral examination of ca. 30 minutes.

**Prerequisites**  
none

**Recommendation**  
The following modules are strongly recommended: "Harmonic Analysis", "Functional Analysis".
4.119 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

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**Events**

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<th>Heat Economy</th>
<th>2 SWS</th>
<th>Lecture /🗣</th>
<th>Fichtner</th>
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**Competence Certificate**

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.

**Prerequisites**

None.

**Recommendation**

None

**Annotation**

See German version.

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

**Heat Economy**

2581001, SS 2023, 2 SWS, Language: German, Open in study portal

**Organizational issues**

Block, Seminarraum Standort West - siehe Institutsauflistung
<table>
<thead>
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**Responsible:** Prof. Dr. Roman Sauer  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-102959 - Homotopy Theory
4.121 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

Type: Written examination
Credits: 4.5
Grading scale: Grade to a third
Recurrence: see Annotations
Version: 3

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.
4.122 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

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**Events**

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<td>2 SWS</td>
<td>Incentives in Organizations</td>
<td>Lecture / 🗣️</td>
<td>Nieken</td>
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<td>ST 2023 2573004</td>
<td>2 SWS</td>
<td>Übung zu Incentives in Organizations</td>
<td>Practice / 🗣️</td>
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Legend: 🖥 Online, ☑ Blended (On-Site/Online), 🗣️ On-Site, ☐ Cancelled

**Competence Certificate**
The assessment of this course is a written examination (60 min). 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 2023, 2 SWS, Language: English, [Open in study portal](#)
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
4.123 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

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**Events**

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<td>2 SWS</td>
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<td>Sack, Tan, Vafaie</td>
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<td>ST 2023 2511607</td>
<td>Exercises to Information Service Engineering</td>
<td>1 SWS</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), ⚪ On-Site, ✗ Cancelled

**Competence Certificate**

The assessment of this course is a written examination (60 min) according to §4(2), 1 of the examination regulation or an oral exam (20 min) following §4, Abs. 2, 2 of the examination regulation.

The exam takes place every semester and can be repeated at every regular examination date.

**Prerequisites**

None

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

**Information Service Engineering**  
2511606, SS 2023, 2 SWS, Language: English, [Open in study portal](#)  

Lecture (V)  
On-Site
Content

- The Art of Understanding
  - Data, Information, Knowledge and Wisdom
  - Syntax, Semantics, Context, Pragmatics, and Experience

- Natural Language Processing
  - NLP and Basic Linguistic Knowledge
  - NLP Applications, Techniques & Challenges
  - Evaluation, Precision and Recall
  - Regular Expressions and Automata
  - Tokenization
  - Language Model and N-Grams
  - Part-of-Speech Tagging
  - Distributional Semantics & Word Embeddings

- Knowledge Graphs
  - Knowledge Representations and Ontologies
  - Resource Description Framework (RDF) as simple Data Model
  - Creating new Models with RDFS
  - Querying RDF(S) with SPARQL
  - More Expressivity via Web Ontology Language (OWL)
  - From Linked Data to Knowledge Graphs
  - Wikipedia, DBpedia, and Wikidata
  - Knowledge Graph Quality Assurance with SHACL

- Basic Machine Learning
  - Machine Learning Fundamentals
  - Evaluation and Generalization Problems
  - Linear Regression
  - Decision Trees
  - Unsupervised Learning
  - Neural Networks and Deep Learning

- ISE Applications
  - Knowledge Graph Embeddings
  - Knowledge Graph Completion
  - Knowledge Graphs and Large Language Models
  - Semantic Search
  - Exploratory Search and 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 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

4.124 Course: Integral Equations [T-MATH-105834]

Responsible: PD Dr. Tilo Arens
Prof. Dr. Roland Griesmaier
PD Dr. Frank Hettlich

Organisation: KIT Department of Mathematics

Part of: M-MATH-102874 - Integral Equations

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Economathematics M.Sc.
Module Handbook as of 04/09/2023
4.125 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

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**Events**

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<td>KT 23/24</td>
<td>2572189</td>
<td>International Business Development and Sales</td>
<td>4 SWS</td>
<td>Block / 🗣 Klarmann, Terzidis, Schmitt</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, 🗑 Canceled

**Competence Certificate**

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

**Annotation**

Please note that currently it cannot be guaranteed that the course will take place in the winter term 22/23. Please contact the Marketing and Sales Research Group for further information.

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

**International Business Development and Sales**

2572189, WS 23/24, 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.
4.126 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>International Finance</th>
<th>2 SWS</th>
<th>Lecture / Walter, Uhrig-Homburg</th>
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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

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 2023, 2 SWS, Language: German, Open in study portal

Organizational issues
Kickoff am Mittwoch, 26.04.23, 15:45 - 19:00 Uhr im Raum 320 im Geb. 09.21 (Blücherstr. 17). Die Veranstaltung wird samstags als Blockveranstaltung angeboten, nach dem Kickoff nach Absprache.

Literature
Weiterführende Literatur:
4.127 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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Prerequisites
none
# 4.128 Course: Introduction to Aperiodic Order [T-MATH-110811]

<table>
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<th>Responsible:</th>
<th>Prof. Dr. Tobias Hartnick</th>
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<td>KIT Department of Mathematics</td>
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<td>Part of:</td>
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**Prerequisites**
none
4.129 Course: Introduction to Convex Integration [T-MATH-112119]

**Responsible:** Dr. Christian Zillinger  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-105964 - Introduction to Convex Integration

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**Events**

| WT 23/24 | 0100024 | Introduction to Convex Integration | 2 SWS | Lecture | Zillinger |

**Competence Certificate**

oral examination of approx. 30 minutes

**Prerequisites**

none

**Recommendation**

The courses “Classical Methods for Partial Differential Equations” and “Functional Analysis” are recommended.
### 4.130 Course: Introduction to Fluid Dynamics [T-MATH-111297]

**Responsible:** Prof. Dr. Wolfgang Reichel  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-105650 - Introduction to Fluid Dynamics

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**Prerequisites**
none
4.131 Course: Introduction to Fluid Mechanics [T-MATH-112927]

Responsibility: TT-Prof. Dr. Xian Liao
Organisation: KIT Department of Mathematics
Part of: M-MATH-106401 - Introduction to Fluid Mechanics

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**Competence Certificate**
The module examination takes the form of an oral examination of approx. 25 minutes.

**Prerequisites**
none

**Recommendation**
The module *Functional Analysis* is strongly recommended.
<table>
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**Responsible:** PD Dr. Steffen Winter  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-102949 - Introduction to Geometric Measure Theory  

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

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

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-105101 - Introduction to Homogeneous Dynamics

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**Prerequisites**

none
4.134 Course: Introduction to Kinetic Equations [T-MATH-111721]

**Responsible:** Dr. Christian Zillinger

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-105837 - Introduction to Kinetic Equations

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

**Prerequisites**
none

**Recommendation**
The course “Classical Methods for Partial Differential Equations” should be studied beforehand.
4.135 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

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Legend: 🖥 Online, 📚 Blended (On-Site/Online), ⬆ On-Site, ✗ Cancelled

**Prerequisites**
none

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

**Introduction to Kinetic Theory**
0155450, WS 23/24, 2 SWS, Language: English, [Open in study portal](Open in study portal)  
Lecture (V)  
Blended (On-Site/Online)

**Content**

Kinetic descriptions play an important role in a variety of physical, biological, and even social applications, for instance, in the description of gases, radiations, bacteria or financial markets. Typically, these systems are described locally not by a finite set of variables but instead by a probability density describing the distribution of a microscopic state. Its evolution is typically given by an integro-differential equation. Unfortunately, the large phase space associated with the kinetic description has made simulations impractical in most settings in the past. However, recent advances in computer resources, reduced-order modeling and numerical algorithms are making accurate approximations of kinetic models more tractable, and this trend is expected to continue in the future. On the theoretical mathematical side, two rather recent Fields medals (Pierre-Louis Lions 1994, Cédric Villani 2010) also indicate the continuing interest in this field, which was already the subject of Hilbert’s sixth out of the 23 problems presented at the World Congress of Mathematicians in 1900.

This course gives an introduction to kinetic theory. Our purpose is to discuss the mathematical passage from a microscopic description of a system of particles, via a probabilistic description to a macroscopic view. This is done in a complete way for the linear case of particles that are interacting with a background medium. The nonlinear case of pairwise interacting particles is treated on a more phenomenological level.

An extremely broad range of mathematical techniques is used in this course. Besides mathematical modeling, we make use of statistics and probability theory, ordinary differential equations, hyperbolic partial differential equations, integral equations (and thus functional analysis) and infinite-dimensional optimization. Among the astonishing discoveries of kinetic theory are the statistical interpretation of the Second Law of Thermodynamics, induced by the Boltzmann-Grad limit, and the result that the macroscopic equations describing fluid motion (namely the Euler and Navier-Stokes equations) can be inferred from abstract geometrical properties of integral scattering operators.

**Organizational issues**
The course will be offered in flipped classroom format. Flipped classroom means that the lectures will be made available as videos. We will regularly meet for tutorials and discussion sessions.
4.136 Course: Introduction to Microlocal Analysis [T-MATH-111722]

**Responsible:** TT-Prof. Dr. Xian Liao

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-105838 - Introduction to Microlocal Analysis

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**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.
### 4.137 Course: Introduction to Scientific Computing [T-MATH-105837]

**Responsible:** Prof. Dr. Willy Dörfler  
Prof. Dr. Marlis Hochbruck  
Prof. Dr. Tobias Jahnke  
Prof. Dr. Andreas Rieder  
Prof. Dr. Christian Wieners

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102889 - Introduction to Scientific Computing

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Course: Introduction to Stochastic Differential Equations [T-MATH-112234]

**Responsible:** Josef Janák
 одну. Mathias Trabs

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-106045 - Introduction to Stochastic Differential Equations

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

**Prerequisites**
none

**Recommendation**
The contents of the module "Probability Theory" are strongly recommended. The module "Continuous Time Finance" is recommended.
### 4.139 Course: Introduction to Stochastic Optimization [T-WIWI-106546]

**Responsible:** Prof. Dr. Steffen Rebennack  
**Organisation:** KIT Department of Economics and Management  
**Part of:**  
- M-WIWI-101414 - Methodical Foundations of OR  
- M-WIWI-102832 - Operations Research in Supply Chain Management  
- M-WIWI-103289 - Stochastic Optimization

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

**Competence Certificate**  
The assessment consists of a written exam (60 minutes). The exam takes place in every semester.

**Prerequisites**  
None.
4.140 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

**Type:** Oral examination  
**Credits:** 8  
**Grading scale:** Grade to a third  
**Version:** 1

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

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Economathematics M.Sc.  
Module Handbook as of 04/09/2023
Below you will find excerpts from events related to this course:

**Judgment and Decision Making**

2540440, WS 23/24, 3 SWS, Language: English, Open in study portal

**Lecture (V)**

Blended (On-Site/Online)

**Content**

In this lecture, students will be introduced to fundamental theories and key insights on human judgment and decision making. Topics include decision making under uncertainty, choice biases, simple heuristics, risk perception and -communication, as well as social and emotional influences on decision making, to name but a few. In the Wintersemester 20/21 this class will be held online. The lecture videos will be available for download and there will be regular online meetings to discuss the topics. The lecture will be held in English.

**Prerequisites**

Registration via the WIWI-Portal is required for participation in the Übung. The Übung is a prerequisite for the exam.

**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 influences 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.

**Competence Certificate**

Alternative exam assessment. The grading includes the following aspects:

- a written exam (60 minutes)
- a presentation during the exercise.

The scoring system for the grading will be announced at the beginning of the course.

The social topics content will be communicated in the lecture. Through the excellent cooperation between the different fields of study, including Economics, Behavioral Economics, Psychology, and Biology, we will engage in the interdisciplinary of judgment and decision making to gain insights into the decision-making process, to understand how people make judgments and decisions and the factors that influence these processes. As such, we seek to understand how people make decisions in a social context, which is the main focus of the course. This will be achieved through a combination of lectures and discussions, as well as through practical exercises and assignments. The course will be held in English.
Course: Key Moments in Geometry [T-MATH-108401]

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

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-104057 - Key Moments in Geometry

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**Prerequisites**

none
Course: Knowledge Discovery [T-WIWI-102666]

**4.143 Course: Knowledge Discovery [T-WIWI-102666]**

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

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

**Competence Certificate**

The assessment is a written exam (60 minutes).

1. Successful participation in the exercises can earn a grade bonus in two ways:
   - By handing in the answers to an exercise sheet and reaching or exceeding 80% correct answers.
   - By handing in the results of an implementation task related to machine learning, which reaches or exceeds a given evaluation value.

If the grade of the written exam is between 4.0 and 1.3, the bonus improves the grade by a maximum of one grade level (0.3 or 0.4).

**Prerequisites**

None

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

**Knowledge Discovery and Graph Representation Learning**  
2511302, WS 23/24, 2 SWS, Language: English, [Open in study portal](#)  
Lecture (V) On-Site
Content
The lecture provides a comprehensive overview of various approaches in machine learning and data mining for knowledge extraction. It explores multiple fields, including machine learning, natural language processing, and knowledge representation. The main focus is on discovering patterns and regularities in extensive data sets, particularly unstructured text found in news articles, publications, and social media. This process is known as knowledge discovery. The lecture delves into specific techniques, methods, challenges, as well as current and future research topics within this field.

One part of the lecture is dedicated to understanding large language models (LLMs), such as ChatGPT, by exploring their underlying principles, training methods, and applications. Additionally, the lecture dives into graph representation learning, which involves extracting meaningful representations from graph data. It covers the mathematical foundations of graph and geometric deep learning, highlighting the latest applications in areas like explainable recommender systems.

Moreover, the lecture highlights the integration of knowledge graphs with large language models, known as neurosymbolic AI. This integration aims to combine structured and unstructured data to enhance knowledge extraction and representation. The content of the lecture encompasses the entire machine learning and data mining process. It covers topics on supervised and unsupervised learning techniques, as well as empirical evaluation. Various learning methods are explored, ranging from classical approaches like decision trees, support vector machines, and neural networks to more recent advancements such as graph neural networks.

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
- 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 and Graph Representation Learning
2511303, WS 23/24, 1 SWS, Language: English, Open in study portal

Content
The exercises are based on the lecture Knowledge Discovery. Several exercises are covered, which take up and discuss in detail the topics covered in the lecture Knowledge Discovery. Practical examples are demonstrated to the students to enable a knowledge transfer of the theoretical aspects learned into practical application.

Contents of the lecture cover the entire machine learning and data mining process with topics on monitored and unsupervised learning processes and empirical evaluation. The learning methods covered range from classical approaches like decision trees, support vector machines and neural networks to selected approaches from current research. Learning problems considered include feature vector-based learning and text mining.

Learning objectives:
Students
- know fundamentals of Machine Learning, Data Mining and Knowledge Discovery.
- are able to design, train and evaluate adaptive systems.
- conduct Knowledge Discovery projects in regards to algorithms, representations and applications.

Literature
- M. Berhold, D. Hand (eds). Intelligent Data Analysis - An Introduction. 2003
- P. Tan, M. Steinbach, V. Kumar: Introduction to Data Mining, 2005, Addison Wesley
4.144 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
4.145 Course: Large-scale Optimization [T-WIWI-106549]

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**Competence Certificate**
The assessment consists of a written exam (60 minutes). The exam takes place in every semester.

**Prerequisites**
None.
4.146 Course: Liberalised Power Markets [T-WIWI-107043]

**Responsible:** Prof. Dr. Wolf Fichtner

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

**Part of:** M-WIWI-101451 - Energy Economics and Energy Markets

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**Events**

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

**Competence Certificate**

The assessment consists of a written exam (60 minutes) (following §4(2) of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date. Depending on the respective pandemic situation, the exam may be offered as an open book exam (alternative exam assessment, following §4(2), 3 of the examination regulation).

**Recommendation**

None

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

**V Liberalised Power Markets**

2581998, WS 23/24, 2 SWS, Language: English, [Open in study portal](#)
Content
1. Power markets in the past, now and in future
2. Designing liberalised power markets
   2.1. Unbundling Dimensions of liberalised power markets
   2.2. Central dispatch versus markets without central dispatch
   2.3. The short-term market model
   2.4. The long-term market model
   2.5. Market flaws and market failure
   2.6. Regulation in liberalised markets
3. The power (sub)markets
   3.1 Day-ahead market
   3.2 Intraday market
   3.3 (Long-term) Forwards and futures markets
   3.4 Emission rights market
   3.5 Market for ancillary services
   3.6 The “market” for renewable energies
   3.7 Future market segments
4. Grid operation and congestion management
   4.1. Grid operation
   4.2. Congestion management
5. Market power
   5.1. Defining market power
   5.2. Indicators of market power
   5.3. Reducing market power
6. Future market structures in the electricity value chain
   1. Power markets in the past, now and in future
   2. Designing liberalised power markets
   2.2. Unbundling Dimensions of liberalised power markets
   2.3. Central dispatch versus markets without central dispatch
   2.4. The short-term market model
   2.5. The long-term market model
   2.6. Market flaws and market failure
   2.7. Regulation in liberalised markets
3. The power (sub)markets
   3.1 Day-ahead market
   3.2 Intraday market
   3.3 (Long-term) Forwards and futures markets
   3.4 Emission rights market
   3.5 Market for ancillary services
   3.6 The “market” for renewable energies
   3.7 Future market segments
4. Grid operation and congestion management
   4.1. Grid operation
   4.2. Congestion management
5. Market power
   5.1. Defining market power
   5.2. Indicators of market power
   5.3. Reducing market power
6. Future market structures in the electricity value chain
Literature
Weiterführende Literatur:
### 4.147 Course: Lie Groups and Lie Algebras [T-MATH-108799]

| Responsible          | Prof. Dr. Tobias Hartnick
                        | Prof. Dr. Enrico Leuzinger |
|----------------------|--------------------------|
| Organisation         | KIT Department of Mathematics |
| Part of              | M-MATH-104261 - Lie Groups and Lie Algebras |

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<tr>
<td>Recurrence</td>
<td>Irregular</td>
</tr>
<tr>
<td>Version</td>
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</table>
### 4.148 Course: Lie-Algebras (Linear Algebra 3) [T-MATH-111723]

**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-105839 - Lie-Algebras (Linear Algebra 3)

<table>
<thead>
<tr>
<th>Type</th>
<th>Credits</th>
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<th>Expansion</th>
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**Prerequisites:** none
4.149 Course: Machine Learning 1 - Basic Methods [T-WIWI-106340]

Responsible: Prof. Dr.-Ing. Johann Marius Zöllner
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101472 - Informatics

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

<table>
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<th>Lecture/Practice</th>
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<td>WT 23/24 2511500</td>
<td>2</td>
<td>Lecture</td>
<td>Zöllner</td>
</tr>
<tr>
<td>WT 23/24 2511501</td>
<td>1</td>
<td>Practice</td>
<td>Zöllner, Polley, Fechner, Daaboul</td>
</tr>
</tbody>
</table>

Legend: 📱 Online, 🗼 Blended (On-Site/Online), 🗽 On-Site, ✗ 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.
- A grade bonus can be earned by successfully completing practice exercises. If the grade of the written exam 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.

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

Machine Learning 1 - Fundamental Methods
2511500, WS 23/24, 2 SWS, Language: German, Open in study portal

Content

The course prepares students for the rapidly evolving field of machine learning by providing a solid foundation, covering core concepts and techniques to get started in the field. Students delve into different methods in supervised, unsupervised, and reinforcement learning, as well as various model types, ranging from basic linear classifiers to more complex methods, such as deep neural networks. Topics include general learning theory, support vector machines, decision trees, neural network fundamentals, convolutional neural networks, recurrent neural networks, unsupervised learning, reinforcement learning, and Bayesian learning.

The course is accompanied by a corresponding exercise, where students gain hands-on experience by implementing and experimenting with different machine learning algorithms, helping them to apply machine learning algorithms on real world problems.

By the end of the course, students will have acquired a solid foundation in machine learning, enabling them to apply state-of-the-art algorithms to solve complex problems, contribute to research efforts, and explore advanced topics in the field.

Learning objectives:

- Students acquire knowledge of the fundamental methods in the field of machine learning.
- Students can classify, formally describe and evaluate methods of machine learning.
- Students can use their knowledge to select suitable models and methods for selected problems in the field of machine learning.
Literatur
Die Foliensätze sind als PDF verfügbar.

Weiterführende Literatur

- Machine Learning - Tom Mitchell
- Deep Learning - Ian Goodfellow, Yoshua Bengio, Aaron Courville
- Pattern Recognition and Machine Learning - Christopher M. Bishop
- Artificial Intelligence: A Modern Approach - Peter Norvig and Stuart J. Russell
- Reinforcement Learning: An Introduction - Richard S. Sutton and Andrew G. Barto

Weitere (spezifische) Literatur zu einzelnen Themen wird in der Vorlesung angegeben.
4.150 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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<th>Grading scale</th>
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<td>2511502</td>
<td>Machine Learning 2 - Advanced methods</td>
<td>Lecture / On-Site</td>
<td>2 SWS</td>
<td>Grade to a third</td>
<td>Each summer term</td>
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<td>ST 2023</td>
<td>2511503</td>
<td>Exercises for Machine Learning 2 - Advanced Methods</td>
<td>Practice / On-Site</td>
<td>1 SWS</td>
<td></td>
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</table>

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ 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 2023, 2 SWS, Language: German, [Open in study portal](#)

**Lecture (V)**
On-Site

**Content**
The subject area of machine intelligence and, in particular, machine learning, taking into account real challenges of complex application domains, is a rapidly expanding field of knowledge and the subject of numerous research and development projects.
The lecture "Machine Learning 2" deals with modern advanced methods of machine learning such as semi-supervised and active learning, deep neural networks (deep learning, CNNs, GANs, diffusion models, transformer, adversarial attacks) and hierarchical approaches, e.g. reinforcement learning. 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 (vehicles, 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

- Deep Learning - Ian Goodfellow
- 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.
4.151 Course: Machine Learning and Optimization in Energy Systems [T-WIWI-113073]

Responsible: Dr.-Ing. Hasan Ümitcan Yilmaz
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101452 - Energy Economics and Technology

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

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<th>Lecture / Practice</th>
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<td>WT 23/24 2581050 Machine Learning and Optimization in Energy Systems 3 SWS</td>
<td>Dengiz, Yilmaz, Perau</td>
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Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate

The assessment of this course is a written examination (60 min) or an oral exam (30 min) depending on the number of participants.
4.152 Course: Management of IT-Projects [T-WIWI-112599]

**Responsible:** Dr. Roland Schätzle  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-101472 - Informatics

<table>
<thead>
<tr>
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<th>Recurrence</th>
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</thead>
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<tr>
<td>Written examination</td>
<td>4.5</td>
<td>Grade to a third</td>
<td>Each summer term</td>
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<table>
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<td>2 SWS</td>
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<td>Management of IT-Projects</td>
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<td>ST 2023 2511215</td>
<td>1 SWS</td>
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<td>Übungen zu Management von IT-Projekten</td>
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</table>

**Legends:** 🖥 Online, 🧩 Blended (On-Site/Online), 💬 On-Site, ✗ Cancelled

**Competence Certificate**
The assessment takes place in the form of a written examination (exam) in the amount of 60 minutes. The examination is offered every semester and can be repeated at any regular examination date.

**Prerequisites**
Prerequisite for the participation in the examination is the successful participation in the exercise, which takes place in the summer semester, starting from summer semester 2020. The number of participants in the exercise is limited.

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

**Management of IT-Projects**  
2511214, SS 2023, 2 SWS, Language: German, [Open in study portal](#)  
Lecture (V) On-Site
Content
The lecture deals with the general framework, impact factors and methods for planning, handling, and controlling of IT projects. Especially following topics are addressed:

- project environment
- project organisation
- project planning including the following items:
  - plan of the project structure
  - flow chart
  - project schedule
  - plan of resources
- effort estimation
- project infrastructure
- project controlling
- risk management
- feasibility studies
- decision processes, conduct of negotiations, time management.

Learning objectives:
Students

- explain the terminology of IT project management and typical used methods for planning, handling and controlling,
- apply methods appropriate to current project phases and project contexts,
- consider organisational and social impact factors.

Recommendations:
Knowledge from the lecture Software Engineering is helpful.

Workload:

- Lecture 30h
- Exercise 15h
- Preparation of lecture 24h
- Preparation of exercises 25h
- Exam preparation 40h
- Exam 1h

Literature

- B. Hindel, K. Hörmann, M. Müller, J. Schmied. Basiswissen Software-Projektmanagement. dpunkt.verlag 2004

Übungen zu Management von IT-Projekten
2511215, SS 2023, 1 SWS, Language: German, Open in study portal

Practice (Ü) On-Site

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.
4.153 Course: Market Research [T-WIWI-107720]

Responsible: Prof. Dr. Martin Klarmann
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101647 - Data Science: Evidence-based Marketing
M-WIWI-105312 - Marketing and Sales Management
M-WIWI-106258 - Digital Marketing

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

Competence Certificate
The assessment of success takes place through a written exam with additional aids in the sense of an open book exam. 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 2023, 2 SWS, Language: English, Open in study portal

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled
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
**4.154 Course: Marketing Analytics [T-WIWI-103139]**

**Responsible:** Prof. Dr. Martin Klarmann  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-101647 - Data Science: Evidence-based Marketing

<table>
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<td>Marketing Analytics</td>
<td>2 SWS</td>
<td>Lecture / 🧩</td>
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<td>WT 23/24</td>
<td>2572171</td>
<td>1 SWS</td>
<td>Practice / 🧩</td>
<td>Pade</td>
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</table>

**Competence Certificate**
Alternative (according to §4(2), 3 of the examination regulation) exam assessment (working on tasks in groups during the lecture).

**Prerequisites**
The prerequisite for taking the course is the successful completion of the course "Market Research".

**Recommendation**
It is strongly recommended to complete the course "Market Research" prior to taking the "Marketing Analytics" course.

**Annotation**
"Marketing Analytics" is offered as a block course with an alternative exam assessment. Starting in the winter semester 22/23, the course will be scheduled to be completed after two thirds of the semester. For further information, please contact the Marketing and Sales Research Group (marketing.iism.kit.edu). Exchange students can bypass the requirement of passing Market Research if they can prove that they possess sufficient statistical knowledge based on courses attended at their home institution. This will be examined individually by the Marketing and Sales Research Group.

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

**Marketing Analytics**  
2572170, WS 23/24, 2 SWS, Language: English, [Open in study portal](#) 

**Content**
In this course various relevant market research questions are addressed, as for example measuring and understanding customer attitudes, preparing strategic decisions and sales forecasting. In order to analyze these questions, students learn to handle social media data, panel data, nested observations and experimental design. To analyze the data, advanced methods, as for example multilevel modeling and return on marketing models are taught. Also, problems of causality are addressed in-depth. The lecture is accompanied by a computer-based exercise, in the course of which the methods are applied practically.

Students
- receive based on the course market research an overview of advanced empirical methods  
- learn in the course of the lecture to handle advanced data collection and data analysis methods  
- are based on the acquired knowledge able to interpret results and derive strategic implications

Total workload for 4.5 ECTS: ca. 135 hours.

In order to attend Marketing Analytics, students are required to have passed the course Market Research.

Exchange students can bypass the requirement of passing Market Research if they can prove that they possess sufficient statistical knowledge based on courses attended at their home institution. This will be examined individually by the Marketing & Sales Research Group.

For further information please contact the Marketing and Sales Research Group (marketing.iism.kit.edu).
Literature

- Cameron, A. Colin, Trivedi, Pravin K. (2005), Microeconometrics: methods and applications, New York.
- Chapman, Christopher, Feit, Elea M. (2015), R for Marketing Research and Analytics, Cham.

Content
Tasks parallel to the lecture to work on in a group of students.

Organizational issues
Blockveranstaltung: genaue Uhrzeiten und Raum werden noch bekannt gegeben
T 4.155 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

<table>
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Competence Certificate
The assessment (alternative exam assessment) consists of a group presentation and a subsequent round of questions totalling 20 minutes.

Prerequisites
None

Recommendation
None

Annotation
Please note that only one of the courses from the election block can be chosen in the module.
Please note: The number of participants for this course is limited. The Marketing and Sales Research Group typically provides the possibility to attend a course with 1.5 ECTS points in the respective module to all students. Participation in a specific course cannot be guaranteed.
In order to participate in this course, you need to apply. Applications are usually accepted at the start of the lecture period in summer term. Detailed information on the application process is usually provided on the website of the Marketing and Sales Research Group (marketing.iism.kit.edu) shortly before the lecture period in summer term starts.
4.156 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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**Prerequisites**
none
4.157 Course: Master's Thesis [T-MATH-105878]

**Responsible:** PD Dr. Stefan Kühnlein  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-102917 - Master's Thesis

### Final Thesis
This course represents a final thesis. The following periods have been supplied:

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<td>3 months</td>
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<tr>
<td>Correction period</td>
<td>8 weeks</td>
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</table>
### 4.158 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

<table>
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<td>8</td>
<td>Grade to a third</td>
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**Prerequisites**  
none
### 4.159 Course: Mathematical Methods of Imaging [T-MATH-106488]

<table>
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<th>Prof. Dr. Andreas Rieder</th>
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<tbody>
<tr>
<td>Organisation:</td>
<td>KIT Department of Mathematics</td>
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<tr>
<td>Part of:</td>
<td>M-MATH-103260 - Mathematical Methods of Imaging</td>
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**Prerequisites**

None
4.160 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

<table>
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**Events**

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<td>0109400</td>
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<td>0109410</td>
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Below you will find excerpts from events related to this course:

**Mathematical Modelling and Simulation**

Lecture (V)

0109400, WS 23/24, 2 SWS, Language: English, [Open in study portal](#)
## 4.161 Course: Mathematical Statistics [T-MATH-105872]

**Responsible:** Dr. rer. nat. Bruno Ebner  
Prof. Dr. Vicky Fasen-Hartmann  
PD Dr. Bernhard Klar  
Prof. Dr. Mathias Trabs

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102909 - Mathematical Statistics

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**Prerequisites**  
none
## 4.162 Course: Mathematical Topics in Kinetic Theory [T-MATH-108403]

<table>
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<tr>
<th>Responsible</th>
<th>Prof. Dr. Dirk Hundertmark</th>
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### Type
Oral examination

### Credits
4

### Grading scale
Grade to a third

### Recurrence
Irregular

### Version
1

**Prerequisites**

none
Course: Mathematics for High Dimensional Statistics [T-WIWI-111247]

**Responsible:** Prof. Dr. Oliver Grothe  
**Organisation:** KIT Department of Economics and Management  
**Part of:**  
- M-WIWI-101473 - Mathematical Programming  
- M-WIWI-101637 - Analytics and Statistics  
- M-WIWI-103289 - Stochastic Optimization

<table>
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<tr>
<th>Events</th>
<th>Type</th>
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<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
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**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**  
2550562, SS 2023, 2 SWS, Open in study portal  
Lecture (V) On-Site

**Content**

**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.
4.164 Course: Maxwell's Equations [T-MATH-105856]

**Responsible:** PD Dr. Tilo Arens
Prof. Dr. Roland Griesmaier
PD Dr. Frank Hettlich

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102885 - Maxwell's Equations

<table>
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<td>Oral exam</td>
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<td>Grade to a third</td>
<td>1</td>
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</table>
**4.165 Course: Media Management [T-WIWI-112711]**

**Responsible:** Prof. Dr. Ann-Kristin Kupfer  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-106258 - Digital Marketing

<table>
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**Events**

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<tr>
<td>WT 23/24</td>
<td>2572192</td>
<td>Media Management</td>
<td>2</td>
<td>Lecture / 👤</td>
<td>Kupfer</td>
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<td>WT 23/24</td>
<td>2572193</td>
<td>Media Management Exercise</td>
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<td>Practice / 🗒️</td>
<td>Mitarbeiter</td>
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(Online, Blended (On-Site/Online), On-Site, Cancelled)

**Competence Certificate**  
The control of success is done by the elaboration and presentation of a group task as well as a written exam. Further details on the design of the performance review will be announced during the lecture.

**Prerequisites**  
None

**Recommendation**  
Students are highly encouraged to actively participate in class.

**Annotation**  
The course will take place in the winter term 23/24 for the first time.

---

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

**Media Management**  
2572192, WS 23/24, 2 SWS, Language: English, [Open in study portal](#)

**Content**  
Students learn the theoretical foundations of media management and its most important concepts. They learn both about the key characteristics of both media products and media markets. They further get to know essential business models of media markets. Special emphasis will be given to understanding media consumers and the marketing mix of media products. A tutorial offers the opportunity to apply the key learnings of the lecture.

The learning objectives are as follows:

- Getting to know the theoretical foundations of media management
- Evaluating strategies for media products and services as media-specific marketing mix instruments
- Fostering critical and analytical thinking skills and the application of knowledge to marketing problems
- Improvement of skills and competences in the area of project management within the framework of group work
- Improvement of foreign language skills (business English)

**Total time required for 4.5 credit points:** approx. 135 hours  
**Attendance time:** 30 hours  
**Self-study:** 105 hours

**Organizational issues**  
Appointments to be announced.
**4.166 Course: Medical Imaging [T-MATH-105861]**

**Responsible:** Prof. Dr. Andreas Rieder  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-102896 - Medical Imaging

<table>
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<tr>
<td>Oral exam</td>
<td>8</td>
<td>Grade to a third</td>
<td>1</td>
</tr>
</tbody>
</table>

**Prerequisites**  
none
4.167 Course: Metric Geometry [T-MATH-111933]

**Responsible:** Prof. Dr. Alexander Lytchak  
Dr. Artem Nepechiy

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-105931 - Metric Geometry

<table>
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<th>Version</th>
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<td>8</td>
<td>Grade to a third</td>
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</table>

**Competence Certificate**  
oral examination of circa 20 minutes

**Prerequisites**  
none
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

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

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<td>Mixed-integer Programming I</td>
<td>2 SWS</td>
<td>Grade to a third</td>
<td>Irregular</td>
<td>Stein</td>
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<td>WT 23/24</td>
<td>Exercises Mixed Integer</td>
<td>Practice</td>
<td>Grade to a third</td>
<td>Irregular</td>
<td>Stein, Beck</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:

<table>
<thead>
<tr>
<th>Type</th>
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<th>Grading scale</th>
<th>Recurrence</th>
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<tr>
<td>Mixed-integer Programming I</td>
<td>2</td>
<td>Grade to a third</td>
<td>Irregular</td>
<td>Stein</td>
</tr>
</tbody>
</table>

Economathematics M.Sc.
Module Handbook as of 04/09/2023
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, and portfolio optimization with limitations on the number of securities. 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 focuses 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
4 COURSES

Course: Mixed Integer Programming II [T-WIWI-102720]

4.169 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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<th>Recurrence</th>
<th>Version</th>
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<td>4.5</td>
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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. 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).
4.170 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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<td>Grade to a third</td>
<td>Each winter term</td>
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Events

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<th>Credits</th>
<th>Format</th>
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<td>WT 23/24</td>
<td>2550490</td>
<td>Modellieren und OR-Software: Fortgeschrittene Themen</td>
<td>3 SWS</td>
<td>Practical course / 🧩 Pomes, Linner, Nickel</td>
</tr>
</tbody>
</table>

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

Competence Certificate
The assessment is a written examination. The examination is held in every semester. The prerequisite can only be obtained in semesters in which the course exercises are offered.

Prerequisites
Prerequisite for admission to the exam is the successful participation in the exercises. This includes the processing and presentation of exercises.

Recommendation
Basic knowledge as conveyed in the module Introduction to Operations Research is assumed.
Successful completion of the course Modeling and OR-Software: Introduction.

Annotation
Due to capacity restrictions, registration before course start is required. For further information see the webpage of the course. The lecture is held in every term. The planned lectures and courses for the next three years are announced online.

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

Modellieren und OR-Software: Fortgeschrittene Themen
2550490, WS 23/24, 3 SWS, Language: German, Open in study portal

Content
The advanced course is designated for Master students that already attended the introductory course or gained equivalent experience elsewhere, e.g. during a seminar or bachelor thesis. We will work on advanced topics and methods in OR, among others cutting planes, column generation and constraint programming. The Software used for the exercises is IBM ILOG CPLEX Optimization Studio. The associated modelling programming languages are OPL and ILOG Script.

Organizational issues
Link zur Bewerbung:
http://go.wiwi.kit.edu/OR_Bewerbung
Bewerberzeitraum:
01.09.2023 00:00 - 12.10.2023 23:55

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

<table>
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<th>ST 2023</th>
<th>2550490</th>
<th>Modellieren und OR-Software: Einführung</th>
<th>3 SWS</th>
<th>Practical course / 🧩</th>
<th>Nickel, Linner, Pomes</th>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**
The assessment is a written examination. The examination is held in every semester. The prerequisite can only be obtained in semesters in which the course exercises are offered.

**Prerequisites**
Prerequisite for admission to the exam is the successful participation in the exercises. This includes the processing and presentation of exercises.

**Recommendation**

**Annotation**
Due to capacity restrictions, registration before course start is required. For further information see the webpage of the course.
The lecture is offered in every term. The planned lectures and courses for the next three years are announced online.

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

**Modellieren und OR-Software: Einführung**  
2550490, SS 2023, 3 SWS, Language: German, [Open in study portal](http://go.wiwi.kit.edu/OR_Bewerbung)

**Content**
After an introduction to general concepts of modelling tools (implementation, data handling, result interpretation,...), the software IBM ILOG CPLEX Optimization Studio and the corresponding modeling language OPL will be discussed which can be used to solve OR problems on a computer-aided basis. Subsequently, a broad range of exercises will be discussed. The main goals of the exercises from literature and practical applications are to learn the process of modeling optimization problems as linear or mixed-integer programs, to efficiently utilize the presented tools for solving these optimization problems and to implement heuristic solution procedures for mixed-integer programs.

**Organizational issues**
Die Teilnehmerzahl für diese Veranstaltung ist begrenzt.  
Bewerbung bis 31.03. möglich:  
http://go.wiwi.kit.edu/OR_Bewerbung
4.172 Course: Modeling and Simulation [T-WIWI-112685]

**Responsible:** Prof. Dr. Sanja Lazarova-Molnar
**Organisation:** KIT Department of Economics and Management
**Part of:** M-WIWI-101472 - Informatics

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**Events**

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<td>2 SWS</td>
<td>Lecture</td>
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<td>Exercises Modeling and Simulation</td>
<td>1 SWS</td>
<td>Practice</td>
<td>Lazarova-Molnar</td>
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**Competence Certificate**

Depending on the number of participants in the course, the exam will be offered either as an oral exam (20 min), or as a written exam (60 min).

The exam takes place every semester and can be repeated at every regular examination date.

**Prerequisites**

None

**Recommendation**

Some experience in programming and knowledge of basic mathematics and statistics.

**Annotation**

Instruction is in the form of lectures and exercises. A detailed course schedule will be published before the start of the semester.

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

**Modeling and Simulation**

2511100, SS 2023, 2 SWS, Language: English, [Open in study portal](#)
Content
Modeling and Simulation is the most widely used operations research / systems engineering technique for designing new systems and optimizing the performance of existing systems. In one way or another, just about every engineering or scientific field uses simulation as an exploration, modeling, or analysis technique. The course is designed to provide students with basic knowledge of modeling and simulation approaches and to provide them with first experience of using a simulation package. The course will focus on modeling and simulation of real-world discrete event systems. Examples of discrete events are customer arrivals at a queue of a service desk, machine failures in manufacturing systems, telephone calls in a call center, etc. Moreover, continuous and hybrid models will be also discussed. Topics include Discrete-Event Simulation, Input Modeling, Output Analysis, Random Number Generation, Verification and Validation, Stochastic Petri Nets and Markov Chains.

Competence Certificate
Depending on the number of participants in the course, the exam will be offered either as an oral exam (20 min), or as a written exam (60 min). The exam takes place every semester and can be repeated at every regular examination date.

Learning Objectives
Knowledge:
• Demonstrate knowledge about general and specific theories, challenges, algorithms, methods, technologies, and tools related to modelling and simulation
• Demonstrate knowledge of two important classes of simulation:
  ◦ Discrete-event Monte-Carlo simulation,
  ◦ Continuous simulation with ODEs
• Demonstrate knowledge of algorithms necessary to build a simulator

Skills:
• Analyse suitability of an approach/tool for a given modelling problem
• Understand simulation models of various types
• Demonstrate methods and techniques to overcome common challenges in modelling and simulation
• Model simulation input data
• Analyse and model discrete stochastic systems
• Analyse and interpret simulation results

Competences:
• Use different methods to conduct simulation-based analysis of real-world data
• Build and simulate stochastic models
• Use simulation software

Prerequisites
Some experience in programming and knowledge of basic mathematics and statistics

Form of instruction
Lectures and exercises. A detailed course plan will be published before the semester start.

Literature
Discrete-Event System Simulation, 5th Edition
Jerry Banks, John S. Carson, II, Barry L. Nelson and David M. Nicol
# 4.173 Course: Monotonicity Methods in Analysis [T-MATH-105877]

**Responsible:** PD Dr. Gerd Herzog  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-102887 - Monotonicity Methods in Analysis

<table>
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<td>Grade to a third</td>
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Economathematics M.Sc.  
Module Handbook as of 04/09/2023
4.174 Course: Multicriteria Optimization [T-WIWI-111587]

- **Responsible:** Prof. Dr. Oliver Stein
- **Organisation:** KIT Department of Economics and Management
- **Part of:**
  - M-WIWI-101473 - Mathematical Programming
  - M-WIWI-102832 - Operations Research in Supply Chain Management
  - M-WIWI-103289 - Stochastic Optimization

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<td>Grade to a third</td>
<td>see Annotations</td>
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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).

**Contents:**
Multicriteria optimization deals with optimization problems with multiple objective functions. In practice, the minimization or maximization of several objectives often conflict with each other, such as weight and stability of mechanical components, return and risk of stock portfolios, or cost and duration of transports. Various scalarization approaches allow one to formulate single-objective problems that can be solved using nonlinear or global optimization techniques, and whose optimal points have a reasonable interpretation for the underlying multicriteria problem.

However, some seemingly obvious scalarization approaches suffer from various drawbacks, so that regardless of scalarization approaches, it is necessary to clarify what is meant by the solution of a multicriteria optimization problem in the first place. For such Pareto-optimal points, optimality conditions and solution procedures based on them can be formulated. From the usually non-unique Pareto set, decision makers finally choose an alternative based on their subjective preferences.

The lecture gives a mathematically sound introduction to multicriteria optimization and is structured as follows:
- Introductory examples and terminology
- Solution concepts
- Methods for the determination of the Pareto set
- Selection of Pareto-optimal points under subjective preferences
4.175 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

**Type**
- Written examination

**Credits**
- 4.5

**Grading scale**
- Grade to a third

**Recurrence**
- Each summer term

**Version**
- 1

**Events**

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<th>Code</th>
<th>Title</th>
<th>SWS</th>
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<td>ST 2023</td>
<td>2550554</td>
<td>Analysis of Multivariate Data</td>
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<td>Grothe</td>
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<td>ST 2023</td>
<td>2550555</td>
<td>Übung zu Multivariate Verfahren</td>
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<td>Practice / 🗣️</td>
<td>Kächele</td>
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</table>

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

**Competence Certificate**
Depending on further pandemic developments, the examination will be offered either as a 60-minute written examination (written examination according to SPO § 4 Abs. 2, Pkt. 1) or as an open-book examination (alternative exam assessment according to SPO § 4 Abs. 2, Pkt. 3).

The exam is offered every semester. Re-examinations are offered only for repeaters.

**Prerequisites**
None

**Recommendation**
The course covers highly advanced statistical methods with a quantitative focus. Hence, participants are necessarily expected to have advanced statistical knowledge, e.g. acquired in the course "Advanced Statistics". Without this, participation in the course is not advised.

Previous attendance of the course Analysis of Multivariate Data is recommended. Alternatively, the script can be provided to interested students.

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

**Analysis of Multivariate Data**

2550554, SS 2023, 2 SWS, Language: German, [Open in study portal](#)

**Literature**

Skript zur Vorlesung

**Responsible:** apl. Prof. Dr. Pradyumn Kumar Shukla

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

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

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<td>ST 2023 2511107</td>
<td>Übungen zu Nature-Inspired Optimization Methods</td>
<td>1 SWS</td>
<td>Practice</td>
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Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

**Competence Certificate**

The assessment consists of a written exam (60 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**

ST 2511106, SS 2023, 2 SWS, Language: English, Open in study portal

**Lecture (V)**

Blended (On-Site/Online)

**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
* Springer, 2003

Economathematics M.Sc.
Module Handbook as of 04/09/2023
**4.177 Course: Non- and Semiparametrics [T-WIWI-103126]**

**Responsible:** Prof. Dr. Melanie Schienle  
**Organisation:** KIT Department of Economics and Management  
**Part of:**  
- M-WIWI-101638 - Econometrics and Statistics I  
- M-WIWI-101639 - Econometrics and Statistics II

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<td>Lecture</td>
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<td>Schienle</td>
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<td>Schienle, Rüter, Wolffram</td>
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**Competence Certificate**

The assessment consists of a written exam (90 minutes) (following §4(2), 1 of the examination regulation).

**Prerequisites**

None

**Recommendation**

Knowledge of the contents covered by the course "Applied Econometrics" [2520020]

**Annotation**

The course takes place every second winter semester: 2018/19 then 2020/21

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

**Non- and Semiparametrics**  
2521300, WS 23/24, 2 SWS, Language: German, [Open in study portal](#)  

**Lecture (V)**

**Content**

**Learning objectives:**

The student

- has profound knowledge of non- and semiparametric estimation methods
- is capable of implementing these methods using statistical software and using them to assess empirical problems

**Content:**

Kernel density estimation, local constant and local linear regression, bandwidth choice, series and sieve estimators, additive models, semiparametric models

**Requirements:**

It is recommended to attend the course *Applied Econometrics* prior to this course.

**Workload:**

Total workload for 4.5 CP: approx. 135 hours  
Attendance: 30 hours  
Preparation and follow-up: 65 hours  
Exam preparation: 40 hours

**Literature**

### 4.178 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
4.179 Course: Nonlinear Maxwell Equations [T-MATH-110283]

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

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-105066 - Nonlinear Maxwell Equations

**Type**
- Oral examination

**Credits**
- 8

**Grading scale**
- Grade to a third

**Recurrence**
- Irregular

**Version**
- 1

**Prerequisites**
- none
4.180 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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</table>

**Prerequisites**  
Keine


### 4.181 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>Lecture / Stein</td>
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<td>Practice / Stein, Schwarze</td>
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</table>

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

**Competence Certificate**

The assessment consists of a written exam (60 minutes) according to Section 4(2), 1 of the examination regulation. The successful completion of the exercises is required for admission to the written exam. The exam takes place in the semester of the lecture and in the following semester. The examination can also be combined with the examination of Nonlinear Optimization II [2550113]. In this case, the duration of the written examination takes 120 minutes.

**Prerequisites**

The module component exam T-WIWI-103637 "Nonlinear Optimization I and II" may not be selected.

**Annotation**

Part I and II of the lecture are held consecutively in the same semester.

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

#### Nonlinear Optimization I

- **2550111, WS 23/24, 2 SWS, Language: German, Open in study portal**

**Lecture (V) On-Site**

**Content**

The lecture treats the minimization of smooth nonlinear functions without constraints. For such problems, which occur very often in economics, engineering, and natural sciences, optimality conditions are derived and, based on them, solution algorithms are developed. The lecture is structured as follows:

- Introduction, examples, and terminology
- Existence results for optimal points
- First and second order optimality conditions
- Algorithms (line search, steepest descent method, variable metric methods, Newton method, Quasi Newton methods, CG method, trust region method)

The lecture is accompanied by exercises which, amongst others, offers the opportunity to implement and to test some of the methods on practically relevant examples.

**Remark:**

The treatment of optimization problems with constraints forms the contents of the lecture "Nonlinear Optimization II". The lectures "Nonlinear Optimization I" and "Nonlinear Optimization II" are held consecutively in the same semester.

**Learning Objectives:**

The student

- knows and understands fundamentals of unconstrained nonlinear optimization,
- is able to choose, design and apply modern techniques of unconstrained nonlinear optimization in practice.
Literature

Weiterführende Literatur:

- W. Alt, Nichtlineare Optimierung, Vieweg, 2002
- M.S. Bazaraa, H.D. Sherali, C.M. Shetty, Nonlinear Programming, Wiley, 1993
Responsibility: Prof. Dr. Oliver Stein
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101414 - Methodical Foundations of OR
M-WIWI-101473 - Mathematical Programming

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<td>2 SWS</td>
<td>Lecture / On-Site</td>
<td>Stein</td>
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<td>Stein</td>
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Legend: Online, Blended (On-Site/Online), On-Site, C Cancelled

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 23/24, 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, among 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

Weiterführende Literatur:

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

#### Events

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<td>Grade to a third</td>
<td>Each winter term</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**

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<td>On-Site</td>
<td>Lecture (V) On-Site</td>
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#### Content

The lecture treats the minimization of smooth nonlinear functions under nonlinear constraints. For such problems, which occur very often in economics, engineering, and natural sciences, optimality conditions are derived and, based on them, solution algorithms are developed. The lecture is structured as follows:

- Topology and first order approximations of the feasible set  
- Theorems of the alternative, first and second order optimality conditions  
- Algorithms (penalty method, multiplier method, barrier method, interior point method, SQP method, quadratic optimization)

The lecture is accompanied by exercises which, amongst others, offers the opportunity to implement and to test some of the methods on practically relevant examples.

#### Remark:

The treatment of optimization problems without constraints forms the contents of the lecture "Nonlinear Optimization I". The lectures "Nonlinear Optimization I" and "Nonlinear Optimization II" are held consecutively in the same semester.

#### Learning objectives:

The student

- knows and understands fundamentals of constrained nonlinear optimization,  
- is able to choose, design and apply modern techniques of constrained nonlinear optimization in practice.
Literature

Weiterführende Literatur:

- W. Alt, Nichtlineare Optimierung, Vieweg, 2002
- M.S. Bazaraa, H.D. Sherali, C.M. Shetty, Nonlinear Programming, Wiley, 1993
### 4.184 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
### 4.185 Course: Nonparametric Statistics [T-MATH-105873]

**Responsible:** Dr. rer. nat. Bruno Ebner  
Prof. Dr. Vicky Fasen-Hartmann  
PD Dr. Bernhard Klar  
Prof. Dr. Mathias Trabs

**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-102910 - Nonparametric Statistics

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**Course:** Numerical Analysis of Helmholtz Problems [T-MATH-111514]

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

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-105764 - Numerical Analysis of Helmholtz Problems
4.187 Course: Numerical Complex Analysis [T-MATH-112280]

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

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-106063 - Numerical Complex Analysis

<table>
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**Competence Certificate**
oral exam of ca. 20 minutes

**Prerequisites**
none

**Recommendation**
Some basic knowledge of Complex Analysis is strongly recommended.
4.188 Course: Numerical Continuation Methods [T-MATH-105912]

- **Responsible:** Prof. Dr. Wolfgang Reichel
- **Organisation:** KIT Department of Mathematics
- **Part of:** M-MATH-102944 - Numerical Continuation Methods

**Type:** Oral examination
**Credits:** 5
**Grading scale:** Grade to a third
**Version:** 1

**Prerequisites:**
none
4 COURSES

Course: Numerical Linear Algebra for Scientific High Performance Computing [T-MATH-107497]

4.189 Course: Numerical Linear Algebra for Scientific High Performance Computing [T-MATH-107497]

Responsible: Prof. 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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Prerequisites
none
## 4.190 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
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<th>Grading scale</th>
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<td>4 SWS</td>
<td>Lecture / Wiener</td>
<td>3</td>
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<td>WT 23/24 0110800</td>
<td>Übungen zu 0110700 (numerische Methoden für Differentialgleichungen)</td>
<td>2 SWS</td>
<td>Practice / Wiener</td>
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4.192 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

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**Prerequisites**
none
4.193 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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### 4.194 Course: Numerical Methods for Maxwell's Equations [T-MATH-105920]

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

**Organisation:** KIT Department of Mathematics

**Part of:** [M-MATH-102931 - Numerical Methods for Maxwell's Equations](#)

<table>
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<tr>
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<td>Grade to a third</td>
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**Responsible:** Prof. Dr. Marlis Hochbruck
Prof. Dr. Tobias Jahnke

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102928 - Numerical Methods for Time-Dependent Partial Differential Equations

<table>
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**Events**

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<th>Credit Hours</th>
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<tr>
<td>ST 2023 0164500</td>
<td>4 SWS</td>
<td>Numerical Methods for Time-Dependent Partial Differential Equations</td>
<td>Lecture</td>
<td>Hochbruck</td>
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<tr>
<td>ST 2023 0164510</td>
<td>2 SWS</td>
<td>Tutorial for 0164500</td>
<td>Practice</td>
<td>Hochbruck</td>
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</table>

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

**Numerical Methods for Time-Dependent Partial Differential Equations**

0164500, SS 2023, 4 SWS, Language: English, [Open in study portal](#)

**Lecture (V)**

**Content**

The aim of this lecture is to construct, analyze and discuss the efficient implementation of numerical methods for time-dependent partial differential equations (pdes). We will consider traditional methods and techniques as well as very recent research.

Prerequisites: The students are expected to be familiar with the basics of the numerical analysis of the time integration of ordinary differential equations (Runge-Kutta and multistep methods) and of finite element methods for elliptic boundary element methods. The lecture starts with a review on Runge-Kutta and multistep methods. Some basic knowledge in functional analysis and the analysis of boundary value problem is helpful but the main results will be repeated in the lecture.
4.196 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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**Prerequisites:**
none
4 COURSES

Course: Numerical Methods in Fluid Mechanics [T-MATH-105902]

4.197 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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<tr>
<td>ST 2023 0164200</td>
<td>Numerische Methoden in der Strömungsmechanik</td>
<td>2 SWS</td>
<td>Lecture</td>
<td>Thäter</td>
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<tr>
<td>ST 2023 0164210</td>
<td>Übungen zu 0164210 (Numerische Methoden in der Strömungsmechanik)</td>
<td>1 SWS</td>
<td>Practice</td>
<td>Thäter</td>
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</tbody>
</table>
4.198 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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**Events**

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<td>Numerical methods in mathematical finance</td>
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<td>2</td>
<td>Practice</td>
<td>Jahnke</td>
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</table>

**Competence Certificate**

oral exam of ca. 30 minutes

**Prerequisites**

none
### 4.199 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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**Events**

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<td>Lecture</td>
<td>Rieder</td>
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<td>0124010</td>
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<td>Übungen zu 0124000 (numerische Optimierungsmethoden)</td>
<td>2</td>
<td>Practice</td>
<td>Rieder</td>
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</table>
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
4.201 Course: Online Concepts for Karlsruhe City Retailers [T-WIWI-111848]

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

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

**Part of:** M-WIWI-105312 - Marketing and Sales Management

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### Events

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<td>Each summer term</td>
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<th>Recurrence</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST 2023</td>
<td>2571184</td>
<td>Online concepts for Karlsruhe city retailers</td>
<td>2 SWS</td>
<td>Others / Klarmann, Kupfer, Weber, Gerlach</td>
</tr>
</tbody>
</table>

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

**Competence Certificate**

Alternative exam assessment:

- presentations in teams (in each case to the extent of approx. 15 minutes per team with subsequent discussion)
- delivery of a written elaboration per team.

**Annotation**

Please note that an application is required to participate in this workshop. The application phase usually takes place at the beginning of the lecture period in the summer semester. More information on the application process is usually available on the Marketing and Sales Research Group website (marketing.iism.kit.edu) shortly before the start of the lecture period in the summer semester.

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

### Online concepts for Karlsruhe city retailers

2571184, SS 2023, 2 SWS, Language: German, Open in study portal

**Content**

As part of a practical project in cooperation with the city marketing department of KME Karlsruhe Marketing und Event GmbH, students will have the opportunity to directly interact with retailers in Karlsruhe. Challenges of the digitalization of brick-and-mortar retailing will be analyzed and solutions will be developed and implemented.

In a theoretical part at the beginning of the event, students will gain an insight into the theoretical foundations of specific online marketing instruments. In cooperation with Karlsruhe City Marketing, students are taught application-oriented skills in online marketing tools, such as content management systems, social media platforms, search engine optimization or Google Ads campaigns.

In the practical part of the course, student teams cooperate with a real retailer in Karlsruhe's city center and learn how to analyze and optimize online presences and digital solutions based on key performance indicators. Possible use cases range from social media communication and website optimization to the introduction of innovative pricing and payment methods. In this way, students are given the tools for developing, maintaining and optimizing individual websites and digital solutions in stationary retailing.

Learning objectives result accordingly as follows:

- Learning of theoretical basics of central, application-oriented tools of online marketing
- Application and practical deep-dive of the acquired knowledge in a real case
- Concise and structured presentation of results

Total time required for 3 credit points: approx. 90.0 hours

Attendance time: 12 hours
Preparation and wrap-up of the course: 58 hours
Exam and exam preparation: 20 hours
Course: Operations Research in Health Care Management [T-WIWI-102884]

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

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

**Part of:** M-WIWI-102805 - Service Operations

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<th>Version</th>
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<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.

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

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

**Part of:**
- M-WIWI-101473 - Mathematical Programming
- M-WIWI-102805 - Service Operations
- M-WIWI-102832 - Operations Research in Supply Chain Management
- M-WIWI-103289 - Stochastic Optimization

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<td>4.5</td>
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**Events**

| ST 2023 | 2550480 | Operations Research in Supply Chain Management | 2 SWS | Lecture / 🗣 | Nickel |
| ST 2023 | 2550481 | Übungen zu OR in Supply Chain Management | 1 SWS | Practice / 🗣 | Hoffmann |

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

**Competence Certificate**
The assessment is a 60 minutes written examination (according to §4(2), 1 of the examination regulation). The examination is held in the term of the lecture and the following lecture.

**Prerequisites**
None

**Recommendation**
Basic knowledge as conveyed in the module Introduction to Operations Research and in the lectures Facility Location and Strategic SCM, Tactical and operational SCMs assumed.

**Annotation**
The course is offered irregularly. Planned lectures for the next three years can be found in the internet at http://dol.ior.kit.edu/english/Courses.php.

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

**Operations Research in Supply Chain Management**
2550480, SS 2023, 2 SWS, Language: English, Open in study portal

**Lecture (V)**
On-Site

**Content**
Supply Chain Management constitutes a general tool for logistics process planning in supply networks. To an increasing degree quantitative decision support is provided by methods and models from Operations Research. The lecture "OR in Supply Chain Management" conveys concepts and approaches for solving practical problems and presents an insight to current research topics. The lecture's focus is set on modeling and solution methods for applications originating in different domains of a supply chain. The emphasis is put on mathematical methods like mixed integer programming, valid inequalities or column generation, and the derivation of optimal solution strategies.

In form and content, the lecture addresses multiple areas of Supply Chain Management: After a short introduction, inventory models, scheduling, assembly line balancing as well as cutting and packing will be discussed. Another main focus of the lecture is the application of methods from online optimization. This optimization discipline has gained more and more importance in the optimization of supply chains over the several past years due to an increasing amount of dynamic data flows.
Literature

- Dyckhoff, H.; Finke, U.: Cutting and Packing in Production and Distribution - A Typology and Bibliography, Physica-Verlag, 1992
### 4.204 Course: Optimisation and Optimal Control for Differential Equations [T-MATH-105864]

<table>
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<th>KIT Department of Mathematics</th>
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<td>M-MATH-102899 - Optimisation and Optimal Control for Differential Equations</td>
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**Prerequisites**

none
4.205 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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**Competence Certificate**
oral examination of approximately 30 minutes

**Prerequisites**
none

**Recommendation**
Some basic knowledge of finite dimensional optimization theory and functional analysis is desirable.
4.206 Course: Optimization Models and Applications [T-WIWI-110162]

Responsible: Dr. Nathan Sudermann-Merx
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101473 - Mathematical Programming
M-WIWI-102832 - Operations Research in Supply Chain Management
M-WIWI-103289 - Stochastic Optimization

Type  Written examination  Credits  4,5  Grading scale  Grade to a third  Recurrence  see Annotations  Version  1

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.
4.207 Course: Optimization under Uncertainty [T-WIWI-106545]

**Responsible:** Prof. Dr. Steffen Rebennack  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-101413 - Applications of Operations Research  
M-WIWI-103289 - Stochastic Optimization  

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<td>Lecture/🧩</td>
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<td>Übungen zu Optimierungsansätze unter Unsicherheit</td>
<td>Practice/🗣</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**

The assessment consists of a written exam (60 minutes) according to Section 4(2), 1 of the examination regulation. The exam takes place in every the semester.

**Prerequisites**

None.
4.208 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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Prerequisites
None

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

Panel Data
2520320, SS 2023, 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

Literature

### 4.209 Course: Parallel Computing [T-MATH-102271]

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

**Organisation:** KIT Department of Mathematics  

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

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4.210 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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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).
4.211 Course: Percolation [T-MATH-105869]

**Responsible:** Prof. Dr. Daniel Hug  
Prof. Dr. Günter Last  
PD Dr. Steffen Winter

**Organisation:** KIT Department of Mathematics

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

<table>
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**Events**

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<td>Winter</td>
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<td>Practice</td>
<td>Winter</td>
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**Prerequisites**

none
4.212 Course: Poisson Processes [T-MATH-105922]

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

**Organisation:** KIT Department of Mathematics

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

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</table>

**Prerequisites**

none
4.213 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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**Events**

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<td>Lecture</td>
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<td>Übungen zu Portfolio and Asset Liability Management</td>
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**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**

Content

Knowledge of various portfolio management techniques in the financial industry.

Learning objectives:

- Portfolio theory: principles of investment, Markowitz portfolio analysis, Modigliani-Miller theorems and absence of arbitrage, efficient markets, capital asset pricing model (CAPM), multi factorial CAPM, arbitrage pricing theory (APT), arbitrage and hedging, multi factorial models, equity-portfolio management, passive strategies, active investment
- Asset liability: statistical portfolio analysis in stock allocation, measures of success, dynamic multi seasonal models, models in building scenarios, stochastic programming in bond and liability management, optimal investment strategies, integrated asset liability management

Workload:

- Total workload for 4.5 CP: approx. 135 hours
- Attendance: 30 hours
- Preparation and follow-up: 65 hours
- Exam preparation: 40 hours
- Exam preparation: 40 hours

Organizational issues

Blockveranstaltung. Termine werden über Ilias bekanntgegeben

Literature

To be announced in the lecture
4.214 Course: Potential Theory [T-MATH-105850]

**Responsible:**
- PD Dr. Tilo Arens
- Prof. Dr. Roland Griesmaier
- PD Dr. Frank Hettlich
- Prof. Dr. Wolfgang Reichel

**Organisation:**
KIT Department of Mathematics

**Part of:**
M-MATH-102879 - Potential Theory

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# Course: Practical Seminar: Health Care Management (with Case Studies) [T-WIWI-102716]

**Responsible:** Prof. Dr. Stefan Nickel  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-102805 - Service Operations

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<td>Seminar / 🧩</td>
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<td>WT 23/24</td>
<td>2500008</td>
<td>Practical seminar: Health Care Management</td>
<td>3 SWS</td>
<td>Others / 🗣</td>
</tr>
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</table>

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

**Competence Certificate**

Due to a research semester of Professor Nickel in WS 19/20, the courses Location Planning and Strategic SCM and Practice Seminar: Health Care Management do NOT take place in WS 19/20. Please also refer to the information at https://dol.ior.kit.edu/Lehrveranstaltungen.php 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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<td>Grade to a third</td>
<td>Each term</td>
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Events

| ST 2023 | 2540554 | Practical Seminar: Information Systems & Service Design (Master) | 3 SWS | Lecture / Online | Mädche |

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

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.

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

Practical Seminar: Information Systems & Service Design (Master)

2540554, SS 2023, 3 SWS, Language: English, Open in study portal

Lecture (V)

Blended (On-Site/Online)

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.
4.217 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.
Course: Predictive Modeling [T-WIWI-110868]

**Responsible:** 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

**Type:** Written examination

**Credits:** 4.5

**Grading scale:** Grade to a third

**Recurrence:** Irregular

**Version:** 2

---

### Competence Certificate

The assessment of this course is a written examination (90 minutes) according to §4(2), 1 of the examination regulation. A bonus can be acquired by successful completion of an assignment (written report + short in-class presentation) during the semester. If the grade of the written examination is between 4.0 and 1.3, the bonus improves the grade by one grade level (0.3 or 0.4).

**Prerequisites**

None

---

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

**Predictive Modeling**

2521311, SS 2023, 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.

**Predictive Modeling (Tutorial)**

2521312, SS 2023, 2 SWS, Language: English, [Open in study portal]
4.219 Course: Pricing [T-WWI-102883]

**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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<td>Grade to a third</td>
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<td>3</td>
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**Events**

| WT 23/24 | 2572199 | Pricing | 3 SWS | Block / On-Site | Klarmann |

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

**Competence Certificate**

Alternative exam assessment. The examination (and thus the grade) is composed of three parts:

1. The design and execution of your own small experimental study around the topic of behavioral pricing (as group work).
2. The processing and presentation of a case study on pricing (as group work).
3. The execution of a simulated price negotiation based on a systematic preparation (usually in teams of two).

**Prerequisites**

Since the earlier course (a) "Pricing Excellence" and (b) "Price Negotiations and Sales Presentations" become parts of the Pricing course, Pricing cannot be taken if (a) and/or (b) have already been completed.

**Recommendation**

Students are highly encouraged to actively participate in class.

**Annotation**

A small application is required for participation in this class. The application phase usually takes place at the beginning of the lecture period in the winter semester. More information on the application process will be made available on the Marketing and Sales Research Group website (marketing.iism.kit.edu) shortly before the start of the winter semester lecture period. This course is limited to 24 participants.

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

**Pricing**

2572199, WS 23/24, 3 SWS, Language: English, Open in study portal
Content
At the Pricing lecture, students learn about current research and best practices in price management. Delivered in workshop format, the lecture has three key elements:

1. "Behavioral Pricing" workshop
   In this part of the course, central concepts and findings from behavioral pricing research (e.g. price information processing, reference prices, price fairness and mental accounting) are presented and discussed on the basis of important behavioral theories (e.g. prospect theory and information economics). After a brief introduction to experimental research, participants will then conduct their own small experimental study in the form of group work on a hypothesis they have developed on pricing behavior, analyze the data, and present it.

2. "Pricing Excellence" workshop
   In a theory section at the beginning of the course, students are taught theoretical principles of pricing. This includes an introduction to (1) pricing of product prices as well as (2) pricing of net customer prices (development of discount systems). Furthermore, theoretical basics of price enforcement and price monitoring are discussed. This will be followed by a practical application of what has been learned by working on a case study in small groups with a concluding presentation.

3. "Price Negotiation" workshop
   After an introduction to key theories and concepts of negotiation, students prepare and then conduct a simulated price negotiation in small groups with guidance.

Learning Objectives:
Students...
- are familiar with central theories explaining behavioral phenomena regarding consumers dealing with prices
- are able to describe and explain central phenomena of behavioral science with regard to price behavior and derive implications from them
- can formulate their own hypotheses on price behavior and design, conduct and evaluate a suitable experimental study for this purpose
- learn theoretical basics of pricing behavior
- learn the theoretical basics of price enforcement and price monitoring
- apply the acquired knowledge in a practical case study
- know important conceptual basics on the subject of price negotiations
- can prepare and competently conduct price negotiations
- present the results of their group work in a concise and structured manner

All events will take place in presence with compulsory attendance at all dates.

Total time required for 4.5 credit points: approx. 135 hours
Attendance time: 30 hours
Self-study: 105 hours

Organizational issues
Dates will be announced.
4.220 Course: Probabilistic Time Series Forecasting Challenge [T-WIWI-111387]

**Responsible:** 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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<td>Bracher, Koster, Lerch</td>
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**Competence Certificate**

Alternative exam assessment. Necessary conditions to pass the course:

1. Weekly submission of statistical forecasts during the semester (excluding the Christmas break).
2. Submission of a final report (10-15 pages) at the end of the semester, describing the forecasting methods and their statistical evaluation.

Grading is based on the final report.

**Prerequisites**

Good methodological knowledge in statistics and data science.

Good knowledge in applied data analysis, incl. programming skills in R, Python or similar.

Knowledge of time series analysis is helpful, but not required.

**Annotation**

The course is limited in participation. Participants will be selected via the WIWI portal.

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

**Probabilistic Time Series Forecasting Challenge**

2500081, WS 23/24, SWS, Language: English, [Open in study portal]

**Project (PRO)**

Blended (On-Site/Online)

**Content**

Statistical forecasts are relevant across all fields of society. In this data science project, students make, evaluate and communicate their own statistical forecasts in a real-time setting. We consider probabilistic forecasts that involve a measure of uncertainty in addition to a point forecast. Students are asked to make forecasts of several real-world time series (including weather variables and the DAX stock market index). Historical data on all series are available from public sources that are updated as time proceeds. While the time series differ from each other in important ways, statistical methods can meaningfully be used for prediction in all cases. We focus on quantile forecasts which are useful to measure forecast uncertainty in a relatively simple way.
Organizational issues

Short description

In this data science project, students make and evaluate statistical forecasts in a realistic setup (involving real-time predictions and real-world time series data). A kick-off meeting will take place in mid October. During the semester, there will be a weekly meeting in which students and instructors discuss the current state of the forecasting challenge.

Prerequisites

Students should have a good working knowledge of statistics and data science, including proficiency in a programming language like R, Python, or Matlab. Knowledge of time series analysis is helpful but not strictly required. Motivation and curiosity are particularly important in this course format that requires regular, active participation over the whole semester.

Please note that the number of participants is limited due to the interactive course format. Application takes place via the Wiwi portal, where further information is available.

Examination rules

The project seminar counts for 4.5 credit points (Leistungspunkte). Examination is via an alternative exam assessment (§4(2), 3 SPO). Necessary conditions to pass the course: 1) Weekly submission of statistical forecasts during the semester (excluding the Christmas break), 2) Submission of a final report (10-15 pages) at the end of the semester, describing the forecasting methods and their statistical evaluation. Grading is based on the final report.
4.221 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
4 COURSES

Course: Process Mining [T-WIWI-109799]

4.222 Course: Process Mining [T-WIWI-109799]

Responsible: Prof. Dr. Andreas Oberweis
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101472 - Informatics

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<td>Each summer term</td>
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Events

| ST 2023  | 2511204 | Process Mining   | 2 SWS | Lecture / 🗣 | Oberweis |
| ST 2023  | 2511205 | Exercise Process Mining | 1 SWS | Practice / 🗣 | Oberweis, Schreiber, Schüler, Rybinski |

Legend: 🏬 Online, ☑ Blended (On-Site/Online), 🗣 On-Site, ✗ Canceled

Competence Certificate

The assessment of this course is a written examination (60 min) according to §4(2), 1 of the examination regulation 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 2023, 2 SWS, Language: German, Open in study portal

Lecture (V)

On-Site

Content

The area of process mining covers approaches which aim at deducting new knowledge on the basis of logfiles generated by information systems. Such information systems are e.g., workflow-management-systems which are used for an efficient control of processes in enterprises and organizations. 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.
4.223 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**

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<td>Product and Innovation Management</td>
<td>2 SWS</td>
<td>Klarmann</td>
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**Competence Certificate**

The assessment of success takes place through a written exam with additional aids in the sense of an open book exam. Further details will be announced during the lecture.

**Prerequisites**

None

**Annotation**

Please note that Product and Innovation Management will not be offered again until summer semester 2026. The course will not take place in the summer semester 2024 and 2025.

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 2023, 2 SWS, Language: English, Open in study portal  
**Lecture (V) On-Site**

**Content**

This course addresses topics around the management of new as well as existing products. After the foundations of product management, especially the product choice behavior of customers, students get to know in detail different steps of the innovation process. Another section regards the management of the existing product portfolio.

Students

- know the most important terms of the product and innovation concept  
- understand the models of product choice behavior (e.g., the Markov model, the Luce model)  
- are familiar with the basics of network theory (e.g. the Triadic Closure concept)  
- know the central strategic concepts of innovation management (especially the market driving approach, pioneer and successor, Miles/Snow typology, blockbuster strategy)  
- master the most important methods and sources of idea generation (e.g. open innovation, lead user method, crowdsourcing, creativity techniques, voice of the customer, innovation games, conjoint analysis, quality function deployment, online toolkits)  
- are capable of defining and evaluating new product concepts and know the associated instruments like focus groups, product testing, speculative sales, test market simulation Assessor, electronic micro test market  
- have advanced knowledge about market introduction (e.g. adoption and diffusion models Bass, Fourt/Woodlock, Mansfield)  
- understand important connections of the innovation process (cluster formation, innovation culture, teams, stage-gate process)

The assessment is carried out (according to §4(2), 3 SPO) in the form of a written open book exam.

Total effort for 3 credit points: approx. 90 hours  
Presence time: 30 hours  
Preparation and wrap-up of LV: 45.0 hours  
Exam and exam preparation: 15.0 hours

For further information please contact Marketing & Sales Research Group (marketing.iism.kit.edu).
Literature
4.224 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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<td>4 SWS</td>
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<td>Thäter, Krause</td>
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Prerequisites
none
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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<td>WT 23/24</td>
<td>2512501</td>
<td>Practical Course Cognitive automobiles and robots (Master)</td>
<td>3 SWS</td>
<td>Practical course</td>
<td>Zöllner, Daaboul</td>
<td></td>
</tr>
</tbody>
</table>

**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:

**Practical Course Cognitive automobiles and robots (Master)**

2512501, WS 23/24, 3 SWS, Language: German/English, Open in study portal

**Practical course (P)**

Blended (On-Site/Online)

**Content**

The lab is intended as a practical supplement to courses such as “Machine Learning 1/2”. Scientific topics, mostly in the area of autonomous driving and robotics, will be addressed in joint work with ML/KI methods. The goal of the internship is for participants to design, develop, and evaluate ML Software system.

In addition to the scientific goals, such as the study and application of methods, the aspects of project-specific teamwork in research (from specification to presentation of results) are also worked on in this internship.

The individual projects require the analysis of the set task, selection of appropriate methods, specification and implementation and evaluation of the solution approach. Finally, the selected solution is to be documented and presented in a short lecture.

**Learning Objectives:**

- Students will be able to practically apply theoretical knowledge from lectures on machine learning to a selected area of current research.
- Students will be proficient in analyzing and solving thematic problems.
- Students will be able to evaluate, document, and present their concepts and results.

**Recommendations:**

- Theoretical knowledge of machine learning and/or AI.
- Python knowledge
- Initial experience with deep learning frameworks such as PyTorch/Jax/Tensorflow may be beneficial.

**Workload:**

The workload of 5 credit points consists of practical implementation of the selected solution, as well as time for literature research and planning/specification of the selected solution. In addition, a short report and presentation of the work performed 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.
4.226 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

<table>
<thead>
<tr>
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<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
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<tr>
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<td>Each summer term</td>
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**Events**

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<th>Code</th>
<th>Description</th>
<th>Credits</th>
<th>Type</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
</tr>
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<tr>
<td>ST 2023</td>
<td>2512500</td>
<td>Project Lab Machine Learning</td>
<td>3</td>
<td>Practical course / 🧩</td>
<td>Grade to a third</td>
<td>Each summer term</td>
<td>3</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
- 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 2023, 3 SWS, Language: German/English, Open in study portal

**Practical course (P)**

**Blended (On-Site/Online)**

**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.
4.227 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

<table>
<thead>
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<td>Grade to a third</td>
<td>Each winter term</td>
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</table>

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

**Events**

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<th>Event Code</th>
<th>Event Code</th>
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<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
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</thead>
<tbody>
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<td>WT 23/24</td>
<td>2561127</td>
<td>Lecture/Practice</td>
<td>3 SWS</td>
<td>Grade to a third</td>
<td>Each winter term</td>
<td>1</td>
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</table>

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

**Competence Certificate**

Depending on the further pandemic development the assessment will consist either of an open book exam (following Art. 4, para. 2, clause 3 of the examination regulation), or of an 1.5h written exam (following Art. 4, para. 2, clause 1 of the examination regulation).

**Prerequisites**

None

**Recommendation**

Basic knowledge of Public Finance is required.

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

**Public Management**

2561127, WS 23/24, 3 SWS, Language: German, Open in study portal

**Literature**

Weiterführende Literatur:

4.228 Course: Quantitative Methods in Energy Economics [T-WIWI-107446]

Responsible: Dr. Patrick Plötz
Organisation: KIT Department of Economics and Management

<table>
<thead>
<tr>
<th>Type</th>
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<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
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<tbody>
<tr>
<td>Oral examination</td>
<td>3.5</td>
<td>Grade to a third</td>
<td>Each winter term</td>
<td>3</td>
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Events

<table>
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<tr>
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<th>Code</th>
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<th>Credits</th>
<th>Type</th>
<th>Responsible</th>
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</thead>
<tbody>
<tr>
<td>WT 23/24</td>
<td>2581007</td>
<td>Quantitative Methods in Energy Economics</td>
<td>2 SWS</td>
<td>Lecture / 🗣</td>
<td>Plötz</td>
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<tr>
<td>WT 23/24</td>
<td>2581008</td>
<td>Übungen zu Quantitative Methods in Energy Economics</td>
<td>1 SWS</td>
<td>Practice / 🗣</td>
<td>Plötz, Britto</td>
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</table>

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

Competence Certificate

The assessment consists of an oral (30 minutes) exam (following §4(2) of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date. Depending on the respective pandemic situation, the exam may be offered as an open book exam (alternative exam assessment, following §4(2), 3 of the examination regulation).

Prerequisites

None

Recommendation

None

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

Quantitative Methods in Energy Economics

2581007, WS 23/24, 2 SWS, Language: English, [Open in study portal]

Lecture (V) On-Site

Content

Energy economics makes use of many quantitative methods in exploration and analysis of data as well as in simulations and modelling. This lecture course aims at introducing students of energy economics into the application of quantitative methods and techniques as taught in elementary courses to real problems in energy economics. The focus is mainly on regression, simulation, time series analysis and related statistical methods as applied in energy economics.

Learning Goals:

The student

- knows and understands selected quantitative methods of energy economics
- is able to use selected quantitative methods of energy economics
- understands they range of usage, limits and is autonomously able to adress new problems by them.

Literature

Wird in der Vorlesung bekannt gegeben.
4.229 Course: Random Graphs [T-MATH-105929]

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

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102951 - Random Graphs

<table>
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<th>Type</th>
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<th>Version</th>
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<tr>
<td>Oral examination</td>
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<td>Grade to a third</td>
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**Prerequisites**
none
4.230 Course: Random Graphs and Networks [T-MATH-112241]

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

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-106052 - Random Graphs and Networks

---

**Type**
Oral examination

**Credits**
8

**Grading scale**
Grade to a third

**Recurrence**
Irregular

**Version**
1

---

**Competence Certificate**
oral exam of ca. 30 min

**Prerequisites**
none

**Recommendation**
The contents of the module ‘Probability Theory’ are strongly recommended.
4.231 Course: Regulation Theory and Practice [T-WIWI-102712]

**Responsible:** Prof. Dr. Kay Mitusch

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

**Part of:** M-WIWI-101451 - Energy Economics and Energy Markets

<table>
<thead>
<tr>
<th><strong>Type</strong></th>
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<th><strong>Grading scale</strong></th>
<th><strong>Recurrence</strong></th>
<th><strong>Version</strong></th>
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<tbody>
<tr>
<td>Oral examination</td>
<td>4.5</td>
<td>Grade to a third</td>
<td>see Annotations</td>
<td>2</td>
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</table>

**Competence Certificate**
The lecture is not offered for an indefinite period of time. Result of success is made by a 20-30 minutes oral examination. Examination is offered every semester and can be retried at any regular examination date.

**Prerequisites**
None

**Recommendation**
Basic knowledge and skills of microeconomics from undergraduate studies (bachelor’s degree) are expected. Particularly helpful but not necessary: Industrial Economics and Principal-Agent- or Contract theories. Prior attendance of the lecture *Competition in Networks* [26240] is helpful in any case but not considered a formal precondition.

**Annotation**
The lecture is not offered for an indefinite period of time.
### 4.232 Course: Riemann Surfaces [T-MATH-113081]

<table>
<thead>
<tr>
<th>Type</th>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Expansion</th>
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<tbody>
<tr>
<td>Oral examination</td>
<td>8</td>
<td>Grade to a third</td>
<td>Irregular</td>
<td>1 terms</td>
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</table>

**Responsible:** Prof. Dr. Frank Herrlich  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-106466 - Riemann Surfaces

**Competence Certificate**  
Oral examination of ca. 30 minutes.

**Prerequisites**  
none
4.233 Course: Ruin Theory [T-MATH-108400]

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

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-104055 - Ruin Theory

**Type:** Oral examination

**Credits:** 4

**Grading scale:** Grade to a third

**Recurrence:** Irregular

**Version:** 1

**Prerequisites**

none
# 4.234 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

<table>
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<th>Type</th>
<th>Credits</th>
<th>Grading scale</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral exam</td>
<td>8</td>
<td>Grade to a third</td>
<td>1</td>
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</tbody>
</table>
4.235 Course: Selected Methods in Fluids and Kinetic Equations [T-MATH-111853]

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-105897 - Selected Methods in Fluids and Kinetic Equations

<table>
<thead>
<tr>
<th>Type</th>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Expansion</th>
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<tbody>
<tr>
<td>Oral examination</td>
<td>3</td>
<td>Grade to a third</td>
<td>Irregular</td>
<td>1 terms</td>
<td>1</td>
</tr>
</tbody>
</table>

**Competence Certificate**
oral examination of approx. 30 minutes

**Prerequisites**
none

**Recommendation**
The courses "Classical Methods for Partial Differential Equations" and "Functional Analysis" are recommended.
4.236 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

<table>
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<th>Grading scale</th>
<th>Recurrence</th>
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<tbody>
<tr>
<td>Oral exam</td>
<td>3</td>
<td>Grade to a third</td>
<td>Irregular</td>
<td>1</td>
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</table>

**Prerequisites**
none
**Course: Semantic Web Technologies [T-WIWI-110848]**

**Responsible:** Dr.-Ing. Tobias Christof Käfer

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

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

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

<table>
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<tr>
<th>ST 2023</th>
<th>2511310</th>
<th><strong>Semantic Web Technologies</strong></th>
<th>2 SWS</th>
<th>Lecture / 🗣</th>
<th>Färber, Käfer, Braun</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST 2023</td>
<td>2511311</td>
<td><strong>Exercises to Semantic Web Technologies</strong></td>
<td>1 SWS</td>
<td>Practice / 🗣</td>
<td>Färber, Käfer</td>
</tr>
</tbody>
</table>

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:*

<table>
<thead>
<tr>
<th>V</th>
<th><strong>Semantic Web Technologies</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>2511310, SS 2023, 2 SWS, Language: English</td>
<td><a href="#">Open in study portal</a></td>
</tr>
</tbody>
</table>

**Lecture (V) On-Site**
Content
The aim of the Semantic Web is to make the meaning (semantics) of data on the web usable in intelligent systems, e.g. in e-commerce and internet portals.

Central concepts are the representation of knowledge in form of RDF and ontologies, the access via Linked Data, as well as querying the data by using SPARQL. This lecture provides the foundations of knowledge representation and processing for the corresponding technologies and presents example applications.

The following topics are covered:

- Resource Description Framework (RDF) and RDF Schema (RDFS)
- Web Architecture and Linked Data
- Web Ontology Language (OWL)
- Query language SPARQL
- Rule languages
- Applications

Learning objectives:
The student

- understands the motivation and foundational ideas behind Semantic Web and Linked Data technologies, and is able to analyse and realise systems
- demonstrates basic competency in the areas of data and system integration on the web
- masters advanced knowledge representation scenarios involving ontologies

Recommendations:
Lectures on Informatics of the Bachelor on Information Systems (Semester 1-4) or equivalent are required. Knowledge of modeling with UML is required.

Workload:

- The total workload for this course is approximately 135 hours
- Time of presentness: 45 hours
- Time of preparation and postprocessing: 60 hours
- Exam and exam preparation: 30 hours

Literature


Weitere Literatur


Exercises to Semantic Web Technologies
2511311, SS 2023, 1 SWS, Language: English, Open in study portal
Content
The exercises are related to the lecture Semantic Web Technologies.
Multiple exercises are held that capture the topics, held in the lecture Semantic Web Technologies, and discuss them in detail. Thereby, practical examples are given to the students in order to transfer theoretical aspects into practical implementation.
The following topics are covered:
- Resource Description Framework (RDF) and RDF Schema (RDFS)
- Web Architecture and Linked Data
- Web Ontology Language (OWL)
- Query language SPARQL
- Rule languages
- Applications

Learning objectives:
The student
- understands the motivation and foundational ideas behind Semantic Web and Linked Data technologies, and is able to analyse and realise systems
- demonstrates basic competency in the areas of data and system integration on the web
- masters advanced knowledge representation scenarios involving ontologies

Recommendations:
Lectures on Informatics of the Bachelor on Information Systems (Semester 1-4) or equivalent are required. Knowledge of modeling with UML is required.

Organizational issues
Die Übungen finden im Rahmen der Termine der Blockvorlesung statt.

Literature

Weitere Literatur
## 4.238 Course: Seminar in Business Administration A (Master) [T-WIWI-103474]

<table>
<thead>
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<th>Event Code</th>
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<th>Type Description</th>
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<th>Grade</th>
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<td>2400121</td>
<td>Interactive Analytics Seminar</td>
<td>2</td>
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<td>Beigl, Mädche</td>
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<tr>
<td>ST 2023</td>
<td>2500018</td>
<td>Successful transformation through innovation</td>
<td>2</td>
<td>Seminar</td>
<td>Busch</td>
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<td>ST 2023</td>
<td>2500027</td>
<td>Design Seminar: Digital Citizen Science</td>
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<td>Seminar</td>
<td>Mädche</td>
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<td>ST 2023</td>
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<td>Engineering Seminar: Human-Centered Systems</td>
<td>3</td>
<td>Seminar</td>
<td>Mädche</td>
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<tr>
<td>ST 2023</td>
<td>2530580</td>
<td>Seminar in Finance (Master)</td>
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<td>Seminar</td>
<td>Uhrig-Homburg, Müller, Thimme</td>
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<tr>
<td>ST 2023</td>
<td>2540472</td>
<td>Digital Citizen Science</td>
<td>2</td>
<td>Seminar</td>
<td>Weinhardt, Knierim, Mädche</td>
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<tr>
<td>ST 2023</td>
<td>2540475</td>
<td>Positive Information Systems</td>
<td>2</td>
<td>Seminar</td>
<td>Knierim, del Pupo, Bartholomeyczik</td>
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<tr>
<td>ST 2023</td>
<td>2540477</td>
<td>Digital Experience &amp; Participation</td>
<td>2</td>
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<td>Peukert, Fegert</td>
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<td>ST 2023</td>
<td>2540478</td>
<td>Smart Grid Economics &amp; Energy Markets</td>
<td>2</td>
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<td>Henni, Semmelmann, Bluhm, Golla</td>
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<td>ST 2023</td>
<td>2540510</td>
<td>Master Seminar in Data Science and Machine Learning</td>
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<td>Geyer-Schulz</td>
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<td>ST 2023</td>
<td>2540553</td>
<td>User-Adaptive Systems Seminar</td>
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<td>Seminar</td>
<td>Mädche, Beigl</td>
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<tr>
<td>ST 2023</td>
<td>2540557</td>
<td>Research Seminar: Human-Centered Systems</td>
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<td>ST 2023</td>
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<td>ST 2023</td>
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<td>Seminar</td>
<td>Klarmann, Mitarbeiter</td>
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<tr>
<td>ST 2023</td>
<td>2571182</td>
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<td>ST 2023</td>
<td>2573012</td>
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<tr>
<td>ST 2023</td>
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<td>Seminar Management Accounting - Sustainability Topics</td>
<td>2</td>
<td>Seminar</td>
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<td>Seminar Energiewirtschaft IV</td>
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<td>Seminar</td>
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### 4 COURSES

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<tr>
<td>WT 23/24 2540473</td>
<td>Business Data Analytics</td>
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<tr>
<td>WT 23/24 2540475</td>
<td>Digital Platforms, Markets &amp; Work</td>
<td>2</td>
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</tr>
<tr>
<td>WT 23/24 2540478</td>
<td>Smart Grids and Energy Markets</td>
<td>2</td>
<td>Seminar</td>
</tr>
<tr>
<td>WT 23/24 2540510</td>
<td>Master Seminar in Data Science and Machine Learning</td>
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<td>Seminar</td>
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<tr>
<td>WT 23/24 2540557</td>
<td>Research Seminar: Human-Centered Systems</td>
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<td>Seminar</td>
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<tr>
<td>WT 23/24 2571181</td>
<td>Seminar Digital Marketing (Master)</td>
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<td>Seminar</td>
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<tr>
<td>WT 23/24 2573012</td>
<td>Seminar Human Resource Management (Master)</td>
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<tr>
<td>WT 23/24 2573013</td>
<td>Seminar Human Resources and Organizations (Master)</td>
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<tr>
<td>WT 23/24 2579911</td>
<td>Seminar Management Accounting - Special Topics</td>
<td>2</td>
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<tr>
<td>WT 23/24 2579919</td>
<td>Seminar Management Accounting - Sustainability Topics</td>
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<tr>
<td>WT 23/24 2581030</td>
<td>Seminar in Energy Economics</td>
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<tr>
<td>WT 23/24 2581976</td>
<td>Seminar in Production and Operations Management I</td>
<td>2</td>
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<tr>
<td>WT 23/24 2581977</td>
<td>Seminar in Production and Operations Management II</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:*
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
Weblink: https://itm.entechnon.kit.edu/192_1281.php

<table>
<thead>
<tr>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Successful transformation through innovation</td>
</tr>
<tr>
<td>2500018, SS 2023, 2 SWS, Language: German, Open in study portal</td>
</tr>
<tr>
<td>Seminar (S) On-Site</td>
</tr>
</tbody>
</table>

Content
This seminar uses strategic innovation management theory and concepts such as organisational ambidexterity, boundary spanning and stakeholder approaches how companies can increase their innovative capacity through innovation. The students will use a core paper to illustrate the steps towards becoming an innovative organisation. The aim is to understand how -with the help of the concepts mentioned above - medium-sized companies, in the context of organisational inertia and path dependency, may become innovation-driven organisations. The seminar will analyse the role of different stakeholders, which role the different stakeholders play and how companies may become part of an innovation ecosystems. Based on the core paper, the students will apply the concepts they have learned to selected companies and present the results in class. In addition to a presentation, the students will submit the results in seminar papers.

Organizational issues
Weblink: https://itm.entechnon.kit.edu/192_1281.php

<table>
<thead>
<tr>
<th>Content</th>
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<tbody>
<tr>
<td>Design Seminar: Digital Citizen Science</td>
</tr>
<tr>
<td>2500027, SS 2023, 2 SWS, Open in study portal</td>
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<td>Seminar (S)</td>
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Content
TBA

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<tr>
<td>Master Seminar in Data Science and Machine Learning</td>
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<tr>
<td>2540510, SS 2023, 2 SWS, Language: German/English, Open in study portal</td>
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<tr>
<td>User-Adaptive Systems Seminar</td>
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<tr>
<td>2540553, SS 2023, 2 SWS, Language: English, Open in study portal</td>
</tr>
<tr>
<td>Seminar (S) Blended (On-Site/Online)</td>
</tr>
</tbody>
</table>
Content
User-adaptive systems collect and analyze biosignals from users to recognize user states as a basis for adaptation. Thermic, mechanical, electric, acoustic, and optical signals are collected using sensors which are integrated in wearables, e.g. glasses, earphones, belts, or bracelets. The collected data is processed with analytics and machine learning techniques in order to determine short-term, evolving over time, and long-term user states in the form of user characteristics, affective-cognitive states, or behavior. Finally, the recognized user states are leveraged for realizing user-centric adaptations.

In this seminar, interdisciplinary teams of students design, develop, and evaluate a user-adaptive system prototype leveraging state-of-the-art hard- and software. This seminar follows an interdisciplinary approach. Students from the fields of computer science, information systems and industrial engineering & management collaborate in the prototype design, development, and evaluation.

The seminar is carried out in cooperation between Teco/Chair of Pervasive Computing Systems (Prof. Beigl) and the Institute of Information Systems and Marketing (Research Group ISSD, Prof. Mädche). It is offered as part of the DFG-funded graduate school “KD2School: Designing Adaptive Systems for Economic Decisions” (https://kd2school.info/)

Learning objectives of the seminar
- Explain what a user-adaptive system is and how it can be conceptualized
- Suggest and evaluate different design solutions for addressing the identified problem
- Build a user-adaptive system prototype using state-of-the-art hard- and software
- Perform a user-centric evaluation of the user-adaptive system prototype

Prerequisites
Strong analytical abilities and profound software development skills are required.

Organizational issues
Termine werden bekannt gegeben

Literature
Required literature will be made available in the seminar.

Research Seminar: Human-Centered Systems
2540557, SS 2023, 3 SWS, Language: English, Open in study portal

Blended (On-Site/Online)
Content
Formerly known as "Information Systems and Service Design Seminar"
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 IS I (Prof. Mädche). The research group "Information Systems I" (IS I) headed by Prof. Mädche focuses on research, education, and innovation on designing interactive intelligent systems. It is positioned at the intersection of Information Systems and Human-Computer Interaction (HCI).
In the seminar, participants will get deeper insights in a contemporary research topic in the field of information systems, specifically interactive intelligent systems.

The actual seminar topics will be derived from current research activities of the research group. Our research assistants offer a rich set of topics from our research clusters (digital experience and participation, intelligent enterprise systems, or digital services design & innovation). Students can select among these topics individually depending on their personal interests. The seminar is carried out in the form of a literature-based thesis project. In the seminar, students will acquire the important methodological skills of running a systematic literature review.

Learning Objectives
- focus on a contemporary topic at the intersection of Information Systems and Human-Computer Interaction (HCI), specifically interactive intelligent systems
- carry out a structured literature search for a given topic
- aggregate the collected information in a suitable way to present and extract knowledge
- write a seminar thesis following academic writing standards
- deliver a presentation in a scientific context in front of an auditorium

Prerequisites
No specific prerequisites are required for the seminar.

Literature
Further literature will be made available in the seminar.

Organizational issues
Termine werden bekannt gegeben

<table>
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<tr>
<th>Entrepreneurship Research</th>
<th>Seminar (S)</th>
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<td>2545002, SS 2023, 2 SWS</td>
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<td>Language: English</td>
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<tr>
<td>Open in study portal</td>
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</tbody>
</table>

Content

The students independently develop a topic from entrepreneurship research in an international setting as a tandem with a partner. At first, there will be an introduction to the methodologies used such as systematic literature review, design science, qualitative and quantitative data analysis and more. As part of a written elaboration, the seminar topic must be presented scientifically on 15-20 pages. The results of the seminar paper will be presented in a block event at the end of the semester (20 min + 10 min open discussion).

Learning Objectives
As part of the written elaboration, the basics of independent scientific work (literature research, argumentation + discussion, citing literature sources, application of qualitative, quantitative and simulative methods) are trained. The skills acquired in the seminar are used to prepare for a potential master thesis. The course is therefore particularly aimed at students who want to write their thesis at the Chair for Entrepreneurship and Technology Management.

Organizational issues
The dates will be announced.
Registration is via the Wiwi-Portal.

Literature
Will be announced in the seminar.

<table>
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<tr>
<th>Hospital Management</th>
<th>Block (B)</th>
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<td>2550493, SS 2023, 2 SWS</td>
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</table>
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
Das Seminar wird als Blockveranstaltung vom 08.05.-12.05. (jeweils 8-10:30 Uhr) stattfinden mit Eigenstudiumphasen an den Nachmittagen. Zusätzlich wird eine Vorbesprechung am Freitag, 5. Mai um 16 Uhr stattfinden.

Seminar Human Resource Management (Master)
2573012, SS 2023, 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 2023, 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 - Special Topics
2579909, SS 2023, 2 SWS, Language: English, Open in study portal
Seminar (S) On-Site

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.

Seminar Management Accounting - Sustainability Topics
2579919, SS 2023, 2 SWS, Language: English, Open in study portal
Seminar (S) On-Site

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.

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<td><strong>Master Seminar in Data Science and Machine Learning</strong></td>
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<td></td>
<td><strong>Seminar Human Resource Management (Master)</strong></td>
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<td></td>
<td><strong>Seminar Human Resources and Organizations (Master)</strong></td>
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<td>Seminar (S) On-Site</td>
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#### 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.

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Economathematics M.Sc.  
Module Handbook as of 04/09/2023  
Page 505
Content
The topics are redefined each semester on the 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
2579911, WS 23/24, 2 SWS, Language: English, Open in study portal

Content
The course will be a mix of lectures, discussions, and student presentations. Students will write a paper in small groups, and present this in the final week. Topics are selectively prediscibed. The seminar course is concentrated in several meetings that are spread throughout the semester.

Learning objectives:

- Students are largely independently able to identify a distinct topic in Management Accounting,
- Students are capable to research the topic, analyze the information, to conceptualize and deduct fundamental principles and relationships from relatively unstructured information,
- Students can afterwards logically and systematically present the results in writing and as an oral presentation, following a scientific approach (structuring, terminology, sources).

Examination:

- The performance review is carried out in the form of a "Prüfungsleistung anderer Art" (following § 4 (2) No. 3 of the examination regulation), which in this case is an essay the seminar participants prepare in group work.
- The final grade of the course is the grade awarded to the paper.

Required prior Courses:

- The LV "Betriebswirtschaftslehre: Finanzwirtschaft und Rechnungswesen" (2600026) must have been completed before starting this seminar.

Workload:

- The total workload for this course is approximately 90 hours. For further information see German version.

Note:

- Maximum of 12 students.

Organizational issues
Ort und Zeit werden noch bekannt gegeben bzw. über ILIAS

Literature
Will be announced in the course.
Seminar Management Accounting - Sustainability Topics
2579919, WS 23/24, 2 SWS, Language: English, Open in study portal

Content
The course will be a mix of lectures, discussions, and student presentations. Students will write a paper in small groups, and present this in the final week. Topics are selectively prediscibed. The seminar course is concentrated in several meetings that are spread throughout the semester.

Learning objectives:
- Students are largely independently able to identify a distinct topic in Management Accounting.
- Students are capable to research the topic, analyze the information, to conceptualize and deduct fundamental principles and relationships from relatively unstructured information,
- Students can afterwards logically and systematically present the results in writing and as an oral presentation, following a scientific approach (structuring, terminology, sources.

Examination:
- The performance review is carried out in the form of a "Prüfungsleistung anderer Art" (following § 4 (2) No. 3 of the examination regulation), which in this case is an essay the seminar participants prepare in group work.
- The final grade of the course is the grade awarded to the paper.

Required prior Courses:
- The LV "Betriebswirtschaftslehre: Finanzwirtschaft und Rechnungswesen" (2600026) must have been completed before starting this seminar.

Workload:
- The total workload for this course is approximately 90 hours. For further information see German version.

Note:
- Maximum of 8 students.

Organizational issues
Ort und Zeit werden noch bekannt gegeben bzw. über ILIAS

Literature
Will be announced in the course.
### 4.239 Course: Seminar in Business Administration B (Master) [T-WIWI-103476]

**Responsible:** Professorenschaft des Fachbereichs Betriebswirtschaftslehre  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-102972 - Seminar

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<th>Type</th>
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<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
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<td>ST 2023 2500027</td>
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<td>ST 2023 2540477</td>
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<td>2 SWS Seminar</td>
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<td>2 SWS Seminar</td>
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<td>ST 2023 2540553</td>
<td>User-Adaptive Systems Seminar</td>
<td>2 SWS Seminar</td>
<td>Mädche, Beigl</td>
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<td>ST 2023 2540557</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:**

**Successful transformation through innovation**

2500018, SS 2023, 2 SWS, Language: German, [Open in study portal](https://campus.kit.edu/)
Content
This seminar uses strategic innovation management theory and concepts such as organisational ambidexterity, boundary spanning and stakeholder approaches how companies can increase their innovative increase their innovative capacity through innovation. The students will use a core paper to illustrate the steps towards becoming an innovative organisation. The aim is to understand how -with the help of the concepts mentioned above - medium-sized companies, in the context of organisational inertia and path dependency, may become innovation-driven organisations. The seminar will analyse the role of different stakeholders, which role the different stakeholders play and how companies may become part of an innovation ecosystems. Based on the core paper, the students will apply the concepts they have learned to selected companies and present the results in class. In addition to a presentation, the students will submit the results in seminar papers.

Organizational issues
Weblink: https://itm.entechnon.kit.edu/192_1281.php

**Design Seminar: Digital Citizen Science**
2500027, SS 2023, 2 SWS, Open in study portal

**Master Seminar in Data Science and Machine Learning**
2540510, SS 2023, 2 SWS, Language: German/English, Open in study portal

**User-Adaptive Systems Seminar**
2540553, SS 2023, 2 SWS, Language: English, Open in study portal

Content
User-adaptive systems collect and analyze biosignals from users to recognize user states as a basis for adaptation. Thermic, mechanical, electric, acoustic, and optical signals are collected using sensors which are integrated in wearables, e.g., glasses, earphones, belts, or bracelets. The collected data is processed with analytics and machine learning techniques in order to determine short-term, evolving over time, and long-term user states in the form of user characteristics, affective-cognitive states, or behavior. Finally, the recognized user states are leveraged for realizing user-centric adaptations.

In this seminar, interdisciplinary teams of students design, develop, and evaluate a user-adaptive system prototype leveraging state-of-the-art hard- and software. This seminar follows an interdisciplinary approach. Students from the fields of computer science, information systems and industrial engineering & management collaborate in the prototype design, development, and evaluation.

The seminar is carried out in cooperation between TecO/Chair of Pervasive Computing Systems (Prof. Beigl) and the Institute of Information Systems and Marketing (Research Group ISSD, Prof. Mädche). It is offered as part of the DFG-funded graduate school "KD2School: Designing Adaptive Systems for Economic Decisions" (https://kd2school.info/)

Learning objectives of the seminar
- Explain what a user-adaptive system is and how it can be conceptualized
- Suggest and evaluate different design solutions for addressing the identified problem
- Build a user-adaptive system prototype using state-of-the-art hard- and software
- Perform a user-centric evaluation of the user-adaptive system prototype

Prerequisites
Strong analytical abilities and profound software development skills are required.

Organizational issues
Termine werden bekannt gegeben

Literature
Required literature will be made available in the seminar.

**Research Seminar: Human-Centered Systems**
2540557, SS 2023, 3 SWS, Language: English, Open in study portal

Economathematics M.Sc.
Module Handbook as of 04/09/2023
Content
Formerly known as "Information Systems and Service Design Seminar"

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 IS I (Prof. Mädche). The research group "Information Systems I" (IS I) 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

**Entrepreneurship Research**
2545002, SS 2023, 2 SWS, Language: English, [Open in study portal](#)

**Hospital Management**
2550493, SS 2023, 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
Das Seminar wird als Blockveranstaltung vom 08.05.-12.05. (jeweils 8-10:30 Uhr) stattfinden mit Eigenstudiumsphasen an den Nachmittagen. Zusätzlich wird eine Vorbesprechung am Freitag, 5. Mai um 16 Uhr stattfinden.

V Seminar Human Resource Management (Master)
2573012, SS 2023, 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

V Seminar Human Resources and Organizations (Master)
2573013, SS 2023, 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 - Special Topics
2579909, SS 2023, 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

Seminar Management Accounting - Sustainability Topics
2579919, SS 2023, 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.

Business Data Analytics
2540473, WS 23/24, 2 SWS, Language: German/English, Open in study portal

Content
wird auf deutsch und englisch gehalten

Organizational issues
Blockveranstaltung, siehe WWW

Master Seminar in Data Science and Machine Learning
2540510, WS 23/24, 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 Human Resources and Organizations (Master)
2573013, WS 23/24, 2 SWS, Language: German, Open in study portal
Content
The topics are redefined each semester on basis of current research topics. The topics will be announced on the website of the Wiwi-Portal.

Aim
The student
- looks critically into current research topics in the fields of human resources and organizations.
- trains his / her presentation skills.
- learns to get his / her ideas and insights across in a focused and concise way, both in oral and written form, and to sum up the crucial facts.
- cultivates the discussion of research approaches.

Workload
The total workload for this course is: approximately 90 hours.
Lecture: 30h
Preparation of lecture: 45h
Exam preparation: 15h

Literature
Selected journal articles and books.

Organizational issues
Blockveranstaltung siehe Homepage

Seminar Management Accounting - Special Topics
2579911, WS 23/24, 2 SWS, Language: English, Open in study portal

Content
The course will be a mix of lectures, discussions, and student presentations. Students will write a paper in small groups, and present this in the final week. Topics are selectively prediscibed. The seminar course is concentrated in several meetings that are spread throughout the semester.

Learning objectives:
- Students are largely independently able to identify a distinct topic in Management Accounting,
- Students are capable to research the topic, analyze the information, to conceptualize and deduct fundamental principles and relationships from relatively unstructured information,
- Students can afterwards logically and systematically present the results in writing and as an oral presentation, following a scientific approach (structuring, terminology, sources).

Examination:
- The performance review is carried out in the form of a "Prüfungsleistung anderer Art" (following § 4 (2) No. 3 of the examination regulation), which in this case is an essay the seminar participants prepare in group work.
- The final grade of the course is the grade awarded to the paper.

Required prior Courses:
- The LV "Betriebswirtschaftslehre: Finanzwirtschaft und Rechnungswesen" (2600026) must have been completed before starting this seminar.

Workload:
- The total workload for this course is approximately 90 hours. For further information see German version.

Note:
- Maximum of 12 students.

Organizational issues
Ort und Zeit werden noch bekannt gegeben bzw. über ILIAS

Literature
Will be announced in the course.
Seminar Management Accounting - Sustainability Topics
2579919, WS 23/24, 2 SWS, Language: English, [Open in study portal]

Content
The course will be a mix of lectures, discussions, and student presentations. Students will write a paper in small groups, and present this in the final week. Topics are selectively prediscibed. The seminar course is concentrated in several meetings that are spread throughout the semester.

Learning objectives:
- Students are largely independently able to identify a distinct topic in Management Accounting,
- Students are capable to research the topic, analyze the information, to conceptualize and deduct fundamental principles and relationships from relatively unstructured information,
- Students can afterwards logically and systematically present the results in writing and as an oral presentation, following a scientific approach (structuring, terminology, sources).

Examination:
- The performance review is carried out in the form of a "Prüfungsleistung anderer Art" (following § 4 (2) No. 3 of the examination regulation), which in this case is an essay the seminar participants prepare in group work.
- The final grade of the course is the grade awarded to the paper.

Required prior Courses:
- The LV "Betriebswirtschaftslehre: Finanzwirtschaft und Rechnungswesen" (2600026) must have been completed before starting this seminar.

Workload:
- The total workload for this course is approximately 90 hours. For further information see German version.

Note:
- Maximum of 8 students.

Organizational issues
Ort und Zeit werden noch bekannt gegeben bzw. über ILIAS

Literature
Will be announced in the course.
## 4.240 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>Seminar / 📚</td>
<td>Each term</td>
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<td>ST 2023</td>
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<td>Seminar / 📚</td>
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<td>ST 2023</td>
<td>Bounded Rationality - Theory and Experiments (Bachelor)</td>
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<td>Seminar / 📚</td>
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<td>ST 2023</td>
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<td>ST 2023</td>
<td>Co-Opetiton: A practical perspective to game theory in the game of business (Bachelor &amp; Master)</td>
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<td>Seminar / 📚</td>
<td>Each term</td>
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<td>WT 23/24</td>
<td>Die Herausforderungen der Mobilitätswende im urbanen Bereich - welche Beiträge kann das Serious Game &quot;MobileCityGame&quot; liefern?</td>
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<td>Seminar</td>
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<td>2 SWS</td>
<td>Seminar</td>
<td>Each term</td>
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<tr>
<td>WT 23/24</td>
<td>Lying and Cheating in Economic Experiments (Master)</td>
<td>2 SWS</td>
<td>Seminar / 📚</td>
<td>Each term</td>
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<tr>
<td>WT 23/24</td>
<td>AI and Digitization for Society (Master)</td>
<td>2 SWS</td>
<td>Seminar / 📚</td>
<td>Each term</td>
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<tr>
<td>WT 23/24</td>
<td>Seminar in Economic Policy</td>
<td>2 SWS</td>
<td>Seminar / 📚</td>
<td>Each term</td>
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<td>WT 23/24</td>
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<td>2 SWS</td>
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<td>Each term</td>
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<td>2 SWS</td>
<td>Seminar / 📚</td>
<td>Each term</td>
<td>1</td>
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<td>WT 23/24</td>
<td>Selected aspects of European transport planning and -modelling</td>
<td>2 SWS</td>
<td>Seminar</td>
<td>Each term</td>
<td>1</td>
</tr>
</tbody>
</table>
Course: Seminar in Economics A (Master) [T-WIWI-103478]

Competence Certificate
Alternative exam assessment (§ 4(2), 3 SPO 2015). The following aspects are included:

- Regular participation in the seminar dates
- Preparation of a seminar paper on a partial aspect of the seminar topic according to scientific methods
- Lecture on the topic of the seminar paper.

The point scheme for the assessment is determined by the lecturer of the respective course. It will be announced at the beginning of the course.

Prerequisites
None.

Recommendation
See seminar description in the course catalogue of the KIT (https://campus.kit.edu/)

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

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

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

**Predictive Data Analytics - An Introduction to Statistical Machine Learning**
2500004, SS 2023, 2 SWS, Language: German/English, Open in study portal

**Advanced Topics in Econometrics**
2521310, SS 2023, 2 SWS, Language: German/English, Open in study portal

**Shaping AI and Digitization for Society (Master)**
2560552, SS 2023, 2 SWS, Language: English, Open in study portal

Content
Participation will be limited to 12 students.

For Master students of the fields Industrial Engineering and Management, Information Engineering and Management, Economics Engineering or Economathematics.

Objective: The student develops an own idea for an economic experiment in this research direction. Students work in groups. Changing topics each semester. For current topics, see http://polit.econ.kit.edu 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.

Students' grades will be based on the quality of presentations in the seminar (40%) and the seminar paper (40%). Additionally students will have to hand in two abstracts with different lengths (20%). Students can improve their grades by actively participating in the discussions of the presentations.

Recommendation: Knowledge in the field of experimental economic research or behavioral economics as well as in the field of microeconomics and game theory may be helpful.

Organizational issues
Blockveranstaltung:
Introductory Meeting April 19, 11.00 - 12.00 Uhr (online)
Seminar Presentations June 7, 2023, 14.00 - 18.30 Uhr (in person)
**Bounded Rationality - Theory and Experiments (Bachelor)**
2560555, SS 2023, 2 SWS, Language: English, Open in study portal

Content
For Bachelor students of the fields Industrial Engineering and Management, Information Engineering and Management, Economics Engineering or Economathematics.

Objective: The student develops an own idea for an economic experiment in this research direction. Students work in groups. Changing topics each semester. For current topics, see [http://polit.econ.kit.edu](http://polit.econ.kit.edu) or [https://portal.wiwi.kit.edu/Seminare](https://portal.wiwi.kit.edu/Seminare)

The acceptance of students for the seminar is based on preferences and suitability for the topics. This includes theoretical and practical experience with Behavioral Economics as well as English skills.

Seminar Papers of 8–10 pages are to be handed in.

Students' grades will be based on the quality of presentations in the seminar (40%) and the seminar paper + individual abstract (60%). Students can improve their grades by actively participating in the discussions of the presentations.

Recommendation: Knowledge in the field of experimental economic research or behavioral economics as well as in the field of microeconomics and game theory may be helpful.

Organizational issues
Blockveranstaltung:
Introductory Meeting April 18 at 2pm (in person)
Seminar Presentations June 5 (in person)

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**Law and Economics (Master)**
2560557, SS 2023, 2 SWS, Language: English, Open in study portal

Content
Participation will be limited to 12 students.

For Master students of the fields Industrial Engineering and Management, Information Engineering and Management, Economics Engineering or Economathematics.

Objective: The student develops an own idea for an economic experiment in this research direction. Students work in groups. Changing topics each semester. For current topics, see [http://polit.econ.kit.edu](http://polit.econ.kit.edu) or [https://portal.wiwi.kit.edu/Seminare](https://portal.wiwi.kit.edu/Seminare)

The acceptance of students for the seminar is based on preferences and suitability for the topics. This includes theoretical and practical experience with Behavioral Economics as well as English skills.

Seminar Papers of 8–10 pages are to be handed in.

Students' grades will be based on the quality of presentations in the seminar (40%) and the seminar paper (40%). Additionally students will have to hand in two abstracts with different lengths (20%). Students can improve their grades by actively participating in the discussions of the presentations.

Recommendation: Knowledge in the field of experimental economic research or behavioral economics as well as in the field of microeconomics and game theory may be helpful.

Organizational issues
Blockveranstaltung
Kick-off 19.04.2023, 10.45 - 11.30 (online)
Presentations 26.05.2023, 14.00 - 18.30 Uhr

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**Co-Opetiton: A practical perspective to game theory in the game of business (Bachelor & Master)**
2560560, SS 2023, 2 SWS, Language: English, Open in study portal
## Content
Participation will be limited to 12 students.

For Master students of the fields Industrial Engineering and Management, Information Engineering and Management, Economics Engineering or Economathematics.

Objective: The student develops an own idea for an economic experiment in this research direction. Students work in groups. Changing topics each semester. For current topics, see [http://polit.econ.kit.edu](http://polit.econ.kit.edu) or [https://portal.wiwi.kit.edu/Seminare](https://portal.wiwi.kit.edu/Seminare)

The acceptance of students for the seminar is based on preferences and suitability for the topics. This includes theoretical and practical experience with Behavioral Economics as well as English skills.

Seminar Papers of 8–10 pages are to be handed in.

Students’ grades will be based on the quality of presentations in the seminar (40%) and the seminar paper (40%). Additionally students will have to hand in two abstracts with different lengths (20%). Students can improve their grades by actively participating in the discussions of the presentations.

Recommendation: Knowledge in the field of experimental economic research or behavioral economics as well as in the field of microeconomics and game theory may be helpful.

## Organizational issues
Blockseminar:
Kick-off 19.04.2023
Präsentation 22.05.2023, 14.00 - 18.30 Uhr, Geb. 10.50, Raum 604

### Disruption and the Digital Economy: Markets, Strategies, and Society (Master)
- **Seminar (S)**
- **On-Site**

**Content**
For Master students of the fields Industrial Engineering and Management, Information Engineering and Management, Economics Engineering, Economathematics or Digital Economics.

Objective: The student investigates a market that was (or might be) disrupted from a strategic perspective. Students work in groups. For more information, see [http://polit.econ.kit.edu](http://polit.econ.kit.edu) or [https://portal.wiwi.kit.edu/Seminare](https://portal.wiwi.kit.edu/Seminare)

Seminar Papers of 8–10 pages are to be handed in.

Recommendation: Knowledge in the field of microeconomics and game theory may be helpful.

### Organizational issues
Application is possible via [https://portal.wiwi.kit.edu/Seminare](https://portal.wiwi.kit.edu/Seminare)
Kick-off: 27.10.2023, 14.00 - 15.30 Uhr, Geb. 01.85, KD2Lab (1. OG über Außentreppe), Teamraum
Präsentationen: 15.01.2024 14.00 - 18.00 Uhr, Geb. 01.85, KD2Lab (1. OG über Außentreppe), Teamraum

### Topics in Experimental Economics
- **Seminar (S)**
- **Online**

**Content**
Students’ grades will be based on the quality of presentations in the seminar (40%) and the seminar paper (40%). Additionally students will have to hand in two abstracts with different lengths (20%). Students can improve their grades by actively participating in the discussions of the presentations.

Recommendation: Knowledge in the field of experimental economic research or behavioral economics as well as in the field of microeconomics and game theory may be helpful.

### Organizational issues
(im WS2021/22 online; sonst Blockseminar; Blücherstraße 17); Termine werden separat bekannt gegeben

### Literature
Als Pflichtliteratur dienen ausgewählte Paper.

### Topics in Econometrics
- **Seminar (S)**

**Content**

### Organizational issues
Blockveranstaltung. Termine werden auf Homepage und über Ilias bekannt gegeben

### Lying and Cheating in Economic Experiments (Master)
- **Seminar (S)**
- **Blended (On-Site/Online)**

**Content**

**Organizational issues**

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Economathematics M.Sc.
Module Handbook as of 04/09/2023
Content
For Master students of the fields Industrial Engineering and Management, Information Engineering and Management, Economics Engineering or Economathematics.

Objective: The student develops an own idea for an economic experiment in this research direction. Students work in groups. Changing topics each semester. For current topics, see http://polit.econ.kit.edu or https://portal.wiwi.kit.edu/Seminare

Seminar Papers of 8–10 pages are to be handed in.

Recommendation: Knowledge in the field of experimental economic research or behavioral economics as well as in the field of microeconomics and game theory may be helpful.

Organizational issues
Application is possible via https://portal.wiwi.kit.edu/Seminare

Kick-off: 24.10.23, 14.00 - 15.30 h, Geb. 01.85, KD2Lab (1. OG über Außentreppe), Teamraum

Präsentationen: 08.01.2024, 14.00 - 18.00 h, Geb. 01.85, KD2Lab (1. OG über Außentreppe), Teamraum

WAI and Digitization for Society (Master)
2560143, WS 23/24, 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

Kick-off: 25.10.2023, 11.00 - 12.00 (online)

Presentations: 12.01.2024, 14.00 - 18.00, Geb. 01.85, KD2Lab (1. OG über Außentreppe), Teamraum
## 4.241 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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<th>Type</th>
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<td>Predictive Data Analytics - An Introduction to Statistical Machine Learning</td>
<td>Seminar / 📧</td>
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<td>Each term</td>
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<td>Seminar / 📧</td>
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<td>Each term</td>
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<td>Shaping AI and Digitization for Society (Master)</td>
<td>Seminar / 📧</td>
<td>2 SWS</td>
<td>Grade to a third</td>
<td>Each term</td>
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<td>ST 2023</td>
<td>2560555</td>
<td>Bounded Rationality - Theory and Experiments (Bachelor)</td>
<td>Seminar / 📧</td>
<td>2 SWS</td>
<td>Grade to a third</td>
<td>Each term</td>
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<td>Seminar / 📧</td>
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<td>Each term</td>
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<td>Each term</td>
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<td>Die Herausforderungen der Mobilitätswende im urbanen Bereich - welche Beiträge kann das Serious Game &quot;MobileCityGame&quot; liefern?</td>
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<td>WT 23/24</td>
<td>2521310</td>
<td>Topics in Econometrics</td>
<td>Seminar / 📧</td>
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<td>Grade to a third</td>
<td>Each term</td>
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<td>Seminar / 📧</td>
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<td>Each term</td>
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<td>WT 23/24</td>
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<td>Seminar in Economic Policy</td>
<td>Seminar / 📧</td>
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<td>Grade to a third</td>
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<td>WT 23/24</td>
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<td>WT 23/24</td>
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<td>Seminar</td>
<td>2 SWS</td>
<td></td>
<td>Each term</td>
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</table>

Legend: 🖥 Online, 🔄 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled
Competence Certificate
Alternative exam assessment (§ 4(2), 3 SPO 2015). The following aspects are included:

- Regular participation in the seminar dates
- Preparation of a seminar paper on a partial aspect of the seminar topic according to scientific methods
- Lecture on the topic of the seminar paper.

The point scheme for the assessment is determined by the lecturer of the respective course. It will be announced at the beginning of the course.

Prerequisites
None.

Recommendation
See seminar description in the course catalogue of the KIT (https://campus.kit.edu/)

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

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

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

V Predictive Data Analytics - An Introduction to Statistical Machine Learning
2500004, SS 2023, 2 SWS, Language: German/English, Open in study portal
Seminar (S) Blended (On-Site/Online)

Organizational issues
Blockveranstaltung. Termine werden bekannt gegeben

V Advanced Topics in Econometrics
2521310, SS 2023, 2 SWS, Language: German/English, Open in study portal
Seminar (S)

Organizational issues
Blockveranstaltung. Termine werden bekannt gegeben

V Shaping AI and Digitization for Society (Master)
2560552, SS 2023, 2 SWS, Language: English, Open in study portal
Seminar (S) Blended (On-Site/Online)

Content
Participation will be limited to 12 students.

For Master students of the fields Industrial Engineering and Management, Information Engineering and Management, Economics Engineering or Economathematics.

Objective: The student develops an own idea for an economic experiment in this research direction. Students work in groups. Changing topics each semester. For current topics, see http://polit.econ.kit.edu 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.

Students’ grades will be based on the quality of presentations in the seminar (40%) and the seminar paper (40%). Additionally students will have to hand in two abstracts with different lengths (20%). Students can improve their grades by actively participating in the discussions of the presentations.

Recommendation: Knowledge in the field of experimental economic research or behavioral economics as well as in the field of microeconomics and game theory may be helpful.

Organizational issues
Blockveranstaltung:
Introductory Meeting April 19, 11.00 - 12.00 Uhr (online)
Seminar Presentations June 7, 2023, 14.00 - 18.30 Uhr (in person)
### Content

**Bounded Rationality - Theory and Experiments (Bachelor)**

For Bachelor students of the fields Industrial Engineering and Management, Information Engineering and Management, Economics Engineering or Economathematics.

Objective: The student develops an own idea for an economic experiment in this research direction. Students work in groups. Changing topics each semester. For current topics, see [http://polit.econ.kit.edu](http://polit.econ.kit.edu) or [https://portal.wiwi.kit.edu/Seminare](https://portal.wiwi.kit.edu/Seminare)

The acceptance of students for the seminar is based on preferences and suitability for the topics. This includes theoretical and practical experience with Behavioral Economics as well as English skills.

Seminar Papers of 8–10 pages are to be handed in.

Students’ grades will be based on the quality of presentations in the seminar (40%) and the seminar paper + individual abstract (60%). Students can improve their grades by actively participating in the discussions of the presentations.

Recommendation: Knowledge in the field of experimental economic research or behavioral economics as well as in the field of microeconomics and game theory may be helpful.

**Organizational issues**

Blockveranstaltung:

Introductory Meeting April 18 at 2pm (in person)

Seminar Presentations June 5 (in person)

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**Law and Economics (Master)**

For Master students of the fields Industrial Engineering and Management, Information Engineering and Management, Economics Engineering or Economathematics.

Objective: The student develops an own idea for an economic experiment in this research direction. Students work in groups. Changing topics each semester. For current topics, see [http://polit.econ.kit.edu](http://polit.econ.kit.edu) or [https://portal.wiwi.kit.edu/Seminare](https://portal.wiwi.kit.edu/Seminare)

The acceptance of students for the seminar is based on preferences and suitability for the topics. This includes theoretical and practical experience with Behavioral Economics as well as English skills.

Seminar Papers of 8–10 pages are to be handed in.

Students’ grades will be based on the quality of presentations in the seminar (40%) and the seminar paper (40%). Additionally students will have to hand in two abstracts with different lengths (20%). Students can improve their grades by actively participating in the discussions of the presentations.

Recommendation: Knowledge in the field of experimental economic research or behavioral economics as well as in the field of microeconomics and game theory may be helpful.

**Organizational issues**

Blockveranstaltung

Kick-off 19.04.2023, 10.45 - 11.30 (online)

Presentations 26.05.2023, 14.00 - 18.30 Uhr

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**Co-Opetiton: A practical perspective to game theory in the game of business (Bachelor & Master)**

For Bachelor and Master students of the fields Industrial Engineering and Management, Information Engineering and Management, Economics Engineering or Economathematics.

Objective: The student develops an own idea for an economic experiment in this research direction. Students work in groups. Changing topics each semester. For current topics, see [http://polit.econ.kit.edu](http://polit.econ.kit.edu) or [https://portal.wiwi.kit.edu/Seminare](https://portal.wiwi.kit.edu/Seminare)

The acceptance of students for the seminar is based on preferences and suitability for the topics. This includes theoretical and practical experience with Behavioral Economics as well as English skills.

Seminar Papers of 8–10 pages are to be handed in.

Students’ grades will be based on the quality of presentations in the seminar (40%) and the seminar paper (40%). Additionally students will have to hand in two abstracts with different lengths (20%). Students can improve their grades by actively participating in the discussions of the presentations.

**Organizational issues**

Blockveranstaltung

Kick-off 19.04.2023, 10.45 - 11.30 (online)

Presentations 26.05.2023, 14.00 - 18.30 Uhr
Content
Participation will be limited to 12 students.
For Master students of the fields Industrial Engineering and Management, Information Engineering and Management, Economics Engineering or Economathematics.
Objective: The student develops an own idea for an economic experiment in this research direction. Students work in groups. Changing topics each semester. For current topics, see http://politecon.kit.edu 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.
Students’ grades will be based on the quality of presentations in the seminar (40%) and the seminar paper (40%). Additionally students will have to hand in two abstracts with different lengths (20%). Students can improve their grades by actively participating in the discussions of the presentations.
Recommendation: Knowledge in the field of experimental economic research or behavioral economics as well as in the field of microeconomics and game theory may be helpful.

Organizational issues
Blockseminar:
Kick-off 19.04.2023
Präsentation 22.05.2023, 14.00 - 18.30 Uhr, Geb. 10.50, Raum 604

<table>
<thead>
<tr>
<th>Topics in Experimental Economics</th>
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Organizational issues
(im WS2021/22 online; sonst Blockseminar; Blücherstraße 17); Termine werden separat bekannt gegeben

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<tr>
<th>Topics in Econometrics</th>
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Organizational issues
Blockveranstaltung. Termine werden auf Homepage und über Ilias bekannt gegeben

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<td>2560142, WS 23/24, 2 SWS, Language: English, Open in study portal</td>
<td>Blended (On-Site/Online)</td>
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</tbody>
</table>

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://politecon.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
Kick-off: 24.10.23, 14.00 - 15.30 h, Geb. 01.85, KD2Lab (1. OG über Außentrepp), Teamraum
Präsentationen: 08.01.2024, 14.00 - 18.00 h, Geb. 01.85, KD2Lab (1. OG über Außentrepp), Teamraum
### 4.242 Course: Seminar in Informatics A (Master) [T-WIWI-103479]

**Responsible:** Professorenschaft des Instituts AIFB  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-102973 - Seminar

<table>
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<td>Each term</td>
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<td>Seminar Knowledge Discovery and Data Mining (Master)</td>
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<td>Seminar / 🗣️</td>
<td>Färber, Käfer, Kulbach, Thoma</td>
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<td>Seminar Data Science &amp; Real-time Big Data Analytics (Master)</td>
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<tr>
<td>Seminar Anwendungen von Semantic MediaWiki (Master)</td>
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<td>Seminar / 🗣️</td>
<td>Zöllner, Daaboul</td>
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<td>Cognitive Automobiles and Robots</td>
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<td>Seminar Linked Data and the Semantic Web (Master)</td>
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<td>Seminar / 🗣️</td>
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<tr>
<td>Seminar Real-World Challenges in Data Science and Analytics (Bachelor)</td>
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<td>Seminar Cognitive Automobiles and Robots (Master)</td>
<td>2 SWS</td>
<td>Seminar / 🗣️</td>
<td>Zöllner, Daaboul</td>
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</tbody>
</table>

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

**Competence Certificate**  
Alternative exam assessment (§ 4(2), 3 SPO 2015). The following aspects are included:

- Regular participation in the seminar dates
- Preparation of a seminar paper on a partial aspect of the seminar topic according to scientific methods
- Lecture on the topic of the seminar paper.

The point scheme for the assessment is determined by the lecturer of the respective course. It will be announced at the beginning of the course.

**Prerequisites**  
None.

**Recommendation**  
See seminar description in the course catalogue of the KIT (https://campus.kit.edu/)

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Economathematics M.Sc.  
Module Handbook as of 04/09/2023
Below you will find excerpts from events related to this course:

### Seminar Knowledge Discovery and Data Mining (Master)

**Seminar (S)**  
2513309, SS 2023, 3 SWS, Language: English, [Open in study portal](https://portal.wiwi.kit.edu).  

**Content**  
In this seminar different machine learning and data mining methods are implemented. The seminar includes different methods of machine learning and data mining. Participants of the seminar should have basic knowledge of machine learning and programming skills.

Domains of interest include, but are not limited to:

- Medicine
- Social Media
- Finance Market
- Scientific Publications

**Further Information:** [https://aifb.kit.edu/web/Lehre/Praktikum_Knowledge_Discovery_and_Data_Science](https://aifb.kit.edu/web/Lehre/Praktikum_Knowledge_Discovery_and_Data_Science)

The exact dates and information for registration will be announced at the event page.

### Organizational issues  

### 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)

**Seminar (S)**  

**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](http://seminar-cep.fzi.de)

Questions are answered via the e-mail address sem-ep@fzi.de.

### Organizational issues  
Further information as well as the registration form can be found under the following link:  
[http://seminar-cep.fzi.de](http://seminar-cep.fzi.de)

Questions are answered via the e-mail address sem-ep@fzi.de.
Seminar Graph Representation Learning (Master)
2513319, SS 2023, 3 SWS, Language: English, Open in study portal

Content
Graphs are a natural way to represent the information of objects and the topological relationship between them. They are the basis for various applications ranging from recommender systems, finance, social networks, and personal assistants (e.g., Alexa).

In this seminar, students will read, discuss, and work on graph algorithms based on scientific literature, including most recent methods for analyzing and creating large graphs (e.g., link prediction on knowledge graphs using graph neural networks), and methods for making the behavior of neural networks based on graphs explainable (e.g., generating text based on a subgraph).

Cognitive Automobiles and Robots
2513500, SS 2023, 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.

Security and Privacy Awareness
2400125, WS 23/24, 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: 23.10.23 14:00 o'clock, Room 1C-03, building 5.20
- First version: 07.01.24
- Final version: 17.02.24
- Presentation: CW 12

Topics will be assigned after the kick-off.

Consider that legal-focused topics require you to speak and understand German legal texts.

Topics:
1: Literature review on reporting obligations / information security incidents (literature - seminar)
2: Privacy Awareness with electronic patient file
4: Ethical analysis of so-called attacker studies that gather security awareness data in public space.
5: Collecting data: The boundaries of consent

Further Topics TBA!

ATTENTION: The seminar is only for MASTER students!
Seminar Linked Data and the Semantic Web (Master)
2513313, WS 23/24, 3 SWS, Language: German/English, Open in study portal
On-Site

Content
Linked Data is a way of publishing data on the web in a machine-understandable fashion. The aim of this practical seminar is to build applications and devise algorithms that consume, provide, or analyse Linked Data.

The Linked Data principles are a set of practices for data publishing on the web. Linked Data builds on the web architecture and uses HTTP for data access, and RDF for describing data, thus aiming towards web-scale data integration. There is a vast amount of data available published according to those principles: recently, 4.5 billion facts have been counted with information about various domains, including music, movies, geography, natural sciences. Linked Data is also used to make web-pages machine-understandable, corresponding annotations are considered by the big search engine providers. On a smaller scale, devices on the Internet of Things can also be accessed using Linked Data which makes the unified processing of device data and data from the web easy.

In this practical seminar, students will build prototypical applications and devise algorithms that consume, provide, or analyse Linked Data. Those applications and algorithms can also extend existing applications ranging from databases to mobile apps.

For the seminar, programming skills or knowledge about web development tools/technologies are highly recommended. Basic knowledge of RDF and SPARQL are also recommended, but may be acquired during the seminar. Students will work in groups. Seminar meetings will take place as 'Block-Seminar'.

Topics of interest include, but are not limited to:

- Travel Security
- Geo data
- Linked News
- Social Media

The exact dates and information for registration will be announced at the event page.

Seminar Real-World Challenges in Data Science and Analytics (Bachelor)
2513314, WS 23/24, 3 SWS, Language: German/English, Open in study portal
On-Site

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 23/24, 3 SWS, Language: German/English, Open in study portal
On-Site

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 23/24, 2 SWS, Language: German/English, Open in study portal
Blended (On-Site/Online)
Content
The seminar is intended as a theoretical supplement to lectures such as "Machine Learning". The theoretical basics will be deepened in the seminar. The aim of the seminar is that the participants work individually to analyze a subsystem from the field of robotics and cognitive systems using one or more procedures from the field of AI/ML.

The individual projects require the analysis of the task at hand, selection of suitable procedures, specification and theoretical evaluation of the approach taken. Finally, the chosen solution has to be documented and presented in a short presentation.

Learning objectives:
- Students can apply knowledge from the Machine Learning lecture in a selected field of current research in robotics or cognitive automobiles for theoretical analysis.
- Students can evaluate, document and present their concepts and results.

Recommendations:
Attendance of the lecture machine learning

Workload:
The workload of 3 credit points consists of the time spent on literature research and planning/specifying the proposed solution. In addition, a short report and a presentation of the work carried out will be prepared.

Organizational issues
Anmeldung und weitere Informationen sind im Wiwi-Portal zu finden.
Registration and further information can be found in the WiWi-portal.
**4.243 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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<td>Seminar /🧩</td>
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<td>Seminar Knowledge Discovery and Data Mining (Master)</td>
<td>3 SWS</td>
<td>Seminar /🧩</td>
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<td>Seminar Data Science &amp; Real-time Big Data Analytics (Master)</td>
<td>2 SWS</td>
<td>Seminar /🧩</td>
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<td>Seminar /🧩</td>
<td>Zöllner, Daaboul</td>
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</table>

**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.

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 2023, 3 SWS, Language: English, [Open in study portal]

Content
In this seminar different machine learning and data mining methods are implemented.

The seminar includes different methods of machine learning and data mining. Participants of the seminar should have basic knowledge of machine learning and programming skills.

Domains of interest include, but are not limited to:

- Medicine
- Social Media
- Finance Market
- Scientific Publications

Further Information: https://aifb.kit.edu/web/Lehre/Praktikum_Knowledge_Discovery_and_Data_Science

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.

**Seminar Data Science & Real-time Big Data Analytics (Master)**
2513311, SS 2023, 2 SWS, Language: English, [Open in study portal]

Content
In this seminar, students will design applications in teams that use meaningful and creative Event Processing methods. Thereby, students have access to an existing record.

Event processing and real-time data are everywhere: financial market data, sensors, business intelligence, social media analytics, logistics. Many applications collect large volumes of data in real time and are increasingly faced with the challenge of being able to process them quickly and react promptly. The challenges of this real-time processing are currently also receiving a great deal of attention under the term "Big Data". The complex processing of real-time data requires both knowledge of methods for data analysis (data science) and their processing (real-time analytics). Seminar papers are offered on both of these areas as well as on interface topics, the input of own ideas is explicitly desired.

Further information to the practical seminar is given under the following Link:
http://seminar-cep.fzi.de

Questions are answered via the e-mail address sem-ep@fzi.de.

Organizational issues
Further information as well as the registration form can be found under the following link:
http://seminar-cep.fzi.de

Questions are answered via the e-mail address sem-ep@fzi.de.
Seminar Graph Representation Learning (Master)
2513319, SS 2023, 3 SWS, Language: English, [Open in study portal]

Content
Graphs are a natural way to represent the information of objects and the topological relationship between them. They are the basis for various applications ranging from recommender systems, finance, social networks, and personal assistants (e.g., Alexa).

In this seminar, students will read, discuss, and work on graph algorithms based on scientific literature, including most recent methods for analyzing and creating large graphs (e.g., link prediction on knowledge graphs using graph neural networks), and methods for making the behavior of neural networks based on graphs explainable (e.g., generating text based on a subgraph).

Cognitive Automobiles and Robots
2513500, SS 2023, 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.

Security and Privacy Awareness
2400125, WS 23/24, 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: 23.10.23 14:00 o'clock, Room 1C-03, building 5.20
- First version: 07.01.24
- Final version: 17.02.24
- Presentation: CW 12

Topics will be assigned after the kick-off.

Consider that legal-focused topics require you to speak and understand German legal texts.

Topics:
1: Literature review on reporting obligations / information security incidents (literature - seminar)
2: Privacy Awareness with electronic patient file
4: Ethical analysis of so-called attacker studies that gather security awareness data in public space.
5: Collecting data: The boundaries of consent

Further Topics TBA!

ATTENTION: The seminar is only for MASTER students!

Econamathematics M.Sc.
Module Handbook as of 04/09/2023
Seminar Linked Data and the Semantic Web (Master)
2513313, WS 23/24, 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 these 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.

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 23/24, 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 23/24, 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 23/24, 2 SWS, Language: German/English, Open in study portal

Economathematics M.Sc. Module Handbook as of 04/09/2023
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.
4.244 Course: Seminar in Operations Research A (Master) [T-WIWI-103481]

**Responsible:** Prof. Dr. Stefan Nickel
Prof. Dr. Steffen Rebennack
Prof. Dr. Oliver Stein

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

**Part of:** M-WIWI-102973 - Seminar

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**Events**

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<td>Nickel, Mitarbeiter</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 on Methodical Foundations of Operations Research (B)

2550131, SS 2023, 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 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, SS 2023, 2 SWS, Language: German, Open in study portal

Seminar (S) Blended (On-Site/Online)
Content
The seminar aims at the presentation, critical evaluation and exemplary discussion of recent questions in discrete optimization. The focus lies on optimization models and algorithms, also with regard to their applicability in practical cases (especially in Supply Chain and Health Care Management). The students get in touch with scientific working: The in-depth work with a special scientific topic makes the students familiar with scientific literature research and argumentation methods. As a further aspect of scientific work, especially for Master students the emphasis is put on a critical discussion of the seminar topic. Regarding the seminar presentations, the students will be familiarized with basic presentational and rhetoric skills.

The topics of the seminar will be announced at the beginning of the term in a preliminary meeting. Attendance is compulsory for the preliminary meeting as well as for all seminar presentations.

Exam:
The assessment consists of a written seminar thesis of 20-25 pages and a presentation of 35-40 minutes (according to §4(2), 3 of the examination regulation).

The final mark for the seminar consists of the seminar thesis, the seminar presentation, the handout, and if applicable further material such as programming code.

The seminar can be attended both by Bachelor and Master students. A differentiation will be achieved by different valuation standards for the seminar thesis and presentation.

Requirements:
If possible, at least one module of the institute should be taken before attending the seminar.

Objectives:
The student

- illustrates and evaluates classic and current research questions in discrete optimization,
- applies optimization models and algorithms in discrete optimization, also with regard to their applicability in practical cases (especially in Supply Chain and Health Care Management),
- successfully gets in touch with scientific working by an in-depth working on a special scientific topic which makes the student familiar with scientific literature research and argumentation methods,
- acquires good rhetorical and presentation skills.

As a further aspect of scientific work, especially for Master students the emphasis is put on a critical discussion of the seminar topic.

Organizational issues
wird auf der Homepage dol.io.r.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 23/24, 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 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 23/24, 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
Anmeldezeitraum: 11.09.23 bis 30.09.23 im Wiwi Portal

Literature
Die Literatur und die relevanten Quellen werden zu Beginn des Seminars bekannt gegeben.
4.245 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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**Events**

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<td>Seminar: Trending Topics in Machine Learning and Optimization (Master)</td>
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<td>ST 2023</td>
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<tr>
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<td>Nickel, Mitarbeiter</td>
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</tbody>
</table>

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

**Competence Certificate**

Alternative exam assessment (§ 4(2), 3 SPO 2015). The following aspects are included:

- Regular participation in the seminar dates
- Preparation of a seminar paper on a partial aspect of the seminar topic according to scientific methods
- Lecture on the topic of the seminar paper.

The point scheme for the assessment is determined by the lecturer of the respective course. It will be announced at the beginning of the course.

**Prerequisites**

None.

**Recommendation**

See seminar description in the course catalogue of the KIT (https://campus.kit.edu/)

**Annotation**

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

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

Below you will find excerpts from events related to this course:
Seminar on Methodical Foundations of Operations Research (B)
2550131, SS 2023, 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 Seminarvorbesprechung 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, SS 2023, 2 SWS, Language: German, Open in study portal

Blended (On-Site/Online)
Content
The seminar aims at the presentation, critical evaluation and exemplary discussion of recent questions in discrete optimization. The focus lies on optimization models and algorithms, also with regard to their applicability in practical cases (especially in Supply Chain and Health Care Management). The students get in touch with scientific working: The in-depth work with a special scientific topic makes the students familiar with scientific literature research and argumentation methods. As a further aspect of scientific work, especially for Master students the emphasis is put on a critical discussion of the seminar topic. Regarding the seminar presentations, the students will be familiarized with basic presentational and rhetoric skills.

The topics of the seminar will be announced at the beginning of the term in a preliminary meeting. Attendance is compulsory for the preliminary meeting as well for all seminar presentations.

Exam:
The assessment consists of a written seminar thesis of 20-25 pages and a presentation of 35-40 minutes (according to §4(2), 3 of the examination regulation).

The final mark for the seminar consists of the seminar thesis, the seminar presentation, the handout, and if applicable further material such as programming code.

The seminar can be attended both by Bachelor and Master students. A differentiation will be achieved by different valuation standards for the seminar thesis and presentation.

Requirements:
If possible, at least one module of the institute should be taken before attending the seminar.

Objectives:
The student

- illustrates and evaluates classic and current research questions in discrete optimization,
- applies optimization models and algorithms in discrete optimization, also with regard to their applicability in practical cases (especially in Supply Chain and Health Care Management),
- successfully gets in touch with scientific working by an in-depth working on a special scientific topic which makes the student familiar with scientific literature research and argumentation methods,
- acquires good rhetorical and presentation skills.

As a further aspect of scientific work, especially for Master students the emphasis is put on a critical discussion of the seminar topic.

Organizational issues
wird auf der Homepage dol.io.r.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 23/24, 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 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 23/24, 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
Anmeldezeitraum: 11.09.23 bis 30.09.23 im Wiwi Portal

Literature
Die Literatur und die relevanten Quellen werden zu Beginn des Seminars bekannt gegeben.
### 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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</table>

**Competence Certificate**

Alternative exam assessment (§ 4(2), 3 SPO 2015). The following aspects are included:

- Regular participation in the seminar dates
- Preparation of a seminar paper on a partial aspect of the seminar topic according to scientific methods
- Lecture on the topic of the seminar paper.

The point scheme for the assessment is determined by the lecturer of the respective course. It will be announced at the beginning of the course.

**Prerequisites**

None.

**Recommendation**

See seminar description in the course catalogue of the KIT (https://campus.kit.edu/)

**Annotation**

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

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

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

**Predictive Data Analytics - An Introduction to Statistical Machine Learning**  
2500004, SS 2023, 2 SWS, Language: German/English, Open in study portal

**Advanced Topics in Econometrics**  
2521310, SS 2023, 2 SWS, Language: German/English, Open in study portal
Topics in Econometrics
2521310, WS 23/24, 2 SWS, Language: German, Open in study portal

Organizational issues
Blockveranstaltung. Termine werden auf Homepage und über Ilias bekannt gegeben
4.247 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

<table>
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<th>Recurrence</th>
<th>Version</th>
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<td>Grade to a third</td>
<td>Each term</td>
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**Events**

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<th>ST 2023</th>
<th>2500004</th>
<th>Predictive Data Analytics - An Introduction to Statistical Machine Learning</th>
<th>2 SWS</th>
<th>Seminar / Online</th>
<th>Schienle, Lerch</th>
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<tr>
<td>ST 2023</td>
<td>2521310</td>
<td>Advanced Topics in Econometrics</td>
<td>2 SWS</td>
<td>Seminar</td>
<td>Schienle, Krüger, Buse, Rüter, Pavlova, Bracher</td>
</tr>
<tr>
<td>ST 2023</td>
<td>2550561</td>
<td>Spezielle forgeschrittene Themen der Datenanalyse und Statistik</td>
<td>2 SWS</td>
<td>Seminar / On-Site</td>
<td>Grothe, Kaplan, Kächele</td>
</tr>
</tbody>
</table>

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

**Competence Certificate**

Alternative exam assessment (§ 4(2), 3 SPO 2015). The following aspects are included:

- Regular participation in the seminar dates
- Preparation of a seminar paper on a partial aspect of the seminar topic according to scientific methods
- Lecture on the topic of the seminar paper.

The point scheme for the assessment is determined by the lecturer of the respective course. It will be announced at the beginning of the course.

**Prerequisites**

None.

**Recommendation**

See seminar description in the course catalogue of the KIT (https://campus.kit.edu/)

**Annotation**

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

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

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

**Predictive Data Analytics - An Introduction to Statistical Machine Learning**

2500004, SS 2023, 2 SWS, Language: German/English, Open in study portal

**Advanced Topics in Econometrics**

2521310, SS 2023, 2 SWS, Language: German/English, Open in study portal

**Organizational issues**

Blockveranstaltung, Termine werden bekannt gegeben
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**Responsible:** PD Dr. Stefan Kühnlein

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102730 - Seminar
4.249 Course: Simulation Game in Energy Economics [T-WIWI-108016]

**Responsible:** Dr. Massimo Genoese  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-101451 - Energy Economics and Energy Markets

<table>
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<tr>
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<th>Recurrence</th>
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<td>ST 2023 2581025</td>
<td>3 SWS</td>
<td>Grade to a third</td>
<td>Examination of another type</td>
<td>Each summer term</td>
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</table>

**Type:** Examination of another type  
**Credits:** 3.5  
**Grading scale:** Grade to a third  
**Recurrence:** Each summer term  
**Version:** 2

**Competence Certificate**  
Examination as written assignment and oral presentation (§4 (2), 1 SPO).

**Prerequisites**  
None

**Recommendation**  
Visiting the course "Introduction to Energy Economics"

**Annotation**  
The number of participants is limited. There is a registration procedure via CAS followed by a selection of the participants.

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

**Simulation Game in Energy Economics**  
2581025, SS 2023, 3 SWS, Language: German, Open in study portal

**Content**

- Introduction  
- Agents and market places in the electricity industry  
- Selected planning tasks of energy service companies  
- Methods of modelling in the energy sector  
- Agent-based simulation: The PowerACE model  
- Simulation game: Simulation in energy economics (electricity and emission trading, investment decisions)

The lecture is structured in a theoretical and a practical part. In the theoretical part, the students are taught the basics to carry out simulations themselves in the practical part which comprises amongst others the simulation of the power exchange. The participants of the simulation game take a role as a power trader in the power market. Based on various sources of information (e.g. prognosis of power prices, available power plants, fuel prices), they can launch bids in the power exchange.

**Assessment:** presentation and written summary  
**Prerequisites:** Basics in Energy economics ad markets are advantageous.

**Organizational issues**  
CIP-Pool West, Raum 102, Geb. 06.41 - siehe Institutsaushang

**Literature**  
Weiterführende Literatur:

4.250 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

<table>
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Events

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<th>WT 23/24</th>
<th>2581023</th>
<th>(Smart) Energy Infrastructure</th>
<th>4 SWS</th>
<th>Lecture / Ardone, Pustisek</th>
</tr>
</thead>
</table>

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

Competence Certificate

The assessment consists of a written exam (60 minutes). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

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

(Smart) Energy Infrastructure
2581023, WS 23/24, 4 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content

The lecture provides a techno-economic overview of different infrastructures of the energy system and their importance regarding the future energy system ("Energiewende") – in particular

- for electricity:
  - the supply side (e.g. power plants)
  - the demand side (e.g. load structures of appliances, flexibilities) as well as
  - transport infrastructures (electricity grids)
- for fuel transportation:
  - pipeline infrastructures (focus on natural gas)
  - shipping of LNG
  - crude oil and oil product transportation
  - hydrogen transportation
  - comparison of potential energy carriers for global trade of renewable energy (e.g., hydrogen and its derivates, e-fuels, reactive metals)
- storage systems (e.g. batteries)

Additionally, the lecture provides a toolbox for energy system analysis such as an overview and classification of energy systems modelling approaches as well as the usage of scenario techniques for energy systems analysis.

The lecture also provides practical examples for the relevant methods presented.

Organizational issues

Blockveranstaltung
### 4.251 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

<table>
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<td>Grade to a third</td>
<td>see Annotations</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 no longer be offered from the coming winter semester 2023/24. It is only possible to take part in the main exam (first-time writer) and follow-up exam (repeater).
# 4.252 Course: Sobolev Spaces [T-MATH-105896]

**Responsible:** Prof. Dr. Roland Schnaubelt  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-102926 - Sobolev Spaces

<table>
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<tr>
<td>Oral examination</td>
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<td>Grade to a third</td>
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4.253 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

### Events

<table>
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<th>Version</th>
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<td>Each summer term</td>
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#### Events

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<th>Grade scale</th>
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<th>Version</th>
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<td>2520537</td>
<td>Social Choice Theory</td>
<td>Lecture / On-Site</td>
<td>2 SWS</td>
<td>Grade to a third</td>
<td>Each summer term</td>
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<tr>
<td>ST 2023</td>
<td>2520539</td>
<td>Übung zu Social Choice Theory</td>
<td>Practice / On-Site</td>
<td>1 SWS</td>
<td>Grade to a third</td>
<td>Each summer term</td>
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</table>

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

### Competence Certificate

The assessment consists of an alternative exam assessment (open book exam). The exam takes place in every summer semester.

### Prerequisites

None

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

#### Social Choice Theory

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Type</th>
<th>Credits</th>
<th>Grade scale</th>
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<tbody>
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<td>2520537</td>
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<td>2 SWS</td>
<td>Grade to a third</td>
<td>Each summer term</td>
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</table>

Language: English, Open in study portal

### Content

How should (political) candidates be elected? What are good ways of merging individual judgments into collective judgments? Social Choice Theory is the systematic study and comparison of how groups and societies can come to collective decisions.

The course offers a rigorous and comprehensive treatment of judgment and preference aggregation as well as voting theory. It is divided into two parts. The first part deals with (general binary) aggregation theory and builds towards a general impossibility result that has the famous Arrow theorem as a corollary. The second part treats voting theory. Among other things, it includes proving the Gibbard-Satterthwaite theorem.

### Literature

**Main texts:**


**Secondary texts:**

4.254 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

<table>
<thead>
<tr>
<th>Events</th>
<th>Type</th>
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<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
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<td>Each term</td>
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<td>Each term</td>
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Legend: Online, Blended (On-Site/Online), On-Site, CANCELLED

Competence Certificate
The alternative exam assessment consists of an implementation and a final thesis documenting the development and use of the application.

Prerequisites
None.

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

**Advanced Lab Development of Sociotechnical Information Systems (Bachelor)**

2512400, SS 2023, 3 SWS, Language: German/English, [Open in study portal](#)

Practical course (P)
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.

**Advanced Lab Development of Sociotechnical Information Systems (Master)**

2512401, SS 2023, 3 SWS, Language: German/English, [Open in study portal](#)

Practical course (P)
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.
4.255 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

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

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<tr>
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<td>Software Quality Management</td>
<td>On-Site</td>
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<tr>
<td>ST 2023</td>
<td>1 SWS</td>
<td>Übungen zu Software-Qualitätsmanagement</td>
<td>Practice</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 in the first week after lecture period.

**Prerequisites**
None

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

**Software Quality Management**

<table>
<thead>
<tr>
<th>Event</th>
<th>Type</th>
<th>Title</th>
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<th>Language</th>
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<tr>
<td>ST 2023</td>
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<td>Lecture</td>
<td>2 SWS</td>
<td>German</td>
<td>On-Site</td>
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</table>

**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 main 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.
4.256 Course: Space and Time Discretization of Nonlinear Wave Equations [T-MATH-112120]

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

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-105966 - Space and Time Discretization of Nonlinear Wave Equations

<table>
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**Prerequisites:**
none
4.257 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

<table>
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<tr>
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**Events**

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<td>2561260</td>
<td>Spatial Economics</td>
<td>2 SWS</td>
<td>Lecture/On-Site</td>
<td>Ott</td>
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<tr>
<td>WT 23/24</td>
<td>2561261</td>
<td>Exercise for Spatial Economics</td>
<td>1 SWS</td>
<td>Practice/On-Site</td>
<td>Ott, Mirzoyan</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 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 23/24, 2 SWS, Language: English, [Open in study portal](#)
Content
The course covers the following topics:

- Geography, trade and development
- Geography and economic theory
- Core models of economic geography and empirical evidence
- Agglomeration, home market effect, and spatial wages
- Applications and extensions

Learning objectives:
The student

- analyses how spatial distribution of economic activity is determined.
- uses quantitative methods within the context of economic models.
- has basic knowledge of formal-analytic methods.
- understands the link between economic theory and its empirical applications.
- understands to what extent concentration processes result from agglomeration and dispersion forces.
- is able to determine theory based policy recommendations.

Recommendations:
Basic knowledge of micro- and macroeconomics is assumed, as taught in the courses Economics I [2600012], and Economics II [2600014]. An interest in mathematical modeling is advantageous.

Workload:
The total workload for this course is approximately 135 hours.

- Classes: ca. 30 h
- Self-study: ca. 45 h
- Exam and exam preparation: ca. 60 h

Assessment:
The assessment consists of a written exam (60 minutes) (following §4(2), 1 of the examination regulation).

Literature

Weitere Literatur wird in der Vorlesung bekanntgegeben.
(Further literature will be announced in the lecture.)
4 COURSES

Course: Spatial Stochastics [T-MATH-105867]

4.258 Course: Spatial Stochastics [T-MATH-105867]

- **Responsible:** Prof. Dr. Daniel Hug
  - Prof. Dr. Günter Last
  - PD Dr. Steffen Winter
- **Organisation:** KIT Department of Mathematics
- **Part of:** M-MATH-102903 - Spatial Stochastics

### Type
- Oral examination

### Credits
- 8

### Grading scale
- Grade to a third

### Version
- 1

<table>
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<th>Code</th>
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<td>Lecture</td>
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<td>WT 23/24</td>
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<td>2</td>
<td>Practice</td>
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</tr>
</tbody>
</table>

### Prerequisites

- none
4.259 Course: Special Topics in Information Systems [T-WIWI-109940]

Responsibility: Prof. Dr. Christof Weinhardt
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-103720 - eEnergy: Markets, Services and Systems

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<td>4,5</td>
<td>Grade to a third</td>
<td>Each term</td>
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</table>

Competence Certificate
The assessment of this course is in form of a written documentation, a presentation of the outcome of the conducted practical components and an active participation in class.
Please take into account that, beside the written documentation, also a practical component (such as a survey or an implementation of an application) is part of the course. Please examine the course description for the particular tasks.

The overall grade is composed as follows:
A total of 60 points can be achieved, of which
- A maximum of 30 points for the written documentation
- A maximum of 30 points for the practical component

In order to pass the success control, at least 15 points (written documentation / practical component) must be achieved.

Prerequisites
see below

Recommendation
None

Annotation
All the practical seminars offered at the chair of Prof. Dr. Weinhardt can be chosen in the Special Topics in Information Systems course. The current topics of the practical seminars are available at the following homepage: www.iism.kit.edu/im/lehre.

The Special Topics Information Systems is equivalent to the practical seminar, as it was only offered for the major in “Information Systems” so far. With this course students majoring in “Industrial Engineering and Management” and “Economics Engineering” also have the chance of getting practical experience and enhance their scientific capabilities.

The Special Topics Information Systems can be chosen instead of a regular lecture (see module description). Please take into account, that this course can only be accounted once per module.
4.260 Course: Special Topics of Numerical Linear Algebra [T-MATH-105891]

**Responsible:** PD Dr. Volker Grimm  
Prof. Dr. Marlis Hochbruck  
PD Dr. Markus Neher

**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-102920 - Special Topics of Numerical Linear Algebra

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<td>Grade to a third</td>
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**Events**

| ST 2023 | 0160400 | Topics in Numerical Linear Algebra | 4 SWS | Lecture | Grimm |

**Prerequisites**

none
Course: Spectral Theory - Exam [T-MATH-103414]

Responsible: Prof. Dr. Dorothee Frey
PD Dr. Gerd Herzog
apl. Prof. Dr. Peer Kunstmann
Prof. Dr. Roland Schnaubelt
Dr. rer. nat. Patrick Tolksdorf

Organisation: KIT Department of Mathematics

Part of: M-MATH-101768 - Spectral Theory

Type
Oral examination

Credits
8

Grading scale
Grade to a third

Version
1

Events

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<td>Lecture</td>
<td>Schnaubelt</td>
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<td>0163710</td>
<td>Tutorial for 0163700 (Spectral Theory)</td>
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<td>Practice</td>
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</table>

Competence Certificate
Oral examination of approx. 30 minutes.

Prerequisites
none

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

Spectral Theory
0163700, SS 2023, 4 SWS, Language: English, Open in study portal

Organizational issues
Lecture notes are provided in Ilias and on Prof. Schnaubelt's webpage.

Literature
- J.B. Conway: A Course in Functional Analysis.
- D. Werner: Funktionalanalysis.
4.262 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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### 4.263 Course: Splitting Methods for Evolution Equations [T-MATH-110805]

**Responsible:** Prof. Dr. Tobias Jahnke  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-105325 - Splitting Methods for Evolution Equations

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**Prerequisites:** none
4.264 Course: Statistical Learning [T-MATH-111726]

**Responsible:** Prof. Dr. Mathias Trabs

**Organisation:** KIT Department of Mathematics

Part of: M-MATH-105840 - Statistical Learning

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<td>1</td>
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</table>

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

**Prerequisites**
one

**Recommendation**
The module "Introduction to Stochastics" is recommended. The module "Probability theory" is preferable.
4.265 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

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Events

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<td>Statistical Modeling of Generalized Regression Models</td>
<td>2 SWS</td>
<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.

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:

V Statistical Modeling of Generalized Regression Models
2521350, WS 23/24, 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
4.266 Course: Steins Method with Applications in Statistics [T-MATH-111187]

**Responsible:** Dr. rer. nat. Bruno Ebner
Prof. Dr. Daniel Hug

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-105579 - Steins Method with Applications in Statistics

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**Prerequisites**
none
4.267 Course: Stochastic Calculus and Finance [T-WIWI-103129]

**Responsible:** Dr. Mher Safarian

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

**Part of:** M-WIWI-101639 - Econometrics and Statistics II

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**Events**

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<td>Finance</td>
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<td>WT 23/24</td>
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<td>Finance</td>
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**Competence Certificate**
The assessment of this course consists of a written examination (§4(2), 1 SPOs, 180 min.).

**Prerequisites**
None

**Annotation**
For more information see http://statistik.econ.kit.edu/

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

**V Stochastic Calculus and Finance**

2521331, WS 23/24, 2 SWS, Language: English, [Open in study portal](#)

**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
4.268 Course: Stochastic Control [T-MATH-105871]

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

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102908 - Stochastic Control

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**Prerequisites**

none
4.269 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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### 4.270 Course: Stochastic Geometry [T-MATH-105840]

**Responsible:** Prof. Dr. Daniel Hug  
Prof. Dr. Günter Last  
PD Dr. Steffen Winter  

**Organisation:** KIT Department of Mathematics  

**Part of:** M-MATH-102865 - Stochastic Geometry

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**Events**

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<th>Lecture</th>
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<tbody>
<tr>
<td>ST 2023</td>
<td>0152610</td>
<td>Tutorial for 0152600 (Stochastic Geometry)</td>
<td>2 SWS</td>
<td>Practice</td>
<td>Hug</td>
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</table>
4.271 Course: Stochastic Simulation [T-MATH-112242]

**Responsible:** TT-Prof. Dr. Sebastian Krumscheid

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-106053 - Stochastic Simulation

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<td>5</td>
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<td>Each winter term</td>
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**Events**

| WT 23/24 | 0100027 | Stochastic Simulation | 2 SWS | Lecture | Krumscheid |

**Competence Certificate**
oral exam of ca. 30 min

**Prerequisites**
none
T 4.272 Course: Strategic Finance and Technology Change [T-WIWI-110511]

**Responsible:** Prof. Dr. Martin Ruckes

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

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

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<td>Each summer term</td>
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**Competence Certificate**
The assessment consists of a written exam (60 min.) according to § 4 paragraph 2 Nr. 1 of the examination regulation. The exam is offered each semester. If there are only a small number of participants registered for the exam, we reserve the right to hold an oral examination instead of a written one.

**Prerequisites**
None

**Recommendation**
Attending the lecture "Financial Management" is strongly recommended.
4.273 Course: Strategy and Management Theory: Developments and “Classics” [T-WIWI-106190]

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

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

**Part of:** M-WIWI-103119 - Advanced Topics in Strategy and Management

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<td>Irregular</td>
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**Events**

| ST 2023 | 2577921 | Strategy and Management Theory: Developments and “Classics” (Master) | 2 SWS | Seminar / 🗣️ | Lindstädt |

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

**Competence Certificate**
The control of success according to § 4(2), 3 SPO takes place by writing a scientific work and a presentation of the results of the work in the context of a conclusion meeting. Details on the design of the performance review will be announced during the lecture.

**Prerequisites**
None

**Recommendation**
Basic knowledge as conveyed in the bachelor module „Strategy and Organization“ is recommended.

**Annotation**
This course is admission restricted. If you were already admitted to another course in the module “Advanced Topics in Strategy and Management” the participation at this course will be guaranteed.

The course is planned to be held for the first time in the winter term 2017/18.

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

**Strategy and Management Theory: Developments and "Classics" (Master)**
2577921, SS 2023, 2 SWS, Language: German, Open in study portal
Content
This course covers highly topical issues of great relevance to the management of organizations. Students will be enabled to take strategic management positions. By applying appropriate models from the fields of strategy and management - or models developed in-house - participants will learn to evaluate the strategic starting position of an organization and derive precise and well-founded recommendations for action based on this.

This course offers students the opportunity to explore current management issues and sharpen their skills in strategic analysis and evaluation. Through intensive collaboration and practical application of the knowledge learned, students are optimally prepared for the demands and challenges of modern business management.

Structure
The course begins with an overarching theme, based on which students are divided into groups of two. The core of the course consists of the preparation of a written paper as well as the presentation and discussion of the results.

Learning Objectives
Upon completion of the course, students will be able to,

- analyze complex business situations, think strategically and derive sound management decisions.
- compose clear and convincing written papers that accurately present the analyses and recommendations developed.
- present results in an engaging manner and actively participate in substantive discussions.

Recommendations:
Prior attendance of the Bachelor's module "Strategy and Organization" or another module with comparable content at another university is recommended.

Workload:
Total effort approx. 90 hours
Attendance time: 15 hours
Preparation and follow-up: 75 hours
Examination and preparation: not applicable

Verification:
The success control according to § 4(2), 3 SPO is done by writing a scientific paper and a presentation of the results of the paper in the context of a final event. Details on the design of the performance review will be announced during the lecture.

Annotation:
The course is admission restricted. In case of prior admission to another course in the module "Strategy and Management: Advanced Topics" [M-WIWI-103119], participation in this course is guaranteed. For more information on the application process, see the IBU website.

Exams are offered at least every other semester, so the entire module can be completed in two semesters.

Organizational issues
siehe Homepage
4.274 Course: Structural Graph Theory [T-MATH-111004]

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

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-105463 - Structural Graph Theory

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<td>Grade to a third</td>
<td>Irregular</td>
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**Prerequisites**

none
4.275 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

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<td>Each term</td>
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**Competence Certificate**
The assessment of this course is a written or (if necessary) oral examination.

**Prerequisites**
None

**Annotation**
This course can be used in particular for the acceptance of external courses whose content is in the broader area of applied informatics, but is not equivalent to another course of this topic.
4.276 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>Grade to a third</td>
<td>Each term</td>
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**Competence Certificate**
The assessment of this course is a written or (if necessary) oral examination.

**Prerequisites**
None

**Annotation**
This course can be used in particular for the acceptance of external courses whose content is in the broader area of software and systems engineering, but cannot assigned to another course of this topic.
Course: Tactical and Operational Supply Chain Management [T-WWI-102714]

**4.277 Course: Tactical and Operational Supply Chain Management [T-WWI-102714]**

- **Responsible:** Prof. Dr. Stefan Nickel
- **Organisation:** KIT Department of Economics and Management
- **Part of:** M-WWI-101413 - Applications of Operations Research

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

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<td>3 SWS</td>
<td>Lecture / 🧩 Nickel</td>
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<td>Übungen zu Taktisches und operatives SCM</td>
<td>1,5 SWS</td>
<td>Practice / 🧩 Pomes, Linner</td>
</tr>
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</table>

**Competence Certificate**

Depending on further pandemic developments, the exam will be offered either as an open-book exam, or as a written exam (60 min).

The exam takes place in every semester.

Prerequisite for admission to examination is the successful completion of the online assessments.

**Prerequisites**

Prerequisite for admission to examination is the successful completion of the online assessments.

**Recommendation**

None

**Annotation**

The lecture is held in every summer term. The planned lectures and courses for the next three years are announced online.

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

**Tactical and operational SCM**

2550486, SS 2023, 3 SWS, Language: German, Open in study portal

**Content**

The planning of material transport is an essential element of Supply Chain Management. By linking transport connections across different facilities, the material source (production plant) is connected with the material sink (customer). The general supply task can be formulated as follows (cf. Gudehus): For given material flows or shipments, choose the optimal (in terms of minimal costs) distribution and transportation chain from the set of possible logistics chains, which asserts the compliance of delivery times and further constraints. The main goal of the inventory management is the optimal determination of order quantities in terms of minimization of fixed and variable costs subject to resource constraints, supply availability and service level requirements. Similarly, the problem of lot sizing in production considers the determination of the optimal amount of products to be produced in a time slot. The course includes an introduction to basic terms and definitions of Supply Chain Management and a presentation of fundamental quantitative planning models for distribution, vehicle routing, inventory management and lot sizing. Furthermore, case studies from practice will be discussed in detail.

Passing the online exercise is a prerequisite for admission to the exam.

**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
4.278 Course: Time Series Analysis [T-MATH-105874]

**Responsible:** Dr. rer. nat. Bruno Ebner  
Prof. Dr. Vicky Fasen-Hartmann  
Prof. Dr. Tilmann Gneiting  
PD Dr. Bernhard Klar  
Prof. Dr. Mathias Trabs

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102911 - Time Series Analysis

<table>
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**Events**

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<th>2 SWS</th>
<th>Lecture</th>
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<td>0161110</td>
<td>Tutorial for 0161100 (Time Series Analysis)</td>
<td>1 SWS</td>
<td>Practice</td>
<td>Ebner</td>
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</table>
4.279 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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<td>Grade to a third</td>
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</table>

**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: Topics in Stochastic Optimization [T-WIWI-112109]

**4.280 Course: Topics in Stochastic Optimization [T-WIWI-112109]**

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<tbody>
<tr>
<td><strong>Responsible:</strong></td>
<td>Prof. Dr. Steffen Rebennack</td>
<td></td>
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#### Events

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<td>Übungen zu Topics in Stochastic Optimization</td>
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<td>Practice / 📚</td>
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<td>2 SWS</td>
<td>Lecture / 📚</td>
<td>Rebennack, Gabl</td>
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</tbody>
</table>

**Legend:** 🖥 Online, 📚 Blended (On-Site/Online), 🗣 On-Site, ⌚ Canceled

#### Competence Certificate

Students will be given problem sets on which they work in groups. The problem sets will involve the implementation of the models presented in the course, and exploring features of these models. The groups will present their findings in front of the class. The grading will be based on the presentation.

#### Recommendation

A solid understanding of Stochastic Optimization and/or Optimization under Uncertainty as well as optimization in general is highly recommended, since we will heavily build upon basics of these areas.

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

<table>
<thead>
<tr>
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<th>Lecture (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2500026, SS 2023, 2 SWS, Language: English</td>
<td>Blended (On-Site/Online)</td>
</tr>
</tbody>
</table>

**Content**

**Content:**

While Stochastic Optimization is a long established, powerful paradigm for dealing with optimization problems under uncertainty, it is also a field that is continuously evolving, in an effort to expand the applicability of the respective techniques, but also to challenge frontiers to other paradigms such as robust optimization. In this course we will closely examine more recent developments in the field, and introduce, and train the usage of the computational techniques, that act as a workhorse for solution strategies.

**Prerequisites:**

None.
### 4.281 Course: Topological Data Analysis [T-MATH-111031]

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

**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-105487 - Topological Data Analysis  

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**Prerequisites**  
none
Course: Topological Genomics [T-MATH-112281]

4.282 Course: Topological Genomics [T-MATH-112281]

Responsible: Dr. Andreas Ott
Organisation: KIT Department of Mathematics
Part of: M-MATH-106064 - Topological Genomics

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Competence Certificate
oral exam of ca. 20 min

Prerequisites
none
4.283 Course: Topological Groups [T-MATH-110802]

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

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-105323 - Topological Groups

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**Prerequisites**
none
### Course: Translation Surfaces [T-MATH-112128]

**Responsible:** Prof. Dr. Frank Herrlich  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-105973 - Translation Surfaces

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</table>

**Prerequisites**

none
4.285 Course: Traveling Waves [T-MATH-105897]

**Responsible:** Dr. Björn de Rijk
Prof. Dr. Wolfgang Reichel

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102927 - Traveling Waves

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<td>Oral examination</td>
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<td>Grade to a third</td>
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**Competence Certificate**
The module examination takes place in form of an oral exam of about 30 minutes. Please see under "Modulnote" for more information about the bonus regulation.

**Prerequisites**
none

**Recommendation**
The following background is strongly recommended: Analysis 1-4.
Course: Trustworthy Emerging Technologies [T-WIWI-113026]

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

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**Events**

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<td>Sunyaev, Lins</td>
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</tbody>
</table>

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

**Competence Certificate**

Alternative exam assessment (§ 4(2), 3 SPO). Details will be announced in the respective course.

**Modeled Conditions**

The following conditions have to be fulfilled:

1. The course T-WIWI-109251 - Selected Issues in Critical Information Infrastructures must not have been started.
Below you will find excerpts from events related to this course:

**Uncertainty Quantification**

0164400, SS 2023, 2 SWS, Language: English, [Open in study portal](#)

**Content**

"There are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns – there are things we do not know we don't know." (Donald Rumsfeld)

In this class, we learn to deal with the known unknowns, a field called Uncertainty Quantification (UQ). We particularly focus on the propagation of uncertainties (e.g. unknown data, unknown initial or boundary conditions) through models (mostly differential equations) and leave other important questions of UQ (especially inference) aside. Given uncertain input, how uncertain is the output? The uncertainties are modeled as random variables, and thus the solutions of the equations become random variables themselves.

Thus we summarize the necessary foundations of probability theory, with a focus on modeling correlated and uncorrelated random vectors. Further, we will see that every uncertain parameter becomes a dimension in the problem. We are thus quickly led to high-dimensional problems. Standard numerical methods suffer from the so-called curse of dimensionality, i.e. to reach a certain accuracy one needs excessively many model evaluations. Thus we study the fundamentals of approximation theory.

The first part of the course ("how to do it") gives an overview on techniques that are used. Among these are:

- Sensitivity analysis
- Monte-Carlo methods
- Spectral expansions
- Stochastic Galerkin method
- Collocation methods, sparse grids

The second part of the course ("why to do it like this") deals with the theoretical foundations of these methods. The so-called "curse of dimensionality" leads us to questions from approximation theory. We look back at the very standard numerical algorithms of interpolation and quadrature, and ask how they perform in many dimensions.

**Organizational issues**

The course will be offered in flipped classroom format. This means that the lectures will be made available as videos; students will also have lecture notes. We meet in presence for the tutorials, and there will also be office hours. First meeting on April 21 at 15:45.

**Literature**

**Course: Valuation [T-WIWI-102621]**

**Responsible:** Prof. Dr. Martin Ruckes  
**Organisation:** KIT Department of Economics and Management

**Part of:**  
- M-WIWI-101480 - Finance 3  
- M-WIWI-101482 - Finance 1  
- M-WIWI-101483 - Finance 2

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<td>WT 23/24</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**

- Code: 2530212, WS 23/24, 2 SWS, Language: English, [Open in study portal](#)

**Literature**

**Weiterführende Literatur**

<table>
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<tr>
<th>Responsible</th>
<th>Prof. Dr. Wolfgang Reichel</th>
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<tr>
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<td>KIT Department of Mathematics</td>
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<tr>
<td>Part of</td>
<td>M-MATH-105093 - Variational Methods</td>
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</table>
4.290 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

**Type**
- Oral examination

**Credits**
- 8

**Grading scale**
- Grade to a third

**Recurrence**
- Irregular

**Version**
- 1

**Prerequisites**
- None
4.291 Course: Wavelets [T-MATH-105838]

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

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102895 - Wavelets

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**Competence Certificate**

Mündliche Prüfung im Umfang von ca. 30 Minuten.

**Prerequisites**

none

Responsibility: TT-Prof. Dr. Julian Thimme
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101480 - Finance 3

Type: Written examination
Credits: 4.5
Grading scale: Grade to a third
Recurrence: Once
Version: 1

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.
<table>
<thead>
<tr>
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</table>

**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:
Content
This course enables the simulation of strategic conflicts in which the participants assume the roles of selected actors. With the help of specially programmed wargaming software, strategic conflicts are simulated interactively and then reflected upon and discussed.

The course focuses on the simulation and analysis of real conflict situations with strategic interaction. Students gain a better understanding of the structural characteristics of strategic conflicts in the fields of economics and politics as well as the ability to derive their own strategies for action.

Through a combination of group work, simulation, and reflection, the seminar provides a learning experience that both strengthens team skills and develops analytical skills in strategic conflict. Join this seminar to gain sound insights into conflict dynamics and develop effective action strategies for complex situations.

Learning Objectives
Upon completion of the course, students will be able to,

- learn the basic methodologies, characteristics and benefits of business wargaming
- improve their understanding of conflict dynamics by reflecting on strategic conflicts
- Strengthen analytical skills by processing a variety of courses of action and deriving strategies for action

Recommendations:
Previous attendance of the bachelor module "Strategy and Organization" or another module with comparable content at another university is recommended.

Workload:

- Total workload: approx. 90 hours
- Attendance time: 15 hours
- Preparation and follow-up: 75 hours
- Examination and preparation: not applicable

Evidence:
In this course, real conflict situations are simulated and analyzed with the help of various methods from business wargaming. Details on the design of the performance review will be announced during the lecture.

Annotation:
The course is admission restricted. In case of prior admission to another course in the module "Strategy and Management: Advanced Topics" [M-WIWI-103119], participation in this course is guaranteed. For more information on the application process, see the IBU website.

Exams are offered at least every other semester, so the entire module can be completed in two semesters.
Content
This course enables the simulation of strategic conflicts in which the participants assume the roles of selected actors. With the help of specially programmed wargaming software, strategic conflicts are simulated interactively and then reflected upon and discussed.

The course focuses on the simulation and analysis of real conflict situations with strategic interaction. Students gain a better understanding of the structural characteristics of strategic conflicts in the fields of economics and politics as well as the ability to derive their own strategies for action.

Through a combination of group work, simulation, and reflection, the seminar provides a learning experience that both strengthens team skills and develops analytical skills in strategic conflict. Join this seminar to gain sound insights into conflict dynamics and develop effective action strategies for complex situations.

Learning Objectives
Upon completion of the course, students will be able to,

- learn the basic methodologies, features and benefits of business wargaming
- improve their understanding of conflict dynamics by reflecting on strategic conflicts
- Strengthen analytical skills by processing a variety of courses of action and deriving strategies for action

Recommendations:
Prior attendance of the Bachelor’s module "Strategy and Organization" or another module with comparable content at another university is recommended.

Workload:

- Total workload: approx. 90 hours
- Attendance time: 15 hours
- Preparation and follow-up: 75 hours
- Examination and preparation: not applicable

Evidence:
In this course, real conflict situations are simulated and analyzed with the help of various methods from business wargaming. Details on the design of the performance review will be announced during the lecture.

Annotation:
The course is admission restricted. In case of prior admission to another course in the module "Strategy and Management: Advanced Topics" [M-WIWI-103119], participation in this course is guaranteed. For more information on the application process, see the IBU website.

Exams are offered at least every other semester, so the entire module can be completed in two semesters.
4.294 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

<table>
<thead>
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**Events**

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<td>Seminar</td>
<td>2 SWS</td>
<td>Seminar</td>
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<td>Lindstädt</td>
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</table>

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

**Competence Certificate**
The evaluation of the performance takes place through the active participation in the discussion rounds; an appropriate preparation is expressed here and a clear understanding of the topic and framework becomes recognizable. Further details on the design of the performance review will be announced during the lecture.

**Prerequisites**
None

**Recommendation**
Basic knowledge as conveyed in the bachelor module „Strategy and Organization“ is recommended.

**Annotation**
This course is admission restricted. If you were already admitted to another course in the module “Advanced Topics in Strategy and Management” the participation at this course will be guaranteed.

The course is planned to be held for the first time in the winter term 2017/18.

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

**Workshop aktuelle Themen Strategie und Management (Master)**

- Code: 2577923, WS 23/24, 2 SWS, Language: German, [Open in study portal](#)
Content
Aspects of strategic management can be found in a variety of daily events. In this course, current strategic and industrial policy issues are discussed and the exchange of ideas on current management topics is promoted.

For this purpose, practice-relevant case studies and dedicated questions are communicated to the students in advance so that they can prepare themselves individually for the discussion. The chair team actively moderates the discussion and creates typical discussion situations such as pro/con discussions and conflicting interests of different groups in order to bring opposing opinions into an exchange and to promote the power of argumentation. In this way, the discussion not only imparts knowledge about the content, but also strengthens the participants’ skills by simulating real discussion situations in a management team.

In addition, company representatives and managers participate in individual case studies to strengthen the context of the content and experience the daily dynamics of discussion in strategic business areas.

Learning Objectives:
Students will

- are able to evaluate strategic decisions using appropriate models of strategic business management,
- are able to present and critically evaluate theoretical approaches and models in the field of strategic business management and illustrate them using practical examples, and
- have the ability to present their position convincingly through a reasoned argumentation in structured discussions.

Recommendations:
Previous attendance of the Bachelor's module “Strategy and Organization” or another module with comparable content at another university is recommended.

Workload:
Total effort approx. 90 hours
Attendance time: 15 hours
Preparation and follow-up: 75 hours
Examination and preparation: not applicable

Evidence:
Performance will be assessed through active discussion participation in the discussion rounds; here, adequate preparation will be expressed and a clear understanding of the topic and framework will be evident. Further details on the design of the performance assessment will be announced during the lecture.

Annotation:
This course is admission restricted. In case of prior admission to another course in the module "Strategy and Management: Advanced Topics"[M-WIWI-103119], participation in this course is guaranteed. For more information on the application process, see the IBU website.
Exams are offered at least every other semester so that the entire module can be completed in two semesters.