

# Module Handbook Information Systems M.Sc.

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KIT DEPARTMENT OF BUSINESS AND ECONOMICS / KIT DEPARTMENT OF INFORMATICS



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| 6.445. Smart Grid Applications - T-WIWI-107504 .....                                                   | 1038 |
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| 6.465. Successful Transformation Through Innovation - T-WIWI-111823 .....                              | 1066 |
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| 6.467. Supply Chain Management with Advanced Planning Systems - T-WIWI-102763 .....                    | 1068 |
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|                                                                                             |      |
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| 6.491. Wearable Robotic Technologies - T-INFO-114145 .....                                  | 1098 |
| 6.492. Web App Programming for Finance - T-WIWI-110933 .....                                | 1100 |
| 6.493. Web Applications and Service-Oriented Architectures (II) - T-INFO-101271 .....       | 1101 |
| 6.494. Workshop Business Wargaming – Analyzing Strategic Interactions - T-WIWI-106189 ..... | 1102 |
| 6.495. Workshop Current Topics in Strategy and Management - T-WIWI-106188 .....             | 1104 |

# 1 The Module Handbook: Your Guide Through Your Studies

Welcome to the **Module Handbook** for your study program at the KIT Department of Economics and Management. We are delighted to have you join us and wish you a successful start to the new semester! This handbook provides an essential introduction to the key terms and regulations governing the selection of modules, courses, and examinations within your program.

Your study program is structured around several disciplines (e.g., Business Administration, Economics, Operations Research). Each discipline is further divided into **modules**, with each module comprising one or more interrelated components that often lead to an examination. The scope of each module is defined by **Credit Points (CP)**, which are awarded upon successful completion. While some modules are compulsory, the program's interdisciplinary nature offers a wide range of individual specialization and deepening opportunities within many modules. This flexibility allows you to tailor the content and timeline of your studies according to your personal interests, career aspirations, and needs.

This module handbook serves as a comprehensive guide to the modules within your program. Specifically, it details:

- The **structure** of the modules
- Their **scope** (in CP)
- Module **dependencies**
- Expected **learning outcomes**
- **Assessment methods** and examinations

This handbook is an essential orientation and a helpful guide throughout your studies. Please note that it **complements, but does not replace, the course catalog**, which provides semester-specific and variable course details such as timetables and locations.

## 1.1 Module Selection and Completion

Each module and each examination can only be selected once. If an examination is selectable within multiple modules, the student's decision on its assignment to a specific module is made at the moment of registration for that examination.

A module is considered completed and passed when its module examination is successfully passed (achieving a grade of 4.0 or better). For modules where the module examination is subdivided into several partial examinations, the module is completed only when all necessary partial examinations have been successfully passed. If a module offers alternative partial examinations, the module examination is considered concluded with the examination that leads to or exceeds the required total credit points. The module grade, reflecting the weight of its predefined credit points, is then included in the overall grade calculation for the study program.

## 1.2 Module Versions and Revisions

Modules are periodically revised, for instance, due to the introduction of new courses or the cancellation of existing examinations. As a rule, a new module version is created, which applies to all students who are newly starting the module. Students who have already commenced a module, however, are generally "grandfathered" and remain subject to the conditions of the module version valid at the time they began. These students can complete the module under the same conditions as at the beginning (exceptions are regulated by the Examination Board). The decisive date for this is the student's "binding declaration" regarding the choice of the module, as defined by §5(2) of the Study and Examination Regulations. This binding declaration is established by registering for the first examination within that module.

## 1.3 Accessing Module Handbook Versions

All modules in this handbook are presented in their current version, with the version number indicated in each module description. Older module versions can be accessed via previous module handbooks in the archive at: [http://www.wiwi.kit.edu/Archiv\\_MHB.php](http://www.wiwi.kit.edu/Archiv_MHB.php).

## 1.4 Examination Formats and Registration

Module examinations can be taken either as a comprehensive general examination or as partial examinations. If offered as a general examination, the entire learning content of the module will be assessed in a single examination. If the module examination is subdivided, the content of each constituent course will be examined in corresponding partial examinations.

Registration for examinations can be done online via the campus management portal. The following functions are available at <https://campus.studium.kit.edu/>:

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

For further and more detailed information, please refer to: <https://campus.studium.kit.edu/faq.php>.

## 1.5 Grading, Repetition Rules, and Types of Assessment

Examinations are categorized into written examinations, oral examinations, and alternative assessment types ("Prüfungsleistungen anderer Art"). All examinations are graded. Ungraded coursework ("Studienleistungen"), on the other hand, can be repeated multiple times and do not receive a grade.

Generally, a failed written exam, oral exam, or alternative assessment can be repeated only once. Should this repeat examination (including any provided oral repeat examination) also be failed, the right to take the examination is forfeited. A request for a second repetition must be submitted in writing to the Examination Board two months after forfeiting the examination right. For more information, please see: <http://www.wiwi.kit.edu/hinweiseZweitwdh.php>.

## 1.6 Examiners

The Examination Board has appointed the KIT examiners and lecturers listed in this module handbook for the modules and their respective courses as official examiners for the courses they offer.

## 1.7 Additional Achievements

Additional achievements are voluntarily undertaken graded assessments that do not impact the student's overall grade. They can pertain to single courses or entire modules. It is mandatory to declare an additional achievement as such at the time of registration for the respective assessment. Additional achievements totaling at most 30 CP may be listed on the final certificate.

## 1.8 Important Resources and Legal Framework

For current information regarding your studies at the KIT Department of Economics and Management, please visit our website [www.wiwi.kit.edu](http://www.wiwi.kit.edu), as well as our channels on Instagram, LinkedIn, and YouTube. Please also consult the current notices and announcements for students at: <https://www.wiwi.kit.edu/studium.php>.

Comprehensive information regarding the legal and regulatory framework of your study program can be found in the respective study and examination regulations. These documents are available under the Official Announcements of KIT at: <http://www.sle.kit.edu/amtlicheBekanntmachungen.php>.

## 1.9 Contact persons

### for Bachelor students

**Personal consultation:** KIT Department of Informatics, Informatics Study Program Service  
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[bachelor@wirtschaftsinformatik.kit.edu](mailto:bachelor@wirtschaftsinformatik.kit.edu)

**editorial responsibility:** Lena Coerdt, KIT Department of Informatics  
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[modulhandbuch@informatik.kit.edu](mailto:modulhandbuch@informatik.kit.edu)

### for master students

**Personal consultation:** KIT Department of Economics and Management, Examination Office  
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[master@wirtschaftsinformatik.kit.edu](mailto:master@wirtschaftsinformatik.kit.edu)

**editorial responsibility:** Dr. André Wiesner, KIT Department of Economics and Management  
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[modul@wiwi.kit.edu](mailto:modul@wiwi.kit.edu)

## 2 General Information

### 2.1 Study program details

|                                 |                                                                                                                                                                                                                                                                                             |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| KIT-Department                  | KIT Department of Business and Economics / KIT Department of Informatics                                                                                                                                                                                                                    |
| Academic Degree                 | Master of Science (M.Sc.)                                                                                                                                                                                                                                                                   |
| Examination Regulations Version | 2019                                                                                                                                                                                                                                                                                        |
| Regular semesters               | 4 semesters                                                                                                                                                                                                                                                                                 |
| Maximum semesters               | 7 semesters                                                                                                                                                                                                                                                                                 |
| Credits                         | 120                                                                                                                                                                                                                                                                                         |
| Language                        | German and English                                                                                                                                                                                                                                                                          |
| Grade calculation               | Weighted average by credits                                                                                                                                                                                                                                                                 |
| Additional Information          | Link to study program<br><a href="http://www.wirtschaftsinformatik.kit.edu/studiengang.php">www.wirtschaftsinformatik.kit.edu/studiengang.php</a><br>Department<br><a href="http://www.wirtschaftsinformatik.kit.edu/studiengang.php">www.wirtschaftsinformatik.kit.edu/studiengang.php</a> |

### 2.2 Content

KIT's Information System Program is characterized by real interdisciplinarity based on a cross-faculty model involving the KIT Departments of Informatics and Economics & Management. The Master's Program of Information Systems has a duration of four semesters and comprises four pillars of studies.

1. Information Systems: The Information Systems modules impart both established concepts of Information Systems, such as the development and management of information systems, and modern aspects of Information Systems, such as the development of digital business models.
2. Informatics: This pillar covers a wide range of choices in the field of Informatics such as algorithms, data engineering, software engineering, robotics, artificial intelligence, telematics, safety, and human-machine interaction.
3. Economics & Management: In the area of economics & management, a large variety of courses can be chosen e.g. in entrepreneurship, marketing, finance, production, operations research, econometrics, or economics.
4. Law: KIT offers a large range of law modules, with a particular focus on information technology.

The desired breadth of qualification is achieved by students having to pass at least two modules in the amount of 18 credits in each of the four thematic core areas mentioned above. In informatics, modules in the total amount of 30 credits must be attended. At least two seminars in business informatics, informatics, economics, or law and the Master's thesis serve to develop the students' capability of writing and presenting the own scientific work.

Thanks to the involvement of the two KIT departments, the Master's program offers many selection and specialization options and pursues a research-oriented teaching concept of high practical relevance.

KIT graduates are characterized by their interdisciplinary methodological competence and their innovative skills in shaping digital transformation of business and society. Based on their knowledge and skills, graduates are capable of independently identifying economic and information technology situations as well as innovative development potentials for the digitization of processes, products, and services and of implementing these potentials within the existing legal framework conditions.

The contents of the studies are structured in a modular way.

#### Special features of the degree program

- The KIT departments of Informatics and Business and Economics involved in the Information Systems program have a long tradition and are among the leaders in teaching and research in relevant rankings.
- Extensive range of courses
- Individual specialization options
- Lively internationality through free language courses, exchange programs, English-language events, sponsored internships abroad and partnerships with international universities
- Integration into the EUCOR university network enables participation in courses at the universities of Freiburg, Basel, Strasbourg, Colmar and Mulhouse
- KIT start-up incubator and pioneer garage as support on the path to self-employment

## 2.3 Qualification Goals

KIT graduates in Information Systems design information assets in an interdisciplinary manner and develop information systems from a sociotechnical perspective to create social and economic value by the digitization of business and society.

They can analyze and structure complex subject-relevant problems and requirements and develop customized solutions and action options. Advantages and drawbacks of existing methods, models, technologies, and approaches can be identified, compared to alternatives, critically assessed, and transferred to new applications.

In accordance with the needs, KIT graduates can also combine and adapt these methods and independently develop novel solution options that are then implemented using innovative information and communication technologies.

Depending on the subjects chosen, KIT graduates will possess the qualifications needed for interdisciplinary activities as IT managers, consultants, technology entrepreneurship, process managers, startup founders, as well as for a further scientific career.

## 2.4 Employment Prospects

Data science, IT management, digital marketing management, consulting or software development are just a small selection of the possible professional fields in which you can work after completing your Master's degree. A Master's degree in Business Informatics opens up excellent career prospects for you.

During your studies, you will acquire comprehensive knowledge in the fields of computer science, economics and law. Thanks to your solid basic mathematical training, you will be able to take a structured approach to complex issues.

As a specialist and manager, you will be able to work nationally and internationally wherever this interface competence is required. The areas of application are just as varied as the career opportunities. A doctorate following the Master's degree also offers you an attractive opportunity to further deepen your specialist knowledge. Last but not least, you can become self-employed with a creative business idea. KIT will support you on this path.

## 2.5 Acceptance Criteria

The program offers 44 study places and admission is restricted. Admission takes place in the first semester and for the higher semester in the winter and summer semesters.

German or EU nationals

**First semester:** 15 July for the winter semester, 15 January for the summer semester

**Second semester:** 15 July for the winter semester, 15 January for the summer semester

Citizens from non-EU countries

**First semester:** 15 July for the winter semester, 15 January for the summer semester

**Second semester:** 15 July for the winter semester, 15 January for the summer semester

## 2.6 Studies and Examination Regulations

The legal basis for the degree program and the examinations in the degree program is the

[Study and Examination Regulations of the Karlsruhe Institute of Technology \(KIT\) for the Master's degree program in Information Systems](#)

## 2.7 Organizational issues

Current information on the degree programs as well as dates for information events and examinations can be found on the websites of the [KIT Department of Economics and Management](#) and the [KIT Department of Informatics](#).

### Recognition of achievements according to § 19 SPO

#### 1. Achievements within the university system

According to § 19 of the Study and Examination Regulations, study and examination achievements that have been completed in study programs at state or state-recognized universities and vocational academies in the Federal Republic of Germany or at foreign state or state-recognized universities can be recognized upon application by the student .

#### 2. Achievements outside the higher education system

Knowledge acquired outside the higher education system can also be recognized. A common example is the recognition of one or more internships through proof of relevant vocational training.

For detailed information on the recognition process and the link to the application forms, please refer to [the KIT department website](#) .

### Frequently asked questions

Answers to frequently asked questions from A for "Abschlussarbeit" to Z for "Zweitwiederholung" can be found in the [Hints A-Z](#) of the KIT Department of Business and Economics and the [FAQs](#) of the KIT Department of Informatics.

### 3 Study plan

The Master's programme in Information Systems has a standard duration of four semesters and comprises 120 credit points. Depending on personal interests and goals, the specialist knowledge acquired in the Bachelor's programme can be expanded and deepened within the scope of the study plan.

Figure 2 shows the subject and module structure with the allocation of credit points (LP) and, as an example, a possible distribution of modules over the semesters.



Figure 2: Structure of the Master's programme in Information Systems (german)

Within the scope of the master's programme, modules from the subjects of Information Systems, Informatics, Economics and Law are to be completed and a master's thesis is to be written.

In the subject Informatics, modules with a total volume of 30 credit points are to be taken. In the remaining subjects Information Systems, Economics and Law, modules with a total of 18 credit points must be proven.

In the subjects Information Systems, Informatics, Economics and Management and Law, two seminars of 3 LP each must be completed. The seminars have to be chosen from different subjects.

It is up to the individual study plan (taking into account the relevant requirements in the study and examination regulations as well as any module regulations) in which subject semester the selected module examinations are started or completed. However, it is recommended that all other academic achievements of the Master's examination be proven before the start of the Master's thesis.

All modules including options within the modules are described in the module handbook. WiWi seminars that can be attended as part of the seminar modules will be published on the Wiwi portal at <https://portal.wiwi.kit.edu/Seminare>.

## 4 Study Program Structure

| Mandatory                |       |
|--------------------------|-------|
| Master's Thesis          | 30 CP |
| Information Systems      | 18 CP |
| Informatics              | 30 CP |
| Economics and Management | 18 CP |
| Law                      | 18 CP |
| Seminars                 | 6 CP  |

### 4.1 Master's Thesis

**Credits**  
30

| Mandatory     |                 |    |       |       |
|---------------|-----------------|----|-------|-------|
| M-WIWI-104833 | Master's Thesis | DE | WS+SS | 30 CP |

### 4.2 Information Systems

**Credits**  
18

| Information Systems (Election: ) |                                                     |       |       |      |
|----------------------------------|-----------------------------------------------------|-------|-------|------|
| M-WIWI-107530                    | Information Systems: AI & Data Science              | EN    | WS+SS | 9 CP |
| M-WIWI-107528                    | Information Systems: Digital Markets & Services     | DE/EN | WS+SS | 9 CP |
| M-WIWI-107531                    | Information Systems: Interactive Systems            | DE/EN | WS+SS | 9 CP |
| M-WIWI-107529                    | Information Systems: Software & Systems Engineering | DE/EN | WS+SS | 9 CP |



**4.3 Informatics****Credits**  
30

| Optional Modules Informatics (Election: ) |                                                                              |       |        |       |
|-------------------------------------------|------------------------------------------------------------------------------|-------|--------|-------|
| M-INFO-106303                             | Access Control Systems: Models and Technology                                | EN    | SS     | 5 CP  |
| M-INFO-106812                             | Advanced Bayesian Data Analysis                                              | EN    | WS     | 5 CP  |
| M-INFO-107200                             | Advanced Data Structures                                                     | EN    | SS     | 5 CP  |
| M-WIWI-106804                             | Advanced Topics in AI: Graph Neural Networks and Language Models             | DE/EN | WS+SS  | 9 CP  |
| M-WIWI-106803                             | Advanced Topics in AI: Knowledge Graphs and the Web                          | DE/EN | WS+SS  | 9 CP  |
| M-INFO-100795                             | Algorithm Engineering                                                        | EN    | SS     | 5 CP  |
| M-INFO-100031                             | Algorithms for Routing                                                       | DE    | SS     | 5 CP  |
| M-INFO-106960                             | Algorithmic Graph Theory                                                     | EN    | Irreg. | 5 CP  |
| M-INFO-107460                             | Algorithmic Network Analysis                                                 | DE    | Irreg. | 5 CP  |
| M-INFO-106961                             | Algorithms for Visualization of Graphs                                       | EN    | Irreg. | 5 CP  |
| M-INFO-107201                             | Algorithms II                                                                | EN    | WS     | 6 CP  |
| M-WIWI-105366                             | Artificial Intelligence                                                      | DE/EN | WS+SS  | 9 CP  |
| M-INFO-106810                             | Artificial Intelligence & IT-Security <span>neu</span>                       | EN    | WS     | 6 CP  |
| M-INFO-107431                             | Selected Aspects in Real-time Systems                                        | DE    | WS     | 3 CP  |
| M-INFO-105338                             | Authentication and Encryption <span>neu</span>                               | DE    | SS     | 4 CP  |
| M-INFO-104447                             | Automated Planning and Scheduling                                            | EN    | Irreg. | 5 CP  |
| M-INFO-100826                             | Automated Visual Inspection and Image Processing                             | DE    | WS     | 6 CP  |
| M-INFO-107599                             | Beating the Worst-Case in Practice: Unexpectedly Efficient Algorithms        | EN    | Irreg. | 6 CP  |
| M-INFO-106824                             | Coding Theory                                                                | DE    | Irreg. | 3 CP  |
| M-INFO-106966                             | Compiler Design                                                              | EN    | Irreg. | 9 CP  |
| M-INFO-107228                             | Computational Geometry                                                       | EN    | Irreg. | 6 CP  |
| M-INFO-106190                             | Computational Imaging                                                        | EN    | WS     | 5 CP  |
| M-INFO-100856                             | Computer Graphics                                                            | DE    | WS     | 6 CP  |
| M-INFO-106685                             | Computer Graphics 2                                                          | DE/EN | SS     | 5 CP  |
| M-INFO-106256                             | Constructive Logic                                                           | EN    | SS     | 5 CP  |
| M-WIWI-106631                             | Cooperative Autonomous Vehicles                                              | EN    | WS+SS  | 9 CP  |
| M-INFO-107435                             | Cryptographic Protocols II: Universal Composability <span>neu</span>         | EN    | WS     | 3 CP  |
| M-INFO-106355                             | Cybersecurity for Industrial Automation and Control Systems <span>neu</span> | DE    | SS     | 4 CP  |
| M-INFO-106655                             | Data Science and Artificial Intelligence for Energy Systems                  | EN    | SS     | 6 CP  |
| M-INFO-101662                             | Practical Course: Database Systems                                           | DE    | WS     | 4 CP  |
| M-INFO-105334                             | Decentralized Systems: Fundamentals, Modeling, and Applications              | EN    | SS     | 6 CP  |
| M-INFO-107197                             | Deep Learning and Neural Networks                                            | EN    | SS     | 6 CP  |
| M-INFO-107695                             | Deep Learning for Computer Vision: Advanced Topics <span>neu</span>          | DE/EN | WS     | 3 CP  |
| M-INFO-106642                             | The de-Casteljau Algorithm                                                   | DE/EN | Once   | 3 CP  |
| M-INFO-107230                             | Design and Architectures of Embedded Systems (ESII)                          | EN    | WS     | 3 CP  |
| M-INFO-105882                             | Digital Accessibility and Assistive Technologies                             | DE/EN | SS     | 3 CP  |
| M-INFO-107215                             | Distributed Computing                                                        | EN    | WS     | 4 CP  |
| M-INFO-106101                             | Introduction to Quantum Computing (IQC)                                      | DE/EN | WS     | 3 CP  |
| M-INFO-100736                             | Introduction to Video Analysis                                               | DE    | SS     | 3 CP  |
| M-INFO-106742                             | Introduction to Quantum Machine Learning                                     | DE    | SS     | 3 CP  |
| M-INFO-107685                             | Empirical Software Engineering <span>neu</span>                              | EN    | Irreg. | 4 CP  |
| M-INFO-106864                             | Energy Informatics                                                           | DE/EN | WS     | 10 CP |
| M-INFO-106626                             | Engineering Self-Adaptive Systems                                            | EN    | WS     | 3 CP  |
| M-WIWI-101477                             | Development of Business Information Systems                                  | DE    | WS+SS  | 9 CP  |
| M-INFO-106302                             | Explainable Artificial Intelligence                                          | EN    | SS     | 3 CP  |
| M-INFO-100799                             | Formal Systems                                                               | DE    | WS     | 6 CP  |
| M-INFO-100744                             | Formal Systems II: Application                                               | DE    | SS     | 5 CP  |
| M-INFO-100841                             | Formal Systems II: Theory                                                    | DE    | SS     | 5 CP  |
| M-INFO-105378                             | Research Project Autonomous Learning Robots                                  | EN    | SS     | 6 CP  |

|               |                                                                                                                       |       |        |      |
|---------------|-----------------------------------------------------------------------------------------------------------------------|-------|--------|------|
| M-INFO-105723 | Advanced Algorithmic Programming                                                                                      | DE    | WS     | 6 CP |
| M-INFO-100731 | Photorealistic Rendering                                                                                              | DE/EN | WS     | 5 CP |
| M-INFO-100725 | Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy | DE    | WS+SS  | 3 CP |
| M-INFO-107211 | Graph Partitioning and Graph Clustering in Theory and Practice                                                        | EN    | SS     | 5 CP |
| M-INFO-101573 | Hands-on Bioinformatics Practical                                                                                     | EN    | Irreg. | 3 CP |
| M-INFO-100822 | Heterogeneous Parallel Computing Systems                                                                              | DE    | WS     | 3 CP |
| M-INFO-106650 | HRI and Social Robotics                                                                                               | EN    | SS     | 6 CP |
| M-INFO-107166 | Human Computer Interaction                                                                                            | EN    | SS     | 6 CP |
| M-WIWI-104520 | Human Factors in Security and Privacy                                                                                 | DE    | WS+SS  | 9 CP |
| M-INFO-106649 | Humanoid Robots - Locomotion and Whole-Body Control neu                                                               | EN    | SS     | 6 CP |
| M-INFO-107152 | Humanoid Robots - Seminar                                                                                             | EN    | WS     | 3 CP |
| M-INFO-100791 | Innovative Concepts for Programming Industrial Robots                                                                 | DE    | SS     | 4 CP |
| M-WIWI-101456 | Intelligent Systems and Services                                                                                      | DE/EN | WS+SS  | 9 CP |
| M-INFO-100732 | Interactive Computer Graphics                                                                                         | DE/EN | SS     | 5 CP |
| M-INFO-100800 | Internet of Everything                                                                                                | EN    | WS     | 4 CP |
| M-INFO-100749 | Introduction to Bioinformatics for Computer Scientists                                                                | EN    | WS     | 3 CP |
| M-INFO-106998 | IT Security                                                                                                           | EN    | WS     | 6 CP |
| M-INFO-100786 | IT-Security Management for Networked Systems                                                                          | DE    | WS     | 5 CP |
| M-INFO-101575 | Computational Complexity Theory, with a View Towards Cryptography                                                     | DE    | Irreg. | 6 CP |
| M-INFO-100728 | Context Sensitive Systems                                                                                             | DE    | SS     | 5 CP |
| M-INFO-105631 | Cryptographic Protocols neu                                                                                           | DE    | SS     | 5 CP |
| M-INFO-100742 | Cryptographic Voting Schemes                                                                                          | DE    | Irreg. | 3 CP |
| M-INFO-107176 | Lab Project: Speech Translation                                                                                       | EN    | WS     | 6 CP |
| M-INFO-107663 | Localization of Mobile Agents neu                                                                                     | EN    | SS     | 6 CP |
| M-INFO-106102 | Logical Foundations of Cyber-Physical Systems                                                                         | EN    | WS     | 6 CP |
| M-INFO-100807 | Low Power Design                                                                                                      | EN    | SS     | 3 CP |
| M-INFO-107169 | Machine Learning - Foundations and Algorithms                                                                         | EN    | SS     | 6 CP |
| M-INFO-106959 | Machine Learning for Natural Sciences                                                                                 | EN    | SS     | 6 CP |
| M-INFO-106470 | Machine Learning in Climate and Environmental Sciences                                                                | EN    | SS     | 6 CP |
| M-INFO-100848 | Machine Translation                                                                                                   | DE    | SS     | 6 CP |
| M-WIWI-103356 | Machine Learning                                                                                                      | DE/EN | WS+SS  | 9 CP |
| M-INFO-100824 | Human-Machine-Interaction in Anthropomatics: Basics                                                                   | DE    | WS     | 3 CP |
| M-INFO-107245 | Mobile Communication                                                                                                  | EN    | WS     | 4 CP |
| M-INFO-106931 | Model-Driven Software Development                                                                                     | EN    | WS     | 3 CP |
| M-INFO-102555 | Motion in Human and Machine - Seminar                                                                                 | EN    | SS     | 3 CP |
| M-INFO-107676 | Multimodal Artificial Intelligence neu                                                                                | EN    | SS     | 6 CP |
| M-INFO-100825 | Pattern Recognition                                                                                                   | DE    | SS     | 6 CP |
| M-INFO-107178 | Natural Language Processing                                                                                           | EN    | WS     | 6 CP |
| M-INFO-107233 | Natural Language Processing and Software Engineering                                                                  | EN    | WS     | 3 CP |
| M-INFO-107218 | Network Security: Architectures and Protocols                                                                         | EN    | SS     | 4 CP |
| M-INFO-100784 | Next Generation Internet                                                                                              | EN    | SS     | 4 CP |
| M-INFO-107229 | Optimization and Synthesis of Embedded Systems (ESI)                                                                  | EN    | WS     | 3 CP |
| M-INFO-105329 | Optimization Methods for Machine Learning and Engineering neu                                                         | EN    | WS     | 5 CP |
| M-INFO-107199 | Parallel Algorithms                                                                                                   | EN    | WS     | 5 CP |
| M-INFO-100808 | Parallel Computer Systems and Parallel Programming                                                                    | DE    | SS     | 4 CP |
| M-INFO-107167 | Parameterized Algorithms                                                                                              | EN    | Irreg. | 6 CP |
| M-INFO-107170 | Participatory Technology Design neu                                                                                   | EN    | WS     | 6 CP |
| M-INFO-107642 | Post-quantum Cryptography from Lattices neu                                                                           | EN    | Irreg. | 3 CP |
| M-INFO-100804 | Power Management neu                                                                                                  | DE    | WS     | 3 CP |
| M-INFO-107244 | Practical Course on Network Security Research                                                                         | EN    | Irreg. | 3 CP |

|               |                                                                                                |       |        |      |
|---------------|------------------------------------------------------------------------------------------------|-------|--------|------|
| M-INFO-107597 | Practical Course on Telematics                                                                 | EN    | WS     | 3 CP |
| M-INFO-107220 | Practical Course on Telematics Research                                                        | EN    | Irreg. | 3 CP |
| M-INFO-103706 | Practical Course: Internet of Things (IoT)                                                     | EN    | WS+SS  | 4 CP |
| M-INFO-105870 | Practical Course: Advanced Topics in High Performance Computing, Data Management and Analytics | EN    | WS+SS  | 6 CP |
| M-INFO-106800 | Practical Course: AI for Climate and Weather Predictions                                       | EN    | Irreg. | 6 CP |
| M-INFO-106996 | Practical Course: Application Security                                                         | EN    | WS+SS  | 4 CP |
| M-INFO-106867 | Practical Course: Artificial Intelligence & Security Lab (AISEC-Lab) neu                       | EN    | SS     | 4 CP |
| M-INFO-107265 | Practical Course: Chip Design I                                                                | EN    | WS+SS  | 3 CP |
| M-INFO-107266 | Practical Course: Chip Design II                                                               | EN    | WS+SS  | 3 CP |
| M-INFO-107677 | Practical Course: Continuous Software Engineering neu                                          | EN    | WS+SS  | 6 CP |
| M-INFO-102570 | Practical Course: Digital Design & Test Automation Flow                                        | EN    | WS+SS  | 3 CP |
| M-INFO-107203 | Practical Course: Efficient Parallel C++                                                       | EN    | Irreg. | 6 CP |
| M-INFO-107678 | Practical Course: Engineering Approaches to Software Development neu                           | EN    | WS+SS  | 6 CP |
| M-INFO-102661 | Practical Course: FPGA Programming                                                             | EN    | WS+SS  | 3 CP |
| M-INFO-100724 | Practical Course: General-Purpose Computation on Graphics Processing Units                     | EN    | WS+SS  | 3 CP |
| M-INFO-106646 | Practical Course: Human-Centred Robotics neu                                                   | EN    | WS+SS  | 6 CP |
| M-INFO-107494 | Practical Course: Interactive Theorem Proving                                                  | EN    | Irreg. | 3 CP |
| M-INFO-104031 | Practical Course: Low Power Design and Embedded Systems                                        | EN    | WS+SS  | 4 CP |
| M-INFO-106932 | Practical Course: Model-Driven Software Development                                            | EN    | SS     | 6 CP |
| M-INFO-106648 | Practical Course: Movement and Technology neu                                                  | EN    | SS     | 6 CP |
| M-INFO-107177 | Practical Course: Natural Language Dialog Systems                                              | EN    | Irreg. | 6 CP |
| M-INFO-106627 | Practical Course: Real-world Vulnerability Discovery and Exploits neu                          | EN    | WS+SS  | 4 CP |
| M-INFO-107600 | Practical Course: Route Planning                                                               | EN    | Irreg. | 6 CP |
| M-INFO-105955 | Practical Course: Smart Energy System                                                          | EN    | WS+SS  | 6 CP |
| M-INFO-107221 | Practical Course: Software Defined Networking                                                  | EN    | SS     | 6 CP |
| M-INFO-101567 | Practical Course: Visual Computing                                                             | EN    | WS+SS  | 6 CP |
| M-INFO-107527 | Practical Course: Wearable Computing                                                           | DE/EN | WS+SS  | 6 CP |
| M-INFO-107241 | Practical Introduction to Hardware Security                                                    | EN    | WS+SS  | 6 CP |
| M-INFO-107238 | Practical SAT Solving                                                                          | EN    | Irreg. | 5 CP |
| M-INFO-103047 | Practical Course Decentralized Systems and Network Services                                    | DE    | Irreg. | 4 CP |
| M-INFO-101559 | Laboratory in Cryptoanalysis                                                                   | DE    | WS+SS  | 3 CP |
| M-INFO-101558 | Laboratory in Cryptography                                                                     | DE    | WS     | 3 CP |
| M-INFO-102092 | Practical Course Protocol Engineering                                                          | DE    | WS     | 4 CP |
| M-INFO-104699 | Practical Course: Hot Research Topics in Computer Graphics                                     | DE/EN | Irreg. | 6 CP |
| M-INFO-106286 | Practical Course: Current Topics of Quantum Computing                                          | EN    | SS     | 6 CP |
| M-INFO-105632 | Practical Course: Data Science                                                                 | DE    | SS     | 6 CP |
| M-INFO-106329 | Practical Course: Data Science for Scientific Data                                             | EN    | Irreg. | 6 CP |
| M-INFO-106312 | Practical Course: Scientific Data Management                                                   | DE    | Irreg. | 4 CP |
| M-INFO-106023 | Practical Course: Advanced Software Development Tools neu                                      | DE    | WS     | 6 CP |
| M-INFO-106290 | Practical Course: Design and Evaluation of Interactive Systems neu                             | DE/EN | SS     | 6 CP |
| M-INFO-103302 | Lab: Graph Visualization in Practice                                                           | DE    | Irreg. | 5 CP |
| M-INFO-105384 | Practical Course: Graphics and Game Development                                                | DE/EN | Irreg. | 6 CP |
| M-INFO-104895 | Penetration Testing Lab                                                                        | DE    | SS     | 4 CP |
| M-INFO-101537 | Practical Course: Programme Verification                                                       | DE/EN | Irreg. | 3 CP |
| M-INFO-106851 | Practical Course: Realtime Computer Graphics                                                   | DE/EN | WS+SS  | 6 CP |
| M-INFO-106687 | Practical Course: Rendering in CGI                                                             | DE/EN | WS+SS  | 6 CP |
| M-INFO-106686 | Practical Course: Scientific Visualization                                                     | DE/EN | WS+SS  | 6 CP |
| M-INFO-103235 | Practical Course: Smart Data Analytics                                                         | DE    | SS     | 6 CP |

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|---------------|------------------------------------------------------------------------------|-------|--------|-------|
| M-INFO-101635 | Practical Course: Web Applications and Service-Oriented Architectures (II)   | DE    | SS     | 5 CP  |
| M-INFO-105037 | Research Project (Project, 1st Semester)                                     | DE    | WS+SS  | 10 CP |
| M-INFO-105038 | Research Project (Project, 2nd Semester)                                     | DE    | WS+SS  | 10 CP |
| M-INFO-107168 | Probability and Computing                                                    | EN    | WS     | 5 CP  |
| M-WIWI-106491 | Project Lab Applied Machine Learning                                         | DE    | WS+SS  | 5 CP  |
| M-INFO-102383 | Project Lab: Image Analysis and Fusion                                       | DE    | SS     | 6 CP  |
| M-INFO-102966 | Practical Course Computer Vision for Human-Computer Interaction              | DE    | SS     | 6 CP  |
| M-INFO-105792 | Humanoid Robotics Laboratory                                                 | DE/EN | WS     | 6 CP  |
| M-INFO-105958 | Practical Course: Machine Learning and Intelligent Systems                   | DE    | WS+SS  | 8 CP  |
| M-INFO-100818 | Computer Architecture                                                        | DE    | SS     | 6 CP  |
| M-INFO-105623 | Reinforcement Learning                                                       | EN    | WS     | 6 CP  |
| M-INFO-100850 | Reliable Computing I                                                         | EN    | Irreg. | 3 CP  |
| M-INFO-106654 | Research Focus Class: Blockchain & Cryptocurrencies                          | EN    | Irreg. | 6 CP  |
| M-INFO-106866 | Research Practical Course: Artificial Intelligence & Security neu            | EN    | WS+SS  | 6 CP  |
| M-INFO-106495 | Research Practical Course: Explainable Artificial Intelligence               | EN    | WS     | 6 CP  |
| M-INFO-106300 | Research Practical Course: Interactive Learning                              | EN    | SS     | 6 CP  |
| M-INFO-107174 | Research Project Deep Learning for Robotics                                  | EN    | WS     | 6 CP  |
| M-INFO-107163 | Research Project: Generative AI for Autonomous Agents                        | EN    | SS     | 6 CP  |
| M-INFO-106871 | Research Project: Machine Learning for Autonomous Agents and Decision Making | EN    | WS     | 6 CP  |
| M-INFO-107155 | Robotics - Practical Course                                                  | EN    | SS     | 6 CP  |
| M-INFO-107162 | Robotics I - Introduction to Robotics                                        | EN    | WS     | 6 CP  |
| M-INFO-107123 | Robotics II - Humanoid Robotics                                              | EN    | SS     | 3 CP  |
| M-INFO-107130 | Robotics III - Sensors and Perception in Robotics                            | EN    | SS     | 3 CP  |
| M-INFO-107598 | Robotics Institute Germany - Lecture Series                                  | EN    | WS     | 3 CP  |
| M-INFO-107090 | Sampling Methods for Machine Learning                                        | EN    | SS     | 6 CP  |
| M-INFO-105780 | Scientific Methods to Design and Analyze Secure Decentralized Systems        | EN    | WS     | 5 CP  |
| M-INFO-105959 | Seminar Laboratory: Machine Learning and Intelligent Systems                 | DE    | SS     | 3 CP  |
| M-INFO-106490 | Seminar: Artificial Intelligence for Energy Systems                          | EN    | WS     | 4 CP  |
| M-INFO-106301 | Seminar: Interactive Learning                                                | EN    | SS     | 3 CP  |
| M-INFO-104877 | Safe Human-Robot-Collaboration                                               | DE    | WS     | 3 CP  |
| M-INFO-106504 | Simulation and Optimization in Robotics and Biomechanics neu                 | EN    | WS     | 6 CP  |
| M-INFO-107237 | Software Architecture and Quality                                            | EN    | WS     | 3 CP  |
| M-INFO-107235 | Software Engineering II                                                      | EN    | SS     | 6 CP  |
| M-INFO-107212 | Software Product Line Engineering                                            | EN    | SS     | 3 CP  |
| M-INFO-106344 | Software Security Engineering                                                | EN    | SS     | 3 CP  |
| M-INFO-100719 | Software-Evolution                                                           | EN    | WS     | 3 CP  |
| M-INFO-102998 | Software Lab Parallel Numerics                                               | DE/EN | WS+SS  | 6 CP  |
| M-INFO-107239 | Software Test and Quality Management (SQM) neu                               | EN    | WS     | 5 CP  |
| M-INFO-100829 | Stochastic Information Processing                                            | DE    | WS     | 6 CP  |
| M-INFO-107243 | Telematics                                                                   | EN    | WS     | 6 CP  |
| M-INFO-100851 | Testing Digital Systems I                                                    | EN    | Irreg. | 3 CP  |
| M-INFO-102962 | Testing Digital Systems II                                                   | EN    | SS     | 3 CP  |
| M-INFO-105584 | Theoretical Foundations of Cryptography                                      | DE    | WS     | 6 CP  |
| M-INFO-107639 | Theory of Satisfiability Algorithms neu                                      | EN    | Irreg. | 4 CP  |
| M-INFO-106293 | Timed Systems                                                                | EN    | SS     | 6 CP  |
| M-INFO-106870 | Tools for Probabilistic Machine Learning                                     | DE    | WS     | 6 CP  |
| M-INFO-107664 | Type Systems and Program Analysis neu                                        | EN    | Irreg. | 6 CP  |
| M-INFO-107161 | Ubiquitous Computing                                                         | EN    | Irreg. | 5 CP  |
| M-INFO-100867 | Virtual Systems neu                                                          | DE    | WS     | 3 CP  |

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|---------------|----------------------------------------------------------|-------|----|------|
| M-INFO-100738 | Visualization                                            | DE/EN | SS | 5 CP |
| M-INFO-107113 | Wearable Robotic Technologies                            | EN    | SS | 4 CP |
| M-INFO-100734 | Web Applications and Service-Oriented Architectures (II) | DE    | SS | 4 CP |

**4.4 Economics and Management****Credits**  
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| <b>Business Administration (Election: )</b> |                                                                          |       |           |      |
|---------------------------------------------|--------------------------------------------------------------------------|-------|-----------|------|
| M-WIWI-105659                               | Advanced Machine Learning and Data Science                               | EN    | WS+SS     | 9 CP |
| M-WIWI-101410                               | Business & Service Engineering                                           | DE/EN | WS+SS     | 9 CP |
| M-WIWI-105714                               | Consumer Research                                                        | EN    | WS+SS     | 9 CP |
| M-WIWI-101498                               | Management Accounting                                                    | EN    | see notes | 9 CP |
| M-WIWI-101510                               | Cross-Functional Management Accounting                                   | EN    | WS+SS     | 9 CP |
| M-WIWI-105032                               | Data Science for Finance                                                 | EN    | WS        | 9 CP |
| M-WIWI-103117                               | Data Science: Data-Driven Information Systems                            | EN    | WS+SS     | 9 CP |
| M-WIWI-103118                               | Data Science: Data-Driven User Modeling                                  | EN    | WS+SS     | 9 CP |
| M-WIWI-101647                               | Data Science: Evidence-based Marketing                                   | EN    | WS+SS     | 9 CP |
| M-WIWI-105661                               | Data Science: Intelligent, Adaptive, and Learning Information Services   | DE/EN | WS+SS     | 9 CP |
| M-WIWI-104080                               | Designing Interactive Information Systems                                | EN    | WS+SS     | 9 CP |
| M-WIWI-106258                               | Digital Marketing                                                        | EN    | WS+SS     | 9 CP |
| M-WIWI-102808                               | Digital Service Systems in Industry                                      | DE    | WS+SS     | 9 CP |
| M-WIWI-103720                               | eEnergy: Markets, Services and Systems                                   | DE    | WS+SS     | 9 CP |
| M-WIWI-101409                               | Electronic Markets                                                       | DE/EN | WS+SS     | 9 CP |
| M-WIWI-101451                               | Energy Economics and Energy Markets                                      | DE/EN | WS+SS     | 9 CP |
| M-WIWI-101452                               | Energy Economics and Technology                                          | DE/EN | WS+SS     | 9 CP |
| M-WIWI-101488                               | Entrepreneurship (EnTechnon)                                             | DE/EN | WS+SS     | 9 CP |
| M-WIWI-107601                               | Ethics of Information Technology                                         | DE/EN | WS        | 9 CP |
| M-WIWI-101482                               | Finance 1                                                                | DE/EN | WS+SS     | 9 CP |
| M-WIWI-101483                               | Finance 2                                                                | DE/EN | WS+SS     | 9 CP |
| M-WIWI-101480                               | Finance 3                                                                | DE/EN | WS+SS     | 9 CP |
| M-WIWI-105894                               | Foundations for Advanced Financial -Quant and -Machine Learning Research | EN    | see notes | 9 CP |
| M-WIWI-105923                               | Incentives, Interactivity & Decisions in Organizations                   | DE/EN | WS+SS     | 9 CP |
| M-WIWI-101471                               | Industrial Production II                                                 | DE/EN | WS        | 9 CP |
| M-WIWI-101412                               | Industrial Production III                                                | DE/EN | SS        | 9 CP |
| M-WIWI-101411                               | Information Engineering                                                  | DE/EN | WS+SS     | 9 CP |
| M-WIWI-104068                               | Information Systems in Organizations                                     | EN    | WS+SS     | 9 CP |
| M-WIWI-101507                               | Innovation Management                                                    | DE/EN | WS+SS     | 9 CP |
| M-WIWI-101446                               | Market Engineering                                                       | DE/EN | WS+SS     | 9 CP |
| M-WIWI-105312                               | Marketing and Sales Management                                           | EN    | SS        | 9 CP |
| M-WIWI-106660                               | Modeling the Dynamics of Financial Markets                               | EN    | SS        | 9 CP |
| M-WIWI-101506                               | Service Analytics                                                        | EN    | WS+SS     | 9 CP |
| M-WIWI-101503                               | Service Design Thinking                                                  | EN    | WS        | 9 CP |
| M-WIWI-102754                               | Service Economics and Management                                         | EN    | WS+SS     | 9 CP |
| M-WIWI-102806                               | Service Innovation, Design & Engineering                                 | EN    | WS+SS     | 9 CP |
| M-WIWI-101448                               | Service Management                                                       | EN    | WS+SS     | 9 CP |
| M-WIWI-103119                               | Advanced Topics in Strategy and Management                               | DE    | WS+SS     | 9 CP |
| M-WIWI-105010                               | Student Innovation Lab (SIL) 1                                           | EN    | WS        | 9 CP |
| M-WIWI-107649                               | Sustainable Information Systems <span style="color: red;">neu</span>     | EN    | WS+SS     | 9 CP |
| <b>Economics (Election: )</b>               |                                                                          |       |           |      |
| M-WIWI-101453                               | Applied Strategic Decisions                                              | EN    | WS+SS     | 9 CP |
| M-WIWI-101504                               | Collective Decision Making                                               | EN    | WS+SS     | 9 CP |
| M-WIWI-107010                               | Economics in a Connected World                                           | EN    | WS+SS     | 9 CP |
| M-WIWI-107011                               | Economics of Innovation and Growth                                       | EN    | WS+SS     | 9 CP |
| M-WIWI-101505                               | Experimental Economics                                                   | DE/EN | WS+SS     | 9 CP |
| M-WIWI-101500                               | Microeconomic Theory                                                     | EN    | WS+SS     | 9 CP |
| M-WIWI-101406                               | Network Economics                                                        | DE/EN | WS+SS     | 9 CP |
| M-WIWI-101502                               | Economic Theory and its Application in Finance                           | EN    | WS+SS     | 9 CP |



|                                         |                                                          |       |       |      |
|-----------------------------------------|----------------------------------------------------------|-------|-------|------|
| M-WIWI-105414                           | Statistics and Econometrics II                           | DE/EN | WS+SS | 9 CP |
| M-WIWI-101468                           | Environmental Economics                                  | DE    | WS+SS | 9 CP |
| M-WIWI-101485                           | Transport Infrastructure Policy and Regional Development | DE/EN | WS+SS | 9 CP |
| M-WIWI-101511                           | Advanced Topics in Public Finance                        | DE    | WS+SS | 9 CP |
| <b>Operations Research (Election: )</b> |                                                          |       |       |      |
| M-WIWI-101473                           | Mathematical Programming                                 | DE/EN | WS+SS | 9 CP |
| M-WIWI-102832                           | Operations Research in Supply Chain Management           | DE/EN | WS+SS | 9 CP |
| M-WIWI-102805                           | Service Operations                                       | DE/EN | WS+SS | 9 CP |
| M-WIWI-103289                           | Stochastic Optimization                                  | DE/EN | WS+SS | 9 CP |
| <b>Statistics (Election: )</b>          |                                                          |       |       |      |
| M-WIWI-101637                           | Analytics and Statistics                                 | DE    | WS+SS | 9 CP |
| M-WIWI-101638                           | Econometrics and Statistics I                            | DE/EN | WS+SS | 9 CP |
| M-WIWI-101639                           | Econometrics and Statistics II                           | DE/EN | WS+SS | 9 CP |
| M-WIWI-105414                           | Statistics and Econometrics II                           | DE/EN | WS+SS | 9 CP |

## 4.5 Law

**Credits**  
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|                                                       |                                    |       |       |      |
|-------------------------------------------------------|------------------------------------|-------|-------|------|
| <b>Compulsory Elective Module in Law (Election: )</b> |                                    |       |       |      |
| M-INFO-106754                                         | Public Economic and Technology Law | DE/EN | WS+SS | 9 CP |
| M-INFO-101216                                         | Private Business Law               | DE    | WS+SS | 9 CP |
| M-INFO-101215                                         | Intellectual Property Law          | DE    | WS+SS | 9 CP |

## 4.6 Seminars

Credits  
6

### Election notes

In the subjects Information Systems, Informatics, Economics and Management and Law, two seminars of 3 LP each must be completed. The seminars have to be chosen from different subjects.

| Seminars (Election: at most 2 items) |                                                                                          |       |        |      |
|--------------------------------------|------------------------------------------------------------------------------------------|-------|--------|------|
| M-WIWI-107692                        | Seminar Module Applied Informatics neu                                                   | DE/EN | WS+SS  | 3 CP |
| M-INFO-107671                        | Seminar Module Law Master neu                                                            | DE    | WS+SS  | 3 CP |
| M-WIWI-104815                        | Seminar Information Systems                                                              | DE    | WS+SS  | 3 CP |
| M-WIWI-102736                        | Seminar Module Economic Sciences                                                         | DE    | WS+SS  | 3 CP |
| M-INFO-105334                        | Decentralized Systems: Fundamentals, Modeling, and Applications neu                      | EN    | SS     | 6 CP |
| M-INFO-107152                        | Humanoid Robots - Seminar neu                                                            | EN    | WS     | 3 CP |
| M-INFO-102555                        | Motion in Human and Machine - Seminar neu                                                | EN    | SS     | 3 CP |
| M-INFO-106495                        | Research Practical Course: Explainable Artificial Intelligence neu                       | EN    | WS     | 6 CP |
| M-INFO-106813                        | Research Seminar in Selected Topics in Statistical Learning and Data Science neu         | EN    | Irreg. | 3 CP |
| M-INFO-102375                        | Seminar Image Analysis and Fusion neu                                                    | DE    | SS     | 3 CP |
| M-INFO-102662                        | Seminar Dependable Computing neu                                                         | EN    | WS+SS  | 3 CP |
| M-INFO-103048                        | Seminar Decentralized Systems and Network Services neu                                   | DE    | Irreg. | 3 CP |
| M-INFO-100746                        | Seminar Hot Topics in Networking neu                                                     | EN    | WS+SS  | 3 CP |
| M-INFO-107242                        | Seminar in Privacy neu                                                                   | EN    | SS     | 4 CP |
| M-INFO-103078                        | Seminar: Designing and Conducting Experimental Studies neu                               | DE    | Irreg. | 4 CP |
| M-INFO-107353                        | Seminar: Advanced Topics in Natural Language Processing neu                              | EN    | WS+SS  | 3 CP |
| M-INFO-107209                        | Seminar: Advanced Topics on SAT Solving neu                                              | EN    | WS     | 3 CP |
| M-INFO-106086                        | Seminar: Algorithm Engineering neu                                                       | EN    | Irreg. | 4 CP |
| M-INFO-106512                        | Seminar: Applications and Extensions of Timed Systems neu                                | EN    | Irreg. | 4 CP |
| M-INFO-106490                        | Seminar: Artificial Intelligence for Energy Systems neu                                  | EN    | WS     | 4 CP |
| M-INFO-105586                        | Seminar: Selected Topics in Public-Key-Cryptography neu                                  | DE/EN | WS     | 3 CP |
| M-INFO-105309                        | Seminar: Continuous Software Engineering neu                                             | EN    | WS     | 4 CP |
| M-INFO-106958                        | Seminar: Critical Topics in AI neu                                                       | EN    | SS     | 3 CP |
| M-INFO-107175                        | Seminar: Deep Learning for Robotics neu                                                  | EN    | WS     | 3 CP |
| M-INFO-105884                        | Seminar: Digital Accessibility and Assistive Technologies neu                            | DE/EN | WS     | 3 CP |
| M-INFO-107231                        | Seminar: Embedded Systems I neu                                                          | EN    | WS+SS  | 3 CP |
| M-INFO-107232                        | Seminar: Embedded Systems II neu                                                         | EN    | WS+SS  | 3 CP |
| M-INFO-103153                        | Seminar: Energy Informatics neu                                                          | DE/EN | Irreg. | 4 CP |
| M-INFO-106927                        | Seminar: Exoskeletons & Motion Capture neu                                               | EN    | WS     | 3 CP |
| M-INFO-106497                        | Seminar: Explainable Artificial Intelligence neu                                         | EN    | WS     | 3 CP |
| M-INFO-106651                        | Seminar: Exploring Robotics - Insights from Science Fiction, Research and Society neu    | EN    | SS     | 3 CP |
| M-INFO-107436                        | Seminar: Failing Forward: Robotics, Critical Reading and the Making of Good Research neu | EN    | WS     | 3 CP |
| M-INFO-106594                        | Seminar: Research Trends in Human-Computer Interaction neu                               | DE/EN | WS+SS  | 3 CP |
| M-INFO-102729                        | Seminar: Advanced Algorithms in Computer Graphics neu                                    | DE    | WS     | 3 CP |
| M-INFO-102550                        | Seminar: Graph Algorithms neu                                                            | DE    | Irreg. | 4 CP |
| M-INFO-106868                        | Seminar: Hot Topics in Artificial Intelligence & Security 1 neu                          | EN    | WS     | 4 CP |
| M-INFO-106869                        | Seminar: Hot Topics in Artificial Intelligence & Security 2 neu                          | EN    | SS     | 4 CP |
| M-INFO-100750                        | Seminar: Hot Topics in Bioinformatics neu                                                | EN    | SS     | 3 CP |
| M-INFO-106392                        | Seminar: Hot Topics in Explainable Artificial Intelligence (XAI) neu                     | EN    | SS     | 4 CP |
| M-INFO-105328                        | Seminar: Computer Science TECO neu                                                       | DE/EN | Irreg. | 3 CP |
| M-INFO-107686                        | Seminar: Information Systems neu                                                         | EN    | WS+SS  | 3 CP |
| M-INFO-106301                        | Seminar: Interactive Learning neu                                                        | EN    | SS     | 3 CP |
| M-INFO-107217                        | Seminar: Interpretability and Causality in Machine Learning neu                          | EN    | SS     | 3 CP |
| M-INFO-106356                        | Seminar: AI Systems Engineering neu                                                      | DE/EN | Irreg. | 4 CP |
| M-INFO-105337                        | Seminar: Cryptanalysis neu                                                               | DE/EN | SS     | 3 CP |
| M-INFO-107033                        | Seminar: Learning Causality - a Challenge for Human and Artificial Intelligence neu      | DE    | SS     | 3 CP |
| M-INFO-106719                        | Seminar: Machine Learning in Climate and Environmental Sciences neu                      | EN    | Irreg. | 3 CP |

|               |                                                                                    |       |        |      |
|---------------|------------------------------------------------------------------------------------|-------|--------|------|
| M-INFO-102412 | Seminar: Neural Networks and Artificial Intelligence neu                           | EN    | WS     | 3 CP |
| M-INFO-105585 | Seminar: Post-Quantum Cryptography neu                                             | EN    | Irreg. | 3 CP |
| M-INFO-107264 | Seminar: Practical Graph Algorithms neu                                            | EN    | Irreg. | 4 CP |
| M-INFO-107216 | Seminar: Privacy and Security neu                                                  | EN    | WS     | 4 CP |
| M-INFO-103306 | Seminar: Proofs from THE BOOK neu                                                  | EN    | Irreg. | 3 CP |
| M-INFO-105408 | Seminar: Quantum Information Theory neu                                            | EN    | Irreg. | 3 CP |
| M-INFO-107172 | Seminar: Recent Highlights in Algorithms neu                                       | EN    | Irreg. | 4 CP |
| M-INFO-105379 | Seminar: Robot Reinforcement Learning neu                                          | DE    | Irreg. | 3 CP |
| M-INFO-105761 | Seminar: Secure Multiparty Computation neu                                         | EN    | Irreg. | 3 CP |
| M-INFO-102372 | Seminar: Service-Oriented Architectures neu                                        | DE    | WS+SS  | 3 CP |
| M-INFO-107236 | Seminar: Software Architecture, Security and Privacy neu                           | EN    | Irreg. | 4 CP |
| M-INFO-105895 | Seminar: Software Quality Assurance and Software Test neu                          | DE/EN | SS     | 4 CP |
| M-INFO-107179 | Seminar: Speech-to-Speech Translation neu                                          | EN    | SS     | 3 CP |
| M-INFO-101880 | Seminar: Ubiquitous Systems neu                                                    | DE    | WS+SS  | 4 CP |
| M-INFO-102305 | Seminar: From Big Data to Data Science: Advanced Methods of Information Fusion neu | DE/EN | WS+SS  | 3 CP |

## 5 Modules

### M

### 5.1 Module: Access Control Systems: Models and Technology [M-INFO-106303]

**Coordinators:** Prof. Dr. Hannes Hartenstein  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

| Credits | Grading | Recurrence       | Duration | Language | Level | Version |
|---------|---------|------------------|----------|----------|-------|---------|
| 5 CP    | graded  | Each summer term | 1 term   | English  | 4     | 1       |

| Mandatory     |                                               |      |             |
|---------------|-----------------------------------------------|------|-------------|
| T-INFO-112775 | Access Control Systems: Models and Technology | 5 CP | Hartenstein |

#### Assessment

See Partial Achievements (Teilleistung).

#### Prerequisites

See Partial Achievements (Teilleistung).

#### Competence Goal

- The student understands the challenges of access control in the era of hyperconnectivity.
- The student understands that an information security model defines access rights that express for a given system which subjects are allowed to perform which actions on which objects. The student understands that a system is said to be secure with respect to a given information security model, if it enforces the corresponding access rights.
- The student is able to derive suitable access control models from scenario requirements and is able to specify concrete access control systems. The student is able to decide which concrete architectures and protocols are technically suited for realizing a given access control model.
- The student knows access control protocols using cryptographic methods and is able to compare protocol realizations based on different cryptographic building blocks.
- The student is aware of the limits of access control models and systems with respect to their analyzability and performance and security characteristics. The student is able to identify the resulting tradeoffs.
- The student knows the state of the art with respect to current research endeavors, e.g., access control in the context of decentralized and distributed systems, Trusted Execution Environments, AI, robotics, or hash-chain based systems.

#### Content

Access control systems are everywhere and the backbone of secure services as they incorporate who is and who is not authorized: think of operating systems, information systems, banking, vehicles, robotics, cryptocurrencies, or decentralized applications as examples. The course starts with current challenges of access control in the era of hyperconnectivity, i.e., in cyber-physical or decentralized systems. Based on the derived needs for next generation access control, we first study how to specify access control and analyze strengths and weaknesses of various approaches. We then focus on up-to-date proposals, like IoT and AI access control. We look at current cryptographic access control aspects, blockchains and cryptocurrencies, and trusted execution environments. We also discuss the ethical dimension of access management. Students prepare for lecture and exercise sessions by studying previously announced literature and by preparation of exercises that are jointly discussed in the sessions.

#### Workload

Lecture workload:

1. Attendance time  
Lecture: 2 SWS: 2,0h x 15 = 30h  
Exercises: 1 SWS: 1,0h x 15 = 15h
2. Self-study (e.g., independent review of course material, work on homework assignments)  
Weekly preparation and follow-up of the lecture: 15 x 1h x 3 = 45h  
Weekly preparation and follow-up of the exercise: 15 x 2h = 30h
3. Preparation for the exam: 30h

$\Sigma = 150h = 5$  ECTS

#### Recommendations

Basics according to the lectures "Information Security" and "IT Security Management for Networked Systems" are recommended.

## M

**5.2 Module: Advanced Algorithmic Programming [M-INFO-105723]**

**Coordinators:** TT-Prof. Dr. Thomas Bläsius  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
German

**Level**  
4

**Version**  
2

| Mandatory     |                                                  |      |         |
|---------------|--------------------------------------------------|------|---------|
| T-INFO-111399 | <a href="#">Advanced Algorithmic Programming</a> | 6 CP | Bläsius |

## M

**5.3 Module: Advanced Bayesian Data Analysis [M-INFO-106812]**

**Coordinators:** Prof. Dr. Nadja Klein  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
5 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                 |      |       |
|---------------|---------------------------------|------|-------|
| T-INFO-113673 | Advanced Bayesian Data Analysis | 5 CP | Klein |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

- Develop a deep understanding of Bayesian statistical principles and computational techniques.
- Master the application of Bayesian regression models to real-world data.
- Gain proficiency in Markov Chain Monte Carlo (MCMC) methods, including Metropolis-Hastings and Gibbs sampling.
- Acquire skills in implementing Bayesian models using relevant software tools such as Stan.

**Content**

This course deepens students' understanding of Bayesian methods and introduces the latest advancements in Bayesian computation. It is designed for Master students in Computer Science, Mathematics, Econometrics, Techno-Mathematics, Business Informatics, or similar programs seeking to enhance their expertise.

Examples of topics covered are the review of key Bayesian concepts including Bayes' Theorem, conjugate prior distributions, and posterior inference. For instance, students may explore the Beta-Binomial conjugacy, where a Beta prior pairs with a Binomial likelihood, and the Normal-Normal conjugacy, where a Normal prior pairs with a normal likelihood with known variance. These examples demonstrate how conjugate priors simplify posterior calculations and enhance analytical tractability.

Next, students delve into Bayesian supervised learning, covering linear, logistic, and nonparametric approaches, with an emphasis on applying Bayesian methods to real-world data and interpreting results.

The course also covers ways to perform posterior estimation, such as, Markov Chain Monte Carlo (MCMC) inference, including the Metropolis-Hastings algorithm and Gibbs sampling. We explore Bayesian high-dimensional regression techniques, such as the horseshoe prior, for handling models with many predictors. Additionally, students will learn about mixture models and Dirichlet processes, which are powerful tools for modelling heterogeneous data and uncovering latent structures.

We conclude with approximate inference methods, including variational inference and Approximate Bayesian Computation (ABC), essential for dealing with complex models and large datasets.

**Workload**

Lecture with 2 SWS + 1 SWS exercise  
 5 ECTS corresponds to approx. 150 hours  
 approx. 30 hours lecture attendance,  
 approx. 15 hours exercise attendance,  
 approx. 80 hours post-processing (self-study)  
 approx. 25 hours exam preparation (self-study)

**Recommendations**

- Knowledge in R or Python
- Mathematics-heavy lecture. The basics will be reviewed, but mathematical proficiency is helpful

## M

**5.4 Module: Advanced Data Structures [M-INFO-107200]**

**Coordinators:** Prof. Dr. Peter Sanders  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
5 CP

**Grading**  
graded

**Recurrence**  
Each summer term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                             |      |         |
|---------------|-------------------------------------------------------------|------|---------|
| T-INFO-114223 | <a href="#">Advanced Data Structures</a>                    | 4 CP | Sanders |
| T-INFO-114224 | <a href="#">Advanced Data Structures Project/Experiment</a> | 1 CP | Sanders |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students acquire a systematic understanding of algorithmic issues and solution approaches in the area of advanced data structures, building on existing knowledge in the subject area of algorithms. They will also be able to apply learned techniques to related problems and interpret and comprehend current research topics in this area.

Upon successful completion of the course, students will be able to:

- explain terms, structures, basic problem definitions, and algorithms from the lecture;
- select which algorithms and data structures are suitable for solving a problem and, if necessary, adapt them to the requirements of a specific problem;
- use algorithms and data structures, analyze them mathematically, and prove the algorithmic properties.

**Content**

In this lecture we deal with modern data structures for fundamental objects such as trees, graphs, integers, and strings. These data structures are the basis for many applications and an important part of efficient algorithms. We look at highlights from different research areas and learn techniques for solving a wide variety of problems.

In addition to the theoretical analysis of data structures, we also look at the practical performance of the various data structures and their applications.

**Workload**

The lectures including the project/experiment with 5 CP corresponds to 150 working hours, which are divided approximately as follows:

- ca. 30 hours attending lectures
- ca. 60 hours preparing and following-up lectures
- ca. 30 hours working on the project/experiment
- ca. 30 hours preparing for the examination



## M

**5.5 Module: Advanced Machine Learning and Data Science [M-WIWI-105659]****Coordinators:** Prof. Dr. Maxim Ulrich**Organisation:** KIT Department of Business and Economics**Part of:** [Economics and Management \(Business Administration\)](#)**Credits**  
9 CP**Grading**  
graded**Recurrence**  
Each term**Duration**  
1 term**Language**  
English**Level**  
4**Version**  
3

| Mandatory     |                                                            |      |        |
|---------------|------------------------------------------------------------|------|--------|
| T-WIWI-111305 | <a href="#">Advanced Machine Learning and Data Science</a> | 9 CP | Ulrich |

**Assessment**

The assessment is carried out in an alternative form. The 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**

None

**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.

**Recommendations**

None

**Teaching and Learning Methods**

Project

**M****5.6 Module: Advanced Topics in AI: Graph Neural Networks and Language Models [M-WIWI-106804]**

**Coordinators:** Dr.-Ing. Tobias Käfer  
**Organisation:** KIT Department of Business and Economics  
**Part of:** Informatics

| Credits | Grading | Recurrence | Duration | Language       | Level | Version |
|---------|---------|------------|----------|----------------|-------|---------|
| 9 CP    | graded  | Each term  | 2 terms  | German/English | 4     | 1       |

| Compulsory Elective Courses (Election: at least 2 items) |                                   |        |                                      |
|----------------------------------------------------------|-----------------------------------|--------|--------------------------------------|
| T-WIWI-102666                                            | Knowledge Discovery               | 4,5 CP | Käfer                                |
| T-WIWI-110548                                            | Advanced Lab Informatics (Master) | 4,5 CP | Professorenschaft des Instituts AIFB |

**Assessment**

The assessment mix of each course of this module is defined for each course separately. The final mark for the module is the average of the marks for each course weighted by the credits and truncated after the first decimal.

**Prerequisites**

None

**Competence Goal**

The student

- knows the basics of machine learning, data mining and knowledge discovery,
- can design, train and evaluate systems that are capable of learning,
- knows advanced concepts and methods, especially in the areas of Graph Neural Networks (GNNs) and Large Language Models (LLMs),
- can carry out knowledge discovery projects, taking into account algorithms, representations and applications,
- can apply interdisciplinary thinking to solve applied problems from different domains.

**Content**

The module focuses on machine learning and data mining methods for gaining knowledge from large data sets. In particular, advanced methods from the areas of Graph Neural Networks (GNNs) and Large Language Models (LLMs) are considered.

The lecture on Knowledge Discovery provides an overview of machine learning and data mining approaches for knowledge discovery from large data sets. These are examined in particular with regard to algorithms, applicability to different data representations and use in real application scenarios. Knowledge discovery is an established field of research with a large community investigating methods for discovering patterns and regularities in large amounts of data, including unstructured text.

A variety of methods exist to extract patterns and provide previously unknown insights. This information can be predictive or descriptive. The lecture will cover specific techniques and methods, challenges, and current and future research topics in this research area. The lecture covers the entire machine learning and data mining process, with topics on supervised and unsupervised learning methods and empirical evaluation.

The learning methods covered range from classical approaches such as decision trees, support vector machines and neural networks to selected approaches from current research. The learning problems considered include feature vector-based learning and text mining. The focus is particularly on advanced methods from the areas of Graph Neural Networks (GNNs) and Large Language Models (LLMs). In the practical course (Praktikum) on Knowledge Discovery, students apply the approaches and methods taught in the lecture to problems from different domains hands-on.

**Workload**

The total workload for this module is approximately 270 hours.

## M

**5.7 Module: Advanced Topics in AI: Knowledge Graphs and the Web [M-WIWI-106803]****Coordinators:** Dr.-Ing. Tobias Käfer**Organisation:** KIT Department of Business and Economics**Part of:** [Informatics](#)**Credits**  
9 CP**Grading**  
graded**Recurrence**  
Each term**Duration**  
2 terms**Language**  
German/English**Level**  
4**Version**  
1

| Compulsory Elective Courses (Election: 2 items) |                                                   |        |                                      |
|-------------------------------------------------|---------------------------------------------------|--------|--------------------------------------|
| T-WIWI-110848                                   | <a href="#">Semantic Web Technologies</a>         | 4,5 CP | Käfer                                |
| T-WIWI-110548                                   | <a href="#">Advanced Lab Informatics (Master)</a> | 4,5 CP | Professorenschaft des Instituts AIFB |

**Assessment**

The assessment mix of each course of this module is defined for each course separately. The final mark for the module is the average of the marks for each course weighted by the credits and truncated after the first decimal.

**Competence Goal**

Students

- know the foundations and technologies used to build Knowledge Graphs.
- develop ontologies for semantic knowledge representation.
- are able to provide data and applications via a Web-based infrastructure.
- know foundations and advanced methods of symbolic reasoning on Knowledge Graphs.
- transfer the methods and technologies of semantic web technologies to various application domains.
- evaluate the potential of semantic web technologies for new application domains.
- are able to practically apply the aforementioned skills to solve problems from various application domains.

**Content**

This module covers a sub-area of artificial intelligence: (semantic) knowledge representation. The module presents the fundamentals, methods and applications for knowledge graph-based AI systems on the World Wide Web. We focus particularly on methods for semantic modelling and the decentralized provision of data and applications via the Web. Formal basics and practical aspects of semantic knowledge modeling are discussed in detail. Furthermore, technical details about the provision of data sets and their metadata on the Web based on Web standards are covered. In the practical course (Praktikum), students apply the skills acquired in the lecture to practical problems in different domains.

**Workload**

The total workload for this module is approximately 270 hours (9 credits). The allocation is based on the credits of the courses of the module. The workload for courses with 4.5 credits is about 135 hours.

The total number of hours per course results from the effort required to attend the lectures and exercises as well as the examination times and the time required to achieve the learning objectives of the module for an average student for an average performance.

## M

**5.8 Module: Advanced Topics in Public Finance [M-WIWI-101511]**

**Coordinators:** Prof. Dr. Berthold Wigger  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [Economics and Management \(Economics\)](#)

**Credits**  
9 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
2 terms

**Language**  
German

**Level**  
4

**Version**  
7

| Electives (Election: between 1 and 2 items)             |                                                                           |        |                   |
|---------------------------------------------------------|---------------------------------------------------------------------------|--------|-------------------|
| T-WIWI-108711                                           | <a href="#">Basics of German Company Tax Law and Tax Planning</a>         | 4,5 CP | Gutekunst, Wigger |
| T-WIWI-102740                                           | <a href="#">Public Management</a>                                         | 4,5 CP | Wigger            |
| Supplementary Courses (Election: between 0 and 1 items) |                                                                           |        |                   |
| T-WIWI-111304                                           | <a href="#">Fundamentals of National and International Group Taxation</a> | 4,5 CP | Wigger            |
| T-WIWI-102739                                           | <a href="#">Public Revenues</a>                                           | 4,5 CP | Wigger            |

**Assessment**

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**

At least one of the courses "Public Management" or "Basics of German Company Tax Law and Tax Planning" is mandatory in the module and must be successfully examined.

**Competence Goal**

The student

- understands the theory and politics of taxation
- has knowledge in the area of public debt.
- understands efficiency problems of public organizations.
- is able to work on fiscal problems.

**Content**

As a branch of Economics, Public Finance is concerned with the theory and policy of the public sector and its interrelations with the private sector. It analyzes the economic role of the state from a normative as well as from a positive point of view. The normative view examines efficiency- and equity-oriented motives for government intervention and develops fiscal policy guidelines. The positive view explains the actual behavior of economic agents in public sector affairs.

In the course of the lectures within this module the students achieve knowledge in the areas of public revenues, national and international law of taxation and theory of public sector organizations.

**Additional Information**

The course T-WIWI-102790 "Specific Aspects in Taxation" will no longer be offered in the module as of winter semester 2018/2019.

Students who successfully passed the exam in „Public Management“ before the introduction of the module “Advanced Topics in Public Finance” in winter term 2014/15 are allowed to take both courses “Public Revenues” and “Specific Aspects in Taxation”.

**Workload**

Total workload for 9 credit points: approx. 270 hours.

Attendance time: approx. 90 hours

Preparation and follow-up: approx. 135 hours

Exam and exam preparation: approx. 45 hours

The exact distribution is based on the credit points of the courses in the module.

**Recommendations**

Basic knowledge in the area of public finance and public management is required.

## M

**5.9 Module: Advanced Topics in Strategy and Management [M-WIWI-103119]**

**Coordinators:** Prof. Dr. Hagen Lindstädt  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [Economics and Management \(Business Administration\)](#)

**Credits**  
9 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
2 terms

**Language**  
German

**Level**  
4

**Version**  
1

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

|               |                                                                                |      |           |
|---------------|--------------------------------------------------------------------------------|------|-----------|
| T-WIWI-106188 | <a href="#">Workshop Current Topics in Strategy and Management</a>             | 3 CP | Lindstädt |
| T-WIWI-106189 | <a href="#">Workshop Business Wargaming – Analyzing Strategic Interactions</a> | 3 CP | Lindstädt |
| T-WIWI-106190 | <a href="#">Strategy and Management Theory: Developments and “Classics”</a>    | 3 CP | Lindstädt |

**Assessment**

The control of success takes place in the form of partial examinations (according to §4(2), 1-3 SPO) on the courses of the module, amounting to a total of 9 LP. The performance review is described for each course of this module. The overall grade of the module is formed from the LP-weighted grades of the partial examinations and truncated after the first decimal place.

**Prerequisites**

None

**Competence Goal**

After completing the module, students will be able to

- independently analyze strategic issues and derive recommendations in a structured manner using suitable models and reference frameworks of management theory.
- present their position convincingly in structured discussions using a well-thought-out line of argument.
- deal independently with a current, research-oriented question from strategic management.
- draw his/her own conclusions from the less structured information, drawing on his/her interdisciplinary knowledge and selectively developing current research findings.
- apply and discuss theoretical contents of management theory to real-life situations by intensively dealing with a large number of practice-relevant case studies.

**Content**

The content will focus on three areas. Firstly, strategic issues are discussed and analyzed on the basis of jointly selected case studies. Secondly, the students deal intensively with the topic of business wargaming in a workshop and analyze strategic interactions. Thirdly, topics of strategy and management theory are developed in a written paper.

**Additional Information**

The module is admission-restricted. Once you have been admitted to a course, you are guaranteed the opportunity to complete the module. The examinations are offered at least every second semester so that the entire module can be completed in two semesters.

**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. The workload for courses with 3 credits is approx. 90h.

## M

**5.10 Module: Algorithm Engineering [M-INFO-100795]**

**Coordinators:** Prof. Dr. Peter Sanders  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

| Credits | Grading | Recurrence       | Duration | Language | Level | Version |
|---------|---------|------------------|----------|----------|-------|---------|
| 5 CP    | graded  | Each summer term | 1 term   | English  | 4     | 4       |

| Mandatory     |                            |      |         |
|---------------|----------------------------|------|---------|
| T-INFO-101332 | Algorithm Engineering      | 4 CP | Sanders |
| T-INFO-111856 | Algorithm Engineering Pass | 1 CP | Sanders |

**Assessment**

See partial achievements (Teilleistung)

There are two partial achievements Algorithm Engineering and Algorithm Engineering Exercises. The partial achievement Algorithm Engineering Exercises must be started to be allowed to take the oral examination for Algorithm Engineering.

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

The students acquire a systematic understanding of algorithmic problems and solution approaches in the field of Algorithm Engineering, building on existing knowledge in the subject area of algorithms. In addition, they will be able to apply learned techniques to related problems and interpret and comprehend current research topics in the field of Algorithm Engineering.

Upon successful completion of the course, the student will be able to

- Explain terms, structures, basic problem definitions, and algorithms from the lecture;
- select which algorithms and data structures are suitable for solving an algorithmic problem and, if necessary, adapt them to the requirements of a specific problem;
- Execute algorithms and data structures, analyze them mathematically precise and prove the algorithmic properties;
- Explain machine models from the lecture and analyze algorithms and data structures according to these models
- Analyze new problems from applications, reduce them to their algorithmic core and create a suitable abstract model; based on the concepts and techniques learned in the lecture, design and analyze own solutions in this model, and prove algorithmic properties in this model.

**Content**

- What is Algorithm Engineering, Motivation etc.
- Realistic modeling of machines and applications
- practice-oriented algorithm design
- implementation techniques
- experimental techniques
- evaluation of measurements

The above skills are taught primarily using concrete examples. In the past these were for example the following topics from the area of basic algorithms and data structures:

- linked lists without special cases
- sorting: parallel, external, superscalar,...
- priority queues (cache efficient,...)
- search trees for integer keys
- Full text indexes
- graph algorithms: minimal spanning trees (external,...), route planning

In each of these cases, the focus is on the best known practical and theoretical methods. These usually differ considerably from the methods taught in beginners' lectures.

**Workload**

Lecture and exercise with a combined 3 semester hours, 5 ECTS

5 ECTS correspond to about 150h of work, split into

about 45h visiting lectures and exercise or block seminar

about 25h preparation and follow-up on lectures

about 40h solving exercise tasks (programming, preparing presentation for mini seminar, etc)

about 40h exam preparation

## M

**5.11 Module: Algorithmic Graph Theory [M-INFO-106960]**

**Coordinators:** Dr. rer. nat. Torsten Ueckerdt  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
5 CP

**Grading**  
graded

**Recurrence**  
Irregular

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                          |      |          |
|---------------|------------------------------------------|------|----------|
| T-INFO-113918 | <a href="#">Algorithmic Graph Theory</a> | 5 CP | Ueckerdt |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students know the basic concepts of algorithmic graph theory and the most important graph classes and their characterizations in this context, namely perfect graphs, chordal graphs, comparability graphs, as well as interval, split and permutation graphs. They will also be able to execute and analyze algorithms for recognizing these graphs and for solving basic algorithmic problems on these graphs. They are also able to identify subproblems in applied problems that can be expressed using these graph classes and to develop algorithms for new problems on these graph classes that are related to problems from the lectures.

**Content**

Many basic problems that arise in many contexts, such as coloring problems or finding independent sets and maximal cliques, are NP-hard in general graphs. However, instances of these difficult problems that occur in applications are often much more structured and can therefore be solved efficiently. The lecture first introduces perfect graphs and their most important subclass, chordal graphs, and presents algorithms for various generally NP-hard problems on chordal graphs. Subsequently, in-depth concepts such as comparability graphs are discussed, with the help of which various other graph classes (interval, split and permutation graphs) can be characterized and recognized, and tools for the design of specialized algorithms for these are presented.

**Workload**

Lecture with 3SWS, 5CP

5 CP corresponds to approx. 150 working hours, of which

approx. 45h lecture attendance

approx. 60 hours of follow-up work and completion of exercises

approx. 45h exam preparation

**Recommendations**

See partial achievements (Teilleistung)



M

5.12 Module: Algorithmic Network Analysis [M-INFO-107460]

**Coordinators:** Prof. Dr. Henning Meyerhenke  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

| Credits | Grading | Recurrence | Duration | Language | Level | Version |
|---------|---------|------------|----------|----------|-------|---------|
| 5 CP    | graded  | Irregular  | 1 term   | German   | 4     | 1       |

| Mandatory     |                                     |      |            |
|---------------|-------------------------------------|------|------------|
| T-INFO-114642 | Algorithmic Network Analysis        | 3 CP | Meyerhenke |
| T-INFO-114643 | Algorithmic Network Analysis - Pass | 2 CP | Meyerhenke |

## M

**5.13 Module: Algorithms for Routing [M-INFO-100031]****Coordinators:** Prof. Dr. Henning Meyerhenke**Organisation:** KIT Department of Informatics**Part of:** [Informatics](#)**Credits**  
5 CP**Grading**  
graded**Recurrence**  
Each summer term**Duration**  
1 term**Language**  
German**Level**  
4**Version**  
1

| Mandatory     |                                        |      |                   |
|---------------|----------------------------------------|------|-------------------|
| T-INFO-100002 | <a href="#">Algorithms for Routing</a> | 5 CP | Laupichler, Sauer |

## M

**5.14 Module: Algorithms for Visualization of Graphs [M-INFO-106961]**

**Coordinators:** Dr. rer. nat. Torsten Ueckerdt  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
5 CP

**Grading**  
graded

**Recurrence**  
Irregular

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                        |      |          |
|---------------|----------------------------------------|------|----------|
| T-INFO-113919 | Algorithms for Visualization of Graphs | 5 CP | Ueckerdt |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students acquire a systematic understanding of algorithmic problems and solution approaches in the field of graph visualization, which builds on existing knowledge in the areas of graph theory and algorithmics.

After successfully completing the course, students will be able to

- explain concepts, structures and basic problem definitions from the lecture;
- execute layout algorithms for different graph classes, analyze them mathematically precisely and prove the algorithmic properties;
- explain complexity results from the lecture and independently perform similar reduction proofs for new layout problems;
- select which algorithms are suitable for solving a given layout problem and, if necessary, adapt them to the requirements of a concrete problem;
- select which algorithms are suitable for solving a given layout problem and, if necessary, adapt them to the requirements of a concrete problem. adapt them to the requirements of a specific problem;
- analyze unknown visualization problems from graph drawing applications, reduce them to their algorithmic core and create an abstract model from this; design and analyze their own solutions in this model based on the concepts and techniques learned in the lecture and prove the algorithmic properties.

**Content**

Networks are relationally structured data that are increasingly appearing in a wide variety of application areas. Examples range from physical networks, such as transportation and supply networks, to abstract networks, such as social networks. Network visualization is a fundamental tool for the investigation and understanding of networks.

Mathematically, networks can be modelled as graphs and the visualization problem can be reduced to the algorithmic core problem of determining a layout of the graph, i.e. suitable node and edge positions in the plane. Depending on the application and graph class, different requirements are placed on the type of drawing and the quality criteria to be optimized. The research field of graph drawing draws on approaches from classical algorithmics, graph theory and algorithmic geometry.

During the course, a representative selection of visualization algorithms will be presented and discussed in depth.

**Workload**

Lecture and exercise with 3 SWS, 5 LP  
 5 LP corresponds to approx. 150 working hours, of which  
 approx. 45 hours attendance of the lecture and exercise,  
 approx. 25 hours preparation and follow-up,  
 approx. 40 hours working on the exercise sheets  
 approx. 40 hours exam preparation

## M

**5.15 Module: Algorithms II [M-INFO-107201]**

**Coordinators:** Prof. Dr. Peter Sanders  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |               |      |         |
|---------------|---------------|------|---------|
| T-INFO-114225 | Algorithms II | 6 CP | Sanders |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

The student has an in-depth insight into the theoretical and practical aspects of algorithms and is able to identify and formally formulate algorithmic problems in various application areas. Furthermore, they know advanced algorithms and data structures from the areas of graph algorithms, algorithmic geometry, string matching, algebraic algorithms, combinatorial optimization, and external memory algorithms. They are able to independently understand algorithms they are unfamiliar with, associate them with the above areas, apply them, determine their running time, evaluate them, and select appropriate algorithms for given applications. Furthermore, the student is able to adapt existing algorithms to related problems. In addition to algorithms for concrete problems, the student knows advanced techniques of algorithmic design. This includes parameterized algorithms, approximation algorithms, online algorithms, randomized algorithms, parallel algorithms, linear programming, and algorithm engineering techniques. For given algorithms, the student is able to identify techniques used to better understand these algorithms. In addition, they are able to select appropriate techniques for a given problem and use them to design their own algorithms.

**Content**

This module is designed to provide students with the basic theoretical and practical aspects of algorithm design, analysis, and engineering. It teaches general methods for designing and analyzing algorithms for basic algorithmic problems, as well as the basic principles of general algorithmic methods such as approximation algorithms, linear programming, randomized algorithms, parallel algorithms, and parameterized algorithms.

**Workload**

Lecture with 3 semester hours + 1 semester hour exercise

6 ECTS correspond to about 180 hours

about 45h visiting the lectures

about 15h visiting the exercises

about 90h follow-up of lectures and solving the exercise sheets

about 30h preparation for the exam

## M

**5.16 Module: Analytics and Statistics [M-WIWI-101637]**

**Coordinators:** Prof. Dr. Oliver Grothe  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [Economics and Management \(Statistics\)](#)

| Credits | Grading | Recurrence | Duration | Language | Level | Version |
|---------|---------|------------|----------|----------|-------|---------|
| 9 CP    | graded  | Each term  | 2 terms  | German   | 4     | 5       |

| Mandatory                                                   |                                                                                                   |        |           |
|-------------------------------------------------------------|---------------------------------------------------------------------------------------------------|--------|-----------|
| T-WIWI-103123                                               | <a href="#">Advanced Statistics</a>                                                               | 4,5 CP | Grothe    |
| Supplementary Courses (Election: between 4,5 and 5 credits) |                                                                                                   |        |           |
| T-WIWI-114746                                               | <a href="#">Selected Topics in Statistics and Analytics: Seminal Papers in Theory and Methods</a> | 4,5 CP | Grothe    |
| T-WIWI-106341                                               | <a href="#">Machine Learning 2 - Advanced Methods</a>                                             | 4,5 CP | Zöllner   |
| T-WIWI-111247                                               | <a href="#">Mathematics for High Dimensional Statistics</a>                                       | 4,5 CP | Grothe    |
| T-WIWI-103124                                               | <a href="#">Multivariate Statistical Methods</a>                                                  | 4,5 CP | Grothe    |
| T-WIWI-112109                                               | <a href="#">Topics in Stochastic Optimization</a>                                                 | 4,5 CP | Rebennack |

**Assessment**

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

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

**Prerequisites**

For all students, the course "Advanced Statistics" within this module is compulsory and must be taken.

**Exception for Students of Economathematics:** Students enrolled in the Economathematics degree program are exempt from the compulsory requirement to take the "Advanced Statistics" course. Instead, they are permitted to choose any two courses offered within this module. As the technical registration of this choice cannot be performed independently in the Campus system, students of Economathematics are kindly requested to contact the Examination Office of the Department of Economics and Management directly for correct module registration and exam enrollment.

**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

**Additional Information**

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

**Workload**

The total workload for this module is approximately 270 hours.

## M

**5.17 Module: Applied Strategic Decisions [M-WIWI-101453]**

**Coordinators:** Prof. Dr. Johannes Philipp Reiß  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [Economics and Management \(Economics\)](#)

**Credits**  
9 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
7

| Mandatory                                                   |                                                                                           |        |                      |
|-------------------------------------------------------------|-------------------------------------------------------------------------------------------|--------|----------------------|
| T-WIWI-102861                                               | <a href="#">Advanced Game Theory</a>                                                      | 4,5 CP | Ehrhart, Puppe, Reiß |
| Supplementary Courses (Election: between 4,5 and 5 credits) |                                                                                           |        |                      |
| T-WIWI-113469                                               | <a href="#">Advanced Corporate Finance</a>                                                | 4,5 CP | Ruckes               |
| T-WIWI-102613                                               | <a href="#">Auction Theory</a>                                                            | 4,5 CP | Ehrhart              |
| T-WIWI-115061                                               | <a href="#">Experimental Research in Economics and Information Systems</a>                | 4,5 CP | Weinhardt            |
| T-WIWI-102623                                               | <a href="#">Financial Intermediation</a>                                                  | 4,5 CP | Ruckes               |
| T-WIWI-105781                                               | <a href="#">Incentives in Organizations</a>                                               | 4,5 CP | Nieken               |
| T-WIWI-112823                                               | <a href="#">Platform &amp; Market Engineering: Commerce, Media, and Digital Democracy</a> | 4,5 CP | Weinhardt            |
| T-WIWI-102862                                               | <a href="#">Predictive Mechanism and Market Design</a>                                    | 4,5 CP | Reiß                 |

**Assessment**

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**

The course "Advanced Game Theory" is obligatory. Exception: The course "Introduction to Game Theory" was completed. Even those who have already successfully proven "Advanced Game Theory" in another master module can take the module. In this case you can choose freely from the rest of the offer. However, this choice can only be made by the examination office of the Department of Economics and Management.

**Competence Goal**

Students

- can model and analyze complex situations of strategic interaction using advanced game theoretic concepts;
- are provided with essential and advanced game theoretic solution concepts on a rigorous level and can apply them to understand real-life problems;
- learn about the experimental method, ranging from designing an economic experiment to data analysis.

**Content**

The module provides solid skills in game theory and offers a broad range of game theoretic applications. To improve the understanding of theoretical concepts, it pays attention to empirical evidence as well.

**Additional Information**

The course *Predictive Mechanism and Market Design* is not offered each year.

**Workload**

The total workload for this module is approximately 270 hours. The exact distribution is made according to the credit points of the courses of the module.

**Recommendations**

Basic knowledge in game theory is assumed.

## M

**5.18 Module: Artificial Intelligence [M-WIWI-105366]****Coordinators:** Dr.-Ing. Tobias Käfer**Organisation:** KIT Department of Business and Economics**Part of:** Informatics**Credits**  
9 CP**Grading**  
graded**Recurrence**  
Each term**Duration**  
2 terms**Language**  
German/English**Level**  
4**Version**  
2

| Compulsory Elective Courses (Election: at least 2 items) |                                                   |        |                                      |
|----------------------------------------------------------|---------------------------------------------------|--------|--------------------------------------|
| T-WIWI-102666                                            | <a href="#">Knowledge Discovery</a>               | 4,5 CP | Käfer                                |
| T-WIWI-110848                                            | <a href="#">Semantic Web Technologies</a>         | 4,5 CP | Käfer                                |
| T-WIWI-110548                                            | <a href="#">Advanced Lab Informatics (Master)</a> | 4,5 CP | Professorenschaft des Instituts AIFB |

**Assessment**

The assessment mix of each course of this module is defined for each course separately. The final mark for the module is the average of the marks for each course weighted by the credits and truncated after the first decimal.

**Prerequisites**

None

**Competence Goal**

The student

- understands the concepts behind Semantic Web and Linked Data technologies
- develops ontologies to be employed in semantic web-based applications and chooses suitable representation languages,
- is familiar with approaches in the area of knowledge representation and modelling,
- is able to transfer the methods and technologies of semantic web technologies to new application sectors,
- evaluates the potential of semantic web for new application sectors,
- understands the challenges in the areas of Data and system integration on the web is able to develop solutions.
- know the basics of machine learning, data mining and knowledge discovery
- can design, train and evaluate systems that are capable of learning
- carry out knowledge discovery projects, taking into account algorithms, representations and applications.

**Content**

The focus of the module is on Semantic Web Technologies as well as machine learning and data mining methods for knowledge acquisition from large databases.

The goal of the semantic web is the meaning (semantics) of data on the web for intelligent systems, e.g. in e-commerce and to make Internet portals usable. The representation of knowledge in the form of RDF and ontologies, the provision of data as Linked Data, as well as the request of data using SPARQL. In this lecture the basics of knowledge representation and processing for the corresponding technologies and application examples are presented.

The lecture "Knowledge Discovery" gives an overview of approaches of machine learning and data mining for knowledge extraction from large data sets. These are examined especially with regard to algorithms, applicability to different data representations and the use in real application scenarios.

Knowledge Discovery is an established research area with a large community that investigates methods for discovering patterns and regularities in large amounts of data, including unstructured text. A variety of methods exist to extract patterns and provide previously unknown insights. This information can be predictive or descriptive.

The lecture gives an overview of Knowledge Discovery. Specific techniques and methods, challenges and current and future research topics in this research area will be taught.

Contents of the lecture cover the entire machine learning and data mining process with topics on supervised and unsupervised learning and empirical evaluation. Covered learning methods range from classical approaches like decision trees, support vector machines and neural networks to selected approaches from current research. Learning problems considered include feature vector-based learning and text mining.

**Workload**

The total workload for this module is approximately 270 hours.

## M

**5.19 Module: Artificial Intelligence & IT-Security [M-INFO-106810]****Coordinators:** Prof. Dr. Christian Wressnegger**Organisation:** KIT Department of Informatics**Part of:** Informatics**Credits**  
6 CP**Grading**  
graded**Recurrence**  
Each winter term**Duration**  
1 term**Language**  
English**Level**  
4**Version**  
1

| Mandatory     |                                       |      |             |
|---------------|---------------------------------------|------|-------------|
| T-INFO-113668 | Artificial Intelligence & IT-Security | 6 CP | Wressnegger |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students know basic concepts of applying artificial intelligence and machine learning in computer security, and are able to evaluate the performance, quality, and security of such systems.

- Students know and understand basic concepts of features and feature engineering in computer security as well as basic attacks against learning-based systems.
- Students know how to apply AI in computer security.
- Students are able to differentiate attack vectors against AI.
- Students understand limits of learning-based security solutions.

**Content**

The lecture is about combining the fields of artificial intelligence, machine learning and computer security in practice. Many tasks in the computer security landscape are based on manual labor, such as searching for vulnerabilities or analyzing malware. Here, machine learning can be used to establish a higher degree of automation, providing more “intelligent” security solutions (AI for Security). However, also these learning-based systems can be attacked and need to be secured (Security of AI). As an example, viciously crafted inputs can be exploited by an adversary to cause devastating damage in the application area. It thus is of utmost importance to investigate, research, and know about the security properties of AI methods.

The module introduces students to theoretic and practical aspects of AI in computer security as well as security of AI. We cover basics on features and feature engineering in the security domain, discuss fundamental learning settings in security and point out “Dos and Don’ts” of using AI/ML in computer security. Moreover, we put particular focus on “Explainable AI” (XAI) and its use in computer security, before we introduce attacks and defense against learning-based systems as discussed in the first half of the course. We cover input-manipulation attacks (e.g., adversarial examples), model-manipulation attacks (e.g., backdooring attacks), privacy attacks (e.g., model stealing and membership inference) and attacks against XAI.

**Workload**

- 58h attendance time
- 56h preparation and follow-up time
- 66h exam preparation

**Recommendations**

The basics of IT security and artificial intelligence are a prerequisite.



## M

**5.20 Module: Authentication and Encryption [M-INFO-105338]**

**Coordinators:** Prof. Dr. Jörn Müller-Quade  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
4 CP

**Grading**  
graded

**Recurrence**  
Each summer term

**Duration**  
1 term

**Language**  
German

**Level**  
4

**Version**  
1

| Mandatory     |                               |      |              |
|---------------|-------------------------------|------|--------------|
| T-INFO-110824 | Authentication and Encryption | 4 CP | Müller-Quade |

**Assessment**

See Partial Achievements (Teilleistung).

**Prerequisites**

See Partial Achievements (Teilleistung).

**Competence Goal**

The student

- can explain the terms confidentiality and authenticity and point out their differences,
- understand the basic security objectives of digital signatures and their relationship to each other and can apply them,
- knows and understands important signature procedures from theory and practice and can explain them,
- understand definitions of actively secure encryption and can explain and apply them,
- can explain procedures for constructing actively secure encryption,
- can understand and apply elementary proof techniques such as reductions and hybrid arguments

**Content**

The guarantee of authenticity and secrecy is a security requirement that arises in many applications.

Building on the lecture "Theoretical Foundations of Cryptography", this lecture deepens the consideration of cryptographic authentication methods (especially signatures and message authentication codes) and actively secure encryption methods.

The focus of the lecture is on various techniques for the construction of digital signature methods as well as the proof of the security properties achieved. For example, the following topics are covered:

- One-time signatures, tree-based signatures and chameleon hash functions
- RSA-based signatures
- Signatures in bilinear groups

In the second part of the lecture, encryption methods that offer security against active attacks are presented. For example, the following constructions are presented:

- Authenticated encryption in the symmetric case
- Methods for constructing actively secure asymmetric encryption

**Workload**

Attendance time in the lecture: 24 h Preparation/follow-up of the lecture: 31 h Exam preparation and attendance in the lecture: 65 h

**Recommendations**

Students should be familiar with the contents of the module "Theoretical Foundations of Cryptography"

## M

**5.21 Module: Automated Planning and Scheduling [M-INFO-104447]**

**Coordinators:** Prof. Dr. Peter Sanders  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
5 CP

**Grading**  
graded

**Recurrence**  
Irregular

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                   |      |         |
|---------------|-----------------------------------|------|---------|
| T-INFO-109085 | Automated Planning and Scheduling | 5 CP | Sanders |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

- The students will be able to model various planning tasks in the PDDL language and solve them using off-the-shelf planners.
- The students will understand the approaches used in automated planning and scheduling algorithms, which will allow them to efficiently model and solve real world planning and scheduling problems by selecting the proper algorithms for the given task.

**Content**

The course offers an introduction to the methods and techniques used in automated planning and scheduling. The course is focused on classical deterministic planning, i.e., planning in a fully observable deterministic environment. The students will learn how to use automated planners and schedulers and also how they work. The topics covered in the lecture include:

- applications of automated planning in artificial intelligence
- formalization of planning problems and the PDDL language
- computational complexity of planning and scheduling
- basic state space search algorithms (forwards/backwards search)
- heuristic search algorithms and planning heuristics
- plan space planning
- planning graph and the graph plan algorithm
- satisfiability based planning
- hierarchical task network planning
- classical scheduling approaches
- constraint-based scheduling
- planning for virtual agents in computer games

**Workload**

2 SWS lecture + 1 SWS exercises

(Preparation and follow-up time: 4h/week for lecture plus 2h/week for exercises; exam preparation: 15h)

Total workload: (2 SWS + 1 SWS + 4 SWS + 2 SWS) x 15h + 15h exam preparation = 9x15h + 15h = 150h = 5 ECTS

## M

**5.22 Module: Automated Visual Inspection and Image Processing [M-INFO-100826]**

**Coordinators:** Prof. Dr.-Ing. Jürgen Beyerer  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
German

**Level**  
4

**Version**  
1

**Mandatory**

|               |                                                  |      |         |
|---------------|--------------------------------------------------|------|---------|
| T-INFO-101363 | Automated Visual Inspection and Image Processing | 6 CP | Beyerer |
|---------------|--------------------------------------------------|------|---------|

**Assessment**

See Partial Achievements (Teilleistung)

**Prerequisites**

See Partial Achievements (Teilleistung)

**Competence Goal**

- Students have a sound knowledge of the basic methods of image processing (pre-processing and image enhancement, image restoration, segmentation, morphological image processing, texture analysis, detection, image pyramids, multiscale analysis and wavelet transformation).
- Students are able to develop and evaluate solution concepts for automatic visual inspection tasks.
- Students have a sound knowledge of various sensors and methods for recording image data as well as the relevant optical principles
- Students are familiar with different concepts for describing image-based data and know the necessary system-theoretical methods and correlations.

**Content**

- Sensors and methods for image acquisition
- Light and color
- Image signals
- Wave optics
- Pre-processing and image enhancement
- Image restoration
- Segmentation
- Morphological image processing
- Texture analysis
- Detection
- Image pyramids, multiscale analysis and wavelet transformation

**Workload**

Total: approx. 180h, of which

1. Attendance time in lectures: 46h
2. Preparation/follow-up of the same: 44h
3. Exam preparation and attendance in the same: 90h

**Recommendations**

See Partial Achievements (Teilleistung)

## M

**5.23 Module: Beating the Worst-Case in Practice: Unexpectedly Efficient Algorithms [M-INFO-107599]**

**Coordinators:** TT-Prof. Dr. Thomas Bläsius  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

| Credits | Grading | Recurrence | Duration | Language | Level | Version |
|---------|---------|------------|----------|----------|-------|---------|
| 6 CP    | graded  | Irregular  | 1 term   | English  | 4     | 1       |

| Mandatory     |                                                                       |      |         |
|---------------|-----------------------------------------------------------------------|------|---------|
| T-INFO-114898 | Beating the Worst-Case in Practice: Unexpectedly Efficient Algorithms | 6 CP | Bläsius |

**Assessment**

See partial achievements. (Teilleistung)

**Prerequisites**

See partial achievements. (Teilleistung)

**Competence Goal**

The students

- can practically apply the knowledge acquired in the basic modules on algorithm engineering,
- are able to independently produce efficient implementations of algorithmic methods,
- master the methodology for the practical evaluation of algorithms, including the processing, analysis, and interpretation of measurement data,
- possess the ability to communicate the results they obtain.

In addition, participants are able to analyze how various typical properties of instances influence the efficiency of algorithms.

**Content**

In this lab, students implement and evaluate a set of given algorithmic approaches on their own. The emphasis is on methods that, on real-world instances, perform far better than worst-case theory would suggest. We investigate this gap in performance using empirical methods throughout the course.

**Workload**

Practical course with 4 SWS, 6 LP

6 LP corresponds to approx. 180 working hours, of which  
 approx. 20 hours attendance time,

approx. 130 hours implementation and evaluation,

approx. 30 hours elaboration and preparation of the presentation

## M

**5.24 Module: Business & Service Engineering [M-WIWI-101410]**

**Coordinators:** Prof. Dr. Christof Weinhardt  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [Economics and Management \(Business Administration\)](#)

| Credits | Grading | Recurrence | Duration | Language       | Level | Version |
|---------|---------|------------|----------|----------------|-------|---------|
| 9 CP    | graded  | Each term  | 1 term   | German/English | 4     | 9       |

| Compulsory Elective Courses (Election: 9 credits) |                                                                    |        |              |
|---------------------------------------------------|--------------------------------------------------------------------|--------|--------------|
| T-WIWI-113160                                     | <a href="#">Digital Democracy</a>                                  | 4,5 CP | Fegert       |
| T-WIWI-112757                                     | <a href="#">Digital Services: Innovation &amp; Business Models</a> | 4,5 CP | Satzger      |
| T-WIWI-110887                                     | <a href="#">Practical Seminar: Service Innovation</a>              | 4,5 CP | Satzger      |
| T-WIWI-102847                                     | <a href="#">Recommender Systems</a>                                | 4,5 CP | Geyer-Schulz |
| T-WIWI-113724                                     | <a href="#">Special Topics in Information Systems</a>              | 4,5 CP | Weinhardt    |

**Assessment**

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**

The student should

- learn to develop and implement new markets with regards to the technological progresses of information and communication technology and the increasing economic networking
- learn to restructure and develop new business processes in markets under those conditions
- understand service competition as a sustainable competitive strategy and understand the effects of service competition on the design of markets, products, processes and services.
- improve his statistics skills and apply them to appropriate cases
- learn to elaborate solutions in a team

**Content**

This module addresses the challenges of creating new kinds of products, processes, services, and markets from a service perspective in the context of new developed information and communication technologies and the globalization process. The module describes service competition as a business strategy in the long term that leads to the design of business processes, business models, forms of organization, markets, and competition. This will be shown by actual examples from personalized services, recommender services and social networks.

**Additional Information**

All practical Seminars offered at the IM can be chosen for *Special Topics in Information Systems*. Please update yourself on [www.iism.kit.edu/im/lehre](http://www.iism.kit.edu/im/lehre).

From summer semester 2023, the course Service Innovation will be offered with a revised course concept and content. The focus will be on the closer integration of the topics of service innovation and digitalization. Current foundational content (e.g., on service innovation challenges or human-centered innovation methods) will remain. New content will cover topics such as digital platforms and ecosystems, IoT and smart service innovation, and business models.

**Workload**

The total workload for this module is approx. 270 hours (9 credits). The distribution is based on the credit points of the courses in the module. The workload for courses with 4.5 credits is approx. 135 hours, for courses with 5 credits approx. 150 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 for an average performance.

**Recommendations**

None

## M

## 5.25 Module: Coding Theory [M-INFO-106824]

**Coordinators:** Prof. Dr. Jörn Müller-Quade  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Irregular

**Duration**  
1 term

**Language**  
German

**Level**  
4

**Version**  
1

| Mandatory     |               |      |              |
|---------------|---------------|------|--------------|
| T-INFO-113693 | Coding Theory | 3 CP | Müller-Quade |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

The student

- can name and explain the methods of coding theory;
- assesses various quality characteristics and parameters of codes;
- assesses the practical significance of theoretical barriers for codes;
- analyzes given systems and adapts them to changing conditions.

**Content**

This lecture mainly deals with channel coding. It examines how signals can be protected against random noise affecting the transmission channel. Bounds of codes (Hamming, Gilbert-Varshamov, Singleton) are presented. In addition to the coding and decoding of classical algebraic codes (linear, Reed Solomon, Goppa and Reed Muller codes), concatenated codes and sums of codes are also covered. In addition, a connection to cryptography, in particular the McEliece encryption method, is established.

**Workload**

Attendance time in the lecture: 24 h

Preparation and follow-up of the same: 24 h

Exam preparation and attendance in the same: 42 h

## M

**5.26 Module: Collective Decision Making [M-WIWI-101504]**

**Coordinators:** Prof. Dr. Clemens Puppe  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [Economics and Management \(Economics\)](#)

**Credits**  
9 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
4

**Compulsory Elective Courses (Election: )**

|               |                                      |        |        |
|---------------|--------------------------------------|--------|--------|
| T-WIWI-102740 | <a href="#">Public Management</a>    | 4,5 CP | Wigger |
| T-WIWI-102859 | <a href="#">Social Choice Theory</a> | 4,5 CP | Puppe  |

**Assessment**

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**

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**

Total workload for 9 credit points: approx. 270 hours

The exact distribution is based on the credit points of the courses in the module.



## M

**5.27 Module: Compiler Design [M-INFO-106966]**

**Coordinators:** Prof. Dr. André Platzer  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
9 CP

**Grading**  
graded

**Recurrence**  
Irregular

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
2

| Mandatory     |                 |      |         |
|---------------|-----------------|------|---------|
| T-INFO-113925 | Compiler Design | 9 CP | Platzer |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

- Distinguish the main phases of a state-of-the-art compiler
- Understand static and dynamic semantics of an imperative language
- Develop parsers and lexers e.g. with parser generators, combinators
- Perform semantic analysis
- Translate abstract syntax trees to intermediate representations and static single assignment form
- Analyze the dataflow in an imperative language
- Perform standard compiler optimizations
- Generate assembly code
- Allocate registers using a graph-coloring algorithm
- Understand opportunities and limitations of compiler optimizations
- Appreciate design tradeoffs how representation affects optimizations
- Automatically manage memory using garbage collection
- Develop complex software following high-level specifications

**Content**

This course covers the design and implementation of compiler and runtime systems for high-level programming languages, and examines the interaction between language design, compiler design, and runtime organization. Topics covered include lexical and syntactic analysis, semantic analysis, type-checking, program analysis, code generation and optimization, memory management, and runtime organization.

Compilers and principles of compiling are one fundamental core aspect of computer science. Compilers and several other parts of compiler technology (especially parsing, transformation, analysis, and optimization) play important roles in many systems built every day. The knowledge gained in this course should be broad enough that if you are confronted with the task of contributing to the implementation of a real compiler in the field or similar technology, you should be able to do so confidently and quickly.

**Workload**

9 ECTS from 270h of coursework consisting of

- 60h=15\*4h from 4SWS lectures
- 90h preparation, reading lecture notes, studying
- 100h developing a compiler
- 20h exam preparation

**Recommendations**

Students are expected to have significant experience in a high-level programming language. Students are also expected to follow the lecture notes.

**M****5.28 Module: Computational Complexity Theory, with a View Towards Cryptography [M-INFO-101575]****Coordinators:** Prof. Dr. Jörn Müller-Quade**Organisation:** KIT Department of Informatics**Part of:** [Informatics](#)**Credits**  
6 CP**Grading**  
graded**Recurrence**  
Irregular**Duration**  
1 term**Language**  
German**Level**  
4**Version**  
1

| Mandatory     |                                                                                   |      |                        |
|---------------|-----------------------------------------------------------------------------------|------|------------------------|
| T-INFO-103014 | <a href="#">Computational Complexity Theory, with a View Towards Cryptography</a> | 6 CP | Hofheinz, Müller-Quade |



## 5.29 Module: Computational Geometry [M-INFO-107228]

**Coordinators:** TT-Prof. Dr. Thomas Bläsius  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Irregular

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                               |      |         |
|---------------|-------------------------------|------|---------|
| T-INFO-114251 | Computational Geometry        | 6 CP | Bläsius |
| T-INFO-114252 | Computational Geometry - Pass | 0 CP | Bläsius |

### Assessment

See partial achievements (Teilleistung)

### Prerequisites

See partial achievements (Teilleistung)

### Competence Goal

Students develop a systematic understanding of questions and solution approaches in the field of computational geometry, building on their existing knowledge of theoretical computer science and algorithms. Upon successful completion of the course, students will be able to:

- \* explain concepts, structures, and fundamental problem definitions presented in the lectures
- \* execute geometric algorithms, analyze them mathematically, and prove their properties
- \* select appropriate algorithms and data structures for solving a given geometric problem and adapt them to specific problem scenarios if necessary
- \* analyze unfamiliar geometric problems, reduce them to their algorithmic core, and create an abstract model; based on the concepts and techniques learned in the lecture, design their own solutions within this model, analyze them, and prove their properties

### Content

Spatial data is processed in a wide variety of areas in computer science, such as computer graphics and visualization, geographic information systems, robotics, and more. Computational geometry focuses on the design and analysis of geometric algorithms and data structures. This module introduces frequently used techniques and concepts in computational geometry, which are explored in depth using selected and application-related questions.

### Workload

Lecture with exercises, 4 hours per week (SWS), 6 ECTS corresponds to approximately 180 hours of work, including: ~60 hours attending lectures and exercises ~30 hours preparation and review ~60 hours working on exercise sheets ~30 hours exam preparation

### Recommendations

Basic knowledge of algorithms and data structures (e.g., from the courses Algorithms 1 + 2) is expected.

## M

**5.30 Module: Computational Imaging [M-INFO-106190]**

**Coordinators:** Prof. Dr.-Ing. Jürgen Beyerer  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
5 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                       |      |       |
|---------------|-----------------------|------|-------|
| T-INFO-112573 | Computational Imaging | 5 CP | Meyer |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Qualification goal: Students are able to model questions of machine vision optically and algorithmically and to process them using holistic optimization.

Learning objectives: Students know

- the essential components of machine vision, their optical modelling and suitable coding methods in the sense of computational imaging,
- methods for emitting, capturing and processing light fields for applications in photography and industrial image processing,
- the concept of light transport analysis, corresponding modelling, capturing and processing methods and
- approaches to holistic modelling and optimization of optical image capturing and processing systems.

**Content**

Digital image acquisition and processing have revolutionized various fields of applications, e.g., medical imaging or automated visual inspection. Yet, the design of most such systems is still based on the separate and individual optimization of the employed illumination, image acquisition and image processing components. By following a holistic approach for system design, modelling and optimization, computational imaging methods yield superior performance with respect to the state of the art. After introducing the students into relevant basics of optics and signal theory, the lecture will thoroughly cover various topics of computational imaging. Accompanying practical exercises will complement the theoretical part of the lecture. The course will enable students to adequately model artificial vision problems in the sense of computational imaging in order to obtain holistically optimal solutions.

**Workload**

Lecture with 2 SWS + 1 SWS exercise  
 5 ECTS corresponds to approx. 150 hours  
 approx. 30 hours lecture attendance,  
 approx. 15 hours exercise attendance,  
 approx. 90 hours post-processing and working on the exercises  
 approx. 30 hours Exam preparation

**Literature**

- Ayush Bhandari, Achuta Kadambi, Ramesh Raskar, Computational Imaging, MIT Press, 2022.
- Jürgen Beyerer, Fernando Puente León, Christian Frese, Machine Vision, Springer, 2015.
- Joseph. W. Goodman, Introduction to Fourier Optics. 4. Auflage W. H. Freeman, 2017.

## M

**5.31 Module: Computer Architecture [M-INFO-100818]****Coordinators:** Prof. Dr. Wolfgang Karl**Organisation:** KIT Department of Informatics**Part of:** [Informatics](#)**Credits**  
6 CP**Grading**  
graded**Recurrence**  
Each summer term**Duration**  
1 term**Language**  
German**Level**  
4**Version**  
1

| Mandatory     |                                       |      |      |
|---------------|---------------------------------------|------|------|
| T-INFO-101355 | <a href="#">Computer Architecture</a> | 6 CP | Karl |

## M

**5.32 Module: Computer Graphics [M-INFO-100856]****Coordinators:** Prof. Dr.-Ing. Carsten Dachsbacher**Organisation:** KIT Department of Informatics**Part of:** [Informatics](#)**Credits**  
6 CP**Grading**  
graded**Recurrence**  
Each winter term**Duration**  
1 term**Language**  
German**Level**  
4**Version**  
2

| Mandatory     |                                   |      |             |
|---------------|-----------------------------------|------|-------------|
| T-INFO-101393 | <a href="#">Computer Graphics</a> | 6 CP | Dachsbacher |

## M

**5.33 Module: Computer Graphics 2 [M-INFO-106685]****Coordinators:** Prof. Dr.-Ing. Carsten Dachsbacher**Organisation:** KIT Department of Informatics**Part of:** [Informatics](#)**Credits**  
5 CP**Grading**  
graded**Recurrence**  
Each summer term**Duration**  
1 term**Language**  
German/English**Level**  
4**Version**  
1

| Mandatory     |                                     |      |             |
|---------------|-------------------------------------|------|-------------|
| T-INFO-113441 | <a href="#">Computer Graphics 2</a> | 5 CP | Dachsbacher |

## M

**5.34 Module: Constructive Logic [M-INFO-106256]**

**Coordinators:** Prof. Dr. André Platzer  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
5 CP

**Grading**  
graded

**Recurrence**  
Each summer term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                    |      |         |
|---------------|--------------------|------|---------|
| T-INFO-112704 | Constructive Logic | 5 CP | Platzer |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

- Understand the working principles of logic
- Understand how the meaning of a proposition comes from its verifications
- Distinguish propositions from judgments
- Use proof rules to conduct formal proofs
- Formalize informal problems into precise logical language
- Justify how proof rules fit to one another in sound and complete ways
- Assess the validity of a formal proof
- Understand propositions as types, proofs as programs, formulas as programs
- Relate constructive logic to computation and constructive proofs to functional programs
- Relate deductive proof search to computation in logic programming
- Relate induction to recursion and use induction to prove properties in and about logical systems
- Understand the principles and applications of logic programming

**Content**

This course provides a thorough introduction to modern constructive logic, its roots in philosophy, its numerous applications in computer science, and its mathematical properties. The core topics of this course are intuitionistic logic, natural deduction, Curry-Howard isomorphism, propositions as types, proofs as programs, formulas as programs, functional programming, logic programming, Heyting arithmetic and primitive recursion, cut elimination, connections between classical and constructive logic, inductive definitions, sequent calculus, and decidable classes. Advanced topics may include type theory, proof search, linear logic, temporal logic, modal logic.

**Additional Information**

Course web page: <https://lfcps.org/course/constlog.html>

**Workload**

5 ECTS from 150h of coursework consisting of  
 45h = 15 \* 3h from 3 SWS lectures  
 15h = 15 \* 1h from 1 SWS exercises  
 90h preparation, reading lecture notes, studying  
 22h exam preparation

**Recommendations**

You will be expected to follow the lecture notes.



## M

**5.35 Module: Consumer Research [M-WIWI-105714]**

**Coordinators:** Prof. Dr. Benjamin Scheibehenne  
**Organisation:** KIT Department of Business and Economics  
**Part of:** Economics and Management (Business Administration)

**Credits**  
9 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
2 terms

**Language**  
English

**Level**  
4

**Version**  
6

| Compulsory Elective Courses (Election: ) |                                                                                            |        |                        |
|------------------------------------------|--------------------------------------------------------------------------------------------|--------|------------------------|
| T-WIWI-113471                            | Bayesian Statistics for Analyzing Data                                                     | 4,5 CP | Scheibehenne           |
| T-WIWI-113095                            | Behavioral Lab Exercise                                                                    | 4,5 CP | Nieken, Scheibehenne   |
| T-WIWI-114186                            | Collective Intelligence in Human Judgment and Decision Making                              | 4,5 CP | Scheibehenne           |
| T-WIWI-114185                            | Computational Modelling of Judgments, Decisions and Cognition                              | 4,5 CP | Scheibehenne           |
| T-WIWI-111100                            | Current Directions in Consumer Psychology                                                  | 4,5 CP | Scheibehenne           |
| T-WIWI-114174                            | Economic Decision Making                                                                   | 4,5 CP | Scheibehenne           |
| T-WIWI-111109                            | KD <sup>2</sup> Lab Hands-On Research Course: New Ways and Tools in Experimental Economics | 4,5 CP | Weinhardt              |
| T-WIWI-107720                            | Market Research                                                                            | 4,5 CP | Klarmann               |
| T-WIWI-114750                            | Perceiving, Understanding and Communicating Risk and Uncertainty                           | 4,5 CP | Gradwohl, Scheibehenne |

**Assessment**

The assessment is based on partial exams within the classes offered in this module. Please check the descriptions of the classes for details.

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

**Prerequisites**

Willingness to actively engage with the topic.

**Competence Goal**

- Understand human judgment and decision making in an economic context
- Learn how to plan, program, conduct, statistically analyze, visualize, model, and report behavioral experiments
- Critically evaluate scientific findings in the aftermath of the replication crisis

**Content**

This module provides students with in-depth knowledge about consumer research at the intersection between Marketing, Psychology, and Cognitive Science. The module consists of classes that look into how individuals and groups make judgments and decisions and what factors influences their behavior (e.g. the lecture on judgment and decision making). Because most findings in this area of research rely on behavioral experiments, this module also focuses on methodological skills. This includes classes on how to plan and design behavioral experiments, conduct and report meaningful statistical analyses, and develop computational cognitive models. The module also includes classes about reproducibility and transparency in the behavioral sciences. The module is a pre-requisite for writing a Master thesis at the KIT Cognition and Consumer Behavior lab.

**Workload**

The total workload for this module is approximately 270 hours.

**Recommendations**

Interest in behavioral research.

## M

**5.36 Module: Context Sensitive Systems [M-INFO-100728]**

**Coordinators:** Prof. Dr.-Ing. Michael Beigl  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
5 CP

**Grading**  
graded

**Recurrence**  
Each summer term

**Duration**  
1 term

**Language**  
German

**Level**  
4

**Version**  
2

| Mandatory     |                                           |      |       |
|---------------|-------------------------------------------|------|-------|
| T-INFO-107499 | <a href="#">Context Sensitive Systems</a> | 5 CP | Beigl |

## M

**5.37 Module: Cooperative Autonomous Vehicles [M-WIWI-106631]****Coordinators:** Prof. Dr. Alexey Vinel**Organisation:** KIT Department of Business and Economics**Part of:** Informatics**Credits**  
9 CP**Grading**  
graded**Recurrence**  
Each term**Duration**  
2 terms**Language**  
English**Level**  
4**Version**  
1

| Compulsory Elective Courses (Election: ) |                                                             |        |       |
|------------------------------------------|-------------------------------------------------------------|--------|-------|
| T-WIWI-113363                            | <a href="#">Collective Perception in Autonomous Driving</a> | 4,5 CP | Vinel |
| T-WIWI-112690                            | <a href="#">Cooperative Autonomous Vehicles</a>             | 4,5 CP | Vinel |
| T-WIWI-113059                            | <a href="#">Human Factors in Autonomous Driving</a>         | 4,5 CP | Vinel |

**Assessment**

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

**Prerequisites**

None.

**Competence Goal**

Students

- know the fundamentals of vehicular communications and networking,
- look critically into current research topics in the field of autonomous driving,
- explain basic concepts in cooperative vehicles,
- apply mathematical methods for the performance evaluation of cooperative driving systems,
- apply simulation tools for the modeling of cooperative autonomous vehicles.

**Content**

The module focuses on the aspects of communication, coordination, and cooperation of highly automated and autonomous vehicles. We explain the state-of-the-art of the vehicular communications (V2X) and respective cooperative driving applications from an interdisciplinary viewpoint. The module includes selected material from wireless networking, formal description methods, human-computer interaction, robotics, and machine learning. The students work with mathematical models, simulation environments and lab equipment.

**Module Grade Calculation**

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.

**Workload**

The total workload for this module is approximately 270 hours. The exact distribution is made according to the credit points of the courses of the module.

## M

**5.38 Module: Cross-Functional Management Accounting [M-WIWI-101510]**

**Coordinators:** Prof. Dr. Marcus Wouters  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [Economics and Management \(Business Administration\)](#)

**Credits**  
9 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
14

| Mandatory                                     |                                                                                                      |        |          |
|-----------------------------------------------|------------------------------------------------------------------------------------------------------|--------|----------|
| T-WIWI-102885                                 | <a href="#">Advanced Management Accounting</a>                                                       | 4,5 CP | Wouters  |
| Supplementary Courses (Election: 4,5 credits) |                                                                                                      |        |          |
| T-WIWI-105777                                 | <a href="#">Business Intelligence Systems</a>                                                        | 4,5 CP | Mädche   |
| T-WIWI-105781                                 | <a href="#">Incentives in Organizations</a>                                                          | 4,5 CP | Nieken   |
| T-WIWI-107720                                 | <a href="#">Market Research</a>                                                                      | 4,5 CP | Klarmann |
| T-WIWI-111848                                 | <a href="#">Online Concepts for Karlsruhe City Retailers</a>                                         | 3 CP   | Kupfer   |
| T-WIWI-102621                                 | <a href="#">Valuation</a>                                                                            | 4,5 CP | Ruckes   |
| T-WIWI-108651                                 | <a href="#">Extraordinary Additional Course in the Module Cross-Functional Management Accounting</a> | 4,5 CP | Wouters  |

**Assessment**

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**

The course "Advanced Management Accounting" is compulsory.

The additional courses can only be chosen after the compulsory course has been completed successfully.

**Competence Goal**

Students will be able to apply advanced management accounting methods to managerial decision-making problems in marketing, finance, organization and strategy.

**Content**

The module includes a course on several advanced management accounting methods that can be used for various decisions in operations and innovation management. By selecting another course, each student looks in more detail at one interface between management accounting a particular field in management, namely marketing, finance, or organization and strategy.

**Additional Information**

The module "Cross-functional Management Accounting" always includes the compulsory course "Advanced Management Accounting." Students look at the interface between management accounting and another field in management. Students build the module by adding a course from the specified list. Students can also suggest another suitable course for this module for evaluation by the coordinator.

**Workload**

Total workload for 9 credit points: approx. 270 hours

The exact distribution is based on the credit points of the courses in the module.

**Recommendations**

None



## 5.39 Module: Cryptographic Protocols [M-INFO-105631]

**Coordinators:** Prof. Dr. Jörn Müller-Quade  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
5 CP

**Grading**  
graded

**Recurrence**  
Each summer term

**Duration**  
1 term

**Language**  
German

**Level**  
4

**Version**  
2

| Mandatory     |                                         |      |              |
|---------------|-----------------------------------------|------|--------------|
| T-INFO-111261 | <a href="#">Cryptographic Protocols</a> | 5 CP | Müller-Quade |

### Assessment

See Partial Achievements (Teilleistung).

### Prerequisites

See Partial Achievements (Teilleistung).

### Competence Goal

The student

- knows and understands the primitives and protocols presented in the lecture, their (game-based) security definitions and proofs
- knows the real/ideal security notion and can independently analyze the security of protocols in it
- knows and understands basic schemes for secure multi-party computation and their advantages and disadvantages can apply the schemes for secure multi-party computation

### Content

While classical cryptography is concerned with ensuring authenticity and secrecy against external adversaries, there are now also a large number of interactive protocols between mutually distrusting parties.

Building on the lecture "Theoretical Foundations of Cryptography", this lecture introduces such basic primitives, protocols and corresponding security notions.

In the first part of the lecture, basic (interactive) building blocks such as commitment schemes, secret sharing, zero-knowledge proof systems and oblivious transfer are introduced. Game-based notions and the real/ideal security notion are used to prove security.

Building on this, the second part introduces more complex protocols for the secure joint evaluation of arbitrary functions on secret inputs. Both protocols based on secret sharing and so-called "garbled circuits" are covered.

First, security against so-called passive adversaries, who honestly follow the protocol and merely attempt to learn additional information, is considered. Building on this, security against active adversaries, who may deviate from the protocol at will, is considered.

### Additional Information

The event takes place as an "inverted classroom". The material is presented in the form of videos, which are then interactively deepened in the subsequent face-to-face event.

### Workload

Attendance time for inverted classroom videos: 24 h

Preparation/follow-up: 36 h

Attendance time in the exercise: 24 h

Preparation/follow-up of the same: 36 h

Exam preparation and attendance in the same: 30 h

= 150 h

### Recommendations

Students should be familiar with the contents of the module "Theoretical Foundations of Cryptography".

## M

**5.40 Module: Cryptographic Protocols II: Universal Composability [M-INFO-107435]**

**Coordinators:** Prof. Dr. Jörn Müller-Quade  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                     |      |              |
|---------------|-----------------------------------------------------|------|--------------|
| T-INFO-114602 | Cryptographic Protocols II: Universal Composability | 3 CP | Müller-Quade |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

The student

- understands the problems that occur in protocol composition and can explain them using examples.
- knows and understands the frameworks, security concepts and their properties presented in the lecture and can explain, relate and prove these.
- knows and understands the protocols and proofs presented in the lecture and can reproduce them.
- can independently apply the techniques presented in the lecture, for example to prove or demonstrate the security or insecurity of simple protocols.

**Content**

In the lecture "Kryptographische Protokolle", methods and building blocks for secure multi-party computation were presented. The security was shown for a single execution and under sequential composition.

In reality, however, protocols are executed concurrently - both multiple instances of the same protocol (concurrent composition) and multiple, different protocols (general composition) that were designed independently of each other.

This protocol composition is not adequately covered by classical security concepts: it may be that the execution of a single protocol instance can be proven to be secure. However, if the same protocol is executed several times simultaneously, all security may be lost.

In this lecture, we re-visit the topics of the "Kryptographische Protokolle" lecture with a focus on composability. The first part of the lecture therefore introduces the concept of universally composable (UC) security, which depicts the setting of general composition in which arbitrary protocols are executed concurrently. An important insight here is that UC security can only be achieved with the help of trust assumptions, so-called "setups". In the second part of the lecture, important protocols that fulfill this strong security are presented, for example for commitments or general secure multi-party computation. At the end of the lecture, further composing security notions and related protocols are considered, which are weaker than UC security, but without setups.

**Workload**

90 h

Lectures: 24 h

Self-study during semester: 31 h

Preparation for the exam: 35 h

**Recommendations**

Students should be familiar with the contents of the modules "Theoretische Grundlagen der Kryptographie" (Theoretical Foundations of Cryptography) and „Kryptographische Protokolle“ (Cryptographic Protocols I).

M

5.41 Module: Cryptographic Voting Schemes [M-INFO-100742]

**Coordinators:** Prof. Dr. Jörn Müller-Quade  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

| Credits | Grading | Recurrence | Duration | Language | Level | Version |
|---------|---------|------------|----------|----------|-------|---------|
| 3 CP    | graded  | Irregular  | 1 term   | German   | 4     | 1       |

| Mandatory     |                                              |      |              |
|---------------|----------------------------------------------|------|--------------|
| T-INFO-101279 | <a href="#">Cryptographic Voting Schemes</a> | 3 CP | Müller-Quade |

**M****5.42 Module: Cybersecurity for Industrial Automation and Control Systems [M-INFO-106355]****Coordinators:** Prof. Dr.-Ing. Jürgen Beyerer**Organisation:** KIT Department of Informatics**Part of:** [Informatics](#)**Credits**  
4 CP**Grading**  
graded**Recurrence**  
Each summer term**Duration**  
1 term**Language**  
German**Level**  
4**Version**  
1

| Mandatory     |                                                                             |      |         |
|---------------|-----------------------------------------------------------------------------|------|---------|
| T-INFO-112880 | <a href="#">Cybersecurity for Industrial Automation and Control Systems</a> | 4 CP | Beyerer |



## M

**5.43 Module: Data Science and Artificial Intelligence for Energy Systems [M-INFO-106655]**

**Coordinators:** TT-Prof. Dr. Benjamin Schäfer  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

| Credits | Grading | Recurrence       | Duration | Language | Level | Version |
|---------|---------|------------------|----------|----------|-------|---------|
| 6 CP    | graded  | Each summer term | 1 term   | English  | 4     | 1       |

| Mandatory     |                                                             |      |         |
|---------------|-------------------------------------------------------------|------|---------|
| T-INFO-113402 | Data Science and Artificial Intelligence for Energy Systems | 6 CP | Schäfer |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

- Students obtained a foundational knowledge of data-driven methods in energy systems as an active research field. They can name some ongoing challenges.
- They can explain different data science methods and their applications in energy systems (including Langevin processes, superstatistics, (probabilistic) forecasts and explainable AI).
- Students can employ AI methods to solve problems in energy systems, including optimizing systems and forecasting time series.
- Students can exploit key properties of trained machine learning models and interpretability tools.
- Students can select suitable analysis tools, justify their choice and carry out data-driven analysis on power systems.

**Content**

Artificial Intelligence (AI) is a key technology in many areas of society and research. Energy systems with the ongoing energy transition ("Energiewende") make it a fascinating field for deploying AI methods. AI and machine learning algorithms can play a crucial role in improving energy efficiency, optimizing power generation and distribution or enhancing system stability while facilitating additional renewable energy integration. In this lecture, we review some mechanics of energy systems, their design and optimization questions and how to solve these using data-driven approaches. We will discuss deterministic dynamics, as well as stochastic aspects of energy systems and will explore fundamental AI algorithms and their applications in energy systems. We will cover both classical time series methods as well as state-of-the-art AI techniques, e.g. for optimization or forecasting.

**Workload**

Course workload:

1. Attendance time: 4 SWS x 15=60 (Course, exercise, etc.)
  2. Self-study: 6 h x 15 = 90 (independent review of course material, work on homework assignments)
  3. Preparation for the exam: 30h
- 60+90+30=180h= 6ECTS

**Recommendations**

Knowledge of AI basics is very helpful.

Previous participation in "Energieinformatik 1" and/or "Energieinformatik 2" is beneficiary but not mandatory.

Knowledge of Python is highly recommended.

## M

**5.44 Module: Data Science for Finance [M-WIWI-105032]**

**Coordinators:** Prof. Dr. Maxim Ulrich  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [Economics and Management \(Business Administration\)](#)

**Credits**  
9 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                                    |        |        |
|---------------|--------------------------------------------------------------------|--------|--------|
| T-WIWI-102878 | <a href="#">Computational Risk and Asset Management</a>            | 4,5 CP | Ulrich |
| T-WIWI-110213 | <a href="#">Python for Computational Risk and Asset Management</a> | 4,5 CP | Ulrich |

**Assessment**

The module examination takes the form of an alternative exam assessment.

The alternative exam assessment consists of a Python-based "Takehome Exam". At the end of the third week of January, the student is given a "Takehome Exam" which he processes and sends back independently within 4 hours using Python. Precise instructions will be announced at the beginning of the course. The alternative exam assessment can be repeated a maximum of once. A timely repeat option takes place at the end of the third week in March of the same year. More detailed instructions will be given at the beginning of the course.

**Competence Goal**

The aim of the module is to use data science, machine learning and financial market theories to generate better investment, risk and asset management decisions. The student gets to know the characteristics of different asset classes in an application-oriented manner using real financial market data. We use Python and web scraping techniques to extract, visualize and examine patterns of publicly available financial market data. Interesting and non-public financial market data such as (option and futures data on shares and interest) are provided. Financial market theories are also discussed to improve data analysis through theoretical knowledge. Students get to know stock, interest rate, futures and options markets through the "data science glasses". Through "finance theory glasses" students understand how patterns can be communicated and interpreted using finance theory. Python is the link through which we bring data science and modern financial market modeling together.

**Content**

The course covers several topics, among them:

- Pattern detection in price and return data in equity, interest rate, futures and option markets
- Quantitative Portfolio Strategies
- Modeling Return Densities using tools from financial econometrics, data science and machine learning
- Valuation of equity, fixed-income, futures and options in a coherent framework to possibly exploit arbitrage opportunities
- Neural networks and Natural Language Processing

**Workload**

The total workload for this module is 270 hours (9 credit points). The total number of hours resulting from income from studying online video, answering quizzes, studying Python notebooks, active and interactive "Python Data Sessions" and reading literature you have heard.

**Recommendations**

Basic knowledge of capital market theory.

**Teaching and Learning Methods**

Lectures and Exercises

## M

**5.45 Module: Data Science: Data-Driven Information Systems [M-WIWI-103117]**

**Coordinators:** Prof. Dr. Alexander Mädche  
Prof. Dr. Christof Weinhardt

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

**Part of:** Economics and Management (Business Administration)

Credits  
9 CPGrading  
gradedRecurrence  
Each termDuration  
1 termLanguage  
EnglishLevel  
4Version  
11**Compulsory Elective Courses (Election: )**

|               |                                                                                      |        |                    |
|---------------|--------------------------------------------------------------------------------------|--------|--------------------|
| T-WIWI-114749 | (Gen)AI and Virtual Reality for Business                                             | 4,5 CP | Pfeiffer           |
| T-WIWI-114210 | (Gen)AI-based Automation in Organizations                                            | 4,5 CP | Mädche             |
| T-WIWI-108715 | Artificial Intelligence in Service Systems                                           | 4,5 CP | Satzger            |
| T-WIWI-114209 | Artificial Intelligence in Service Systems II: Generative AI Applications & Adoption | 4,5 CP | Satzger            |
| T-WIWI-113471 | Bayesian Statistics for Analyzing Data                                               | 4,5 CP | Scheibehenne       |
| T-WIWI-106187 | Business Data Strategy                                                               | 4,5 CP | Weinhardt          |
| T-WIWI-105777 | Business Intelligence Systems                                                        | 4,5 CP | Mädche             |
| T-WIWI-114089 | Data Science for Business                                                            | 4,5 CP | Pfeiffer           |
| T-WIWI-113160 | Digital Democracy                                                                    | 4,5 CP | Fegert             |
| T-WIWI-113459 | Practical Seminar: Human-Centered Systems                                            | 4,5 CP | Mädche             |
| T-WIWI-111385 | Responsible Artificial Intelligence                                                  | 4,5 CP | Hoffmann, Pfeiffer |
| T-WIWI-106207 | Practical Seminar: Data-Driven Information Systems                                   | 4,5 CP | Satzger, Weinhardt |

**Assessment**

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.

**Prerequisites**

None.

**Competence Goal**

The student

- understands the strategic role of integrating, transforming, and analyzing large and complex enterprise data in modern business information systems and is capable of comparing and assessing strategic alternatives
- has the core skills to design, model, and control complex, inter-organisational analytical, processes, including various business functions as well as customers and markets
- understands the usage of performance indicators for a variety of controlling and management issues and is able to define models for generating the relevant performance indicators under considerations of data availability
- distinguishes different analytics methods and concepts and learn when to apply to better understand and anticipate business relationships and developments of industrial and in particular service companies to derive fact- and data- founded managerial actions and strategies.
- knows how to capture uncertainty in the data and how to appropriately consider and visualize uncertainty in decision support or business intelligence systems and analytical processes as a whole.

**Content**

The amount of business-related data available in modern enterprise information systems grows exponentially, and the various data sources are more and more integrated, transformed, and analyzed jointly to gain valuable business insights, pro-actively control and manage business processes, to leverage planning and decision making, and to provide appropriate, potentially novel services to customers based on relationships and developments observed in the data.

Also, data sources are more and more connected and single business unit that used to operate on separate data pools are now becoming highly integrated, providing tremendous business opportunities but also challenges regarding how the data should be represented, integrated, preprocessed, transformed, and finally used in analytics planning and decision processes.

The courses of this module equip the students with core skills to understand the strategic role of integrating, transforming, and analyzing large and complex enterprise data in modern business information systems. Students will be capable to designing, comparing, and evaluating strategic alternatives. Also, students will learn how to design, model, and control complex analytical processes, including various business functions of industrial and service companies including customers and markets. Students learn core skills to understand fundamental strategies for integrating analytic models and operative controlling mechanisms while ensuring the technical feasibility of the resulting information systems..

Furthermore, the student can distinguish different methods and concepts in the realm of data science and learns when to apply. She/he will know the means of characterizing and analyzing heterogeneous, high-dimensional data available data in data warehouses and external data sources to gain additional insights valuable for enterprise planning and decision making. Also, the students know how to capture uncertainty in the data and how to appropriately consider and visualize uncertainty in business information and business intelligence systems.

The module offers the opportunity to apply and deepen this knowledge in a seminar and hands-on tutorials that are offered with all lectures.

Texteintrag

**Workload**

**Attendance time:** 90 h

**Self-study:** approx. 100 h

**Exam preparation:** approx. 80 h

**Total workload:** approx. 270 h

**Recommendations**

For successful participation in the module, basic knowledge of business informatics (in particular of tasks, systems and processes) is very helpful. In this context, prior attendance of the course Grundzüge der Wirtschaftsinformatik [2540450] is recommended. In addition, knowledge of operations research as well as descriptive and inferential statistics is advantageous in order to be able to follow the quantitative content of the module.

## M

**5.46 Module: Data Science: Data-Driven User Modeling [M-WIWI-103118]**

**Coordinators:** Prof. Dr. Christof Weinhardt  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [Economics and Management \(Business Administration\)](#)

| Credits | Grading | Recurrence | Duration | Language | Level | Version |
|---------|---------|------------|----------|----------|-------|---------|
| 9 CP    | graded  | Each term  | 1 term   | English  | 4     | 9       |

| Compulsory Elective Courses (Election: at least 9 credits) |                                                                                                          |        |                    |
|------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|--------|--------------------|
| T-WIWI-114089                                              | <a href="#">Data Science for Business</a>                                                                | 4,5 CP | Pfeiffer           |
| T-WIWI-113160                                              | <a href="#">Digital Democracy</a>                                                                        | 4,5 CP | Fegert             |
| T-WIWI-115061                                              | <a href="#">Experimental Research in Economics and Information Systems</a>                               | 4,5 CP | Weinhardt          |
| T-WIWI-111109                                              | <a href="#">KD<sup>2</sup>Lab Hands-On Research Course: New Ways and Tools in Experimental Economics</a> | 4,5 CP | Weinhardt          |
| T-WIWI-111385                                              | <a href="#">Responsible Artificial Intelligence</a>                                                      | 4,5 CP | Hoffmann, Pfeiffer |
| T-WIWI-108765                                              | <a href="#">Practical Seminar: Advanced Analytics</a>                                                    | 4,5 CP | Weinhardt          |

**Assessment**

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.

**Prerequisites**

None

**Competence Goal**

Students of this module

- learn methods for planning empirical studies, in particular laboratory experiments,
- acquire theoretical knowledge and practical skills in analysing empirical data,
- familiarize with different ways of modelling user behaviour, are able to critically discuss, and to evaluate them

**Content**

Understanding and supporting user interactions with applications better plays an increasingly large role in the design of business applications. This applies both to interfaces for customers and to internal information systems. The data that is generated during user interactions can be channelled straight into business processes, for instance by analysing and decomposing purchase decisions, and by feeding this data into product design processes.

The Crowd Analytics section considers the analysis of data from online platforms, particularly of those following crowd- or peer-to-peer based business models. This includes platforms like Airbnb, Kickstarter and Amazon Mechanical Turk.

Theoretical models of user (decision) behaviour help analyzing the empirically observed user behaviour in a systematic fashion. Testing these models and their predictions in controlled experiments (primarily in the lab) in turn helps refine theory and to generate practically relevant design recommendations. Analyses are carried out using advanced analytic methods.

Students learn fundamental theoretical models for user behaviour in systems and apply them to cases. Students are also taught methods and skills for conceptualizing and planning empirical studies and for analyzing the resulting data.

**Recommendations**

Basic knowledge of Information Management, Operations Research, Descriptive Statistics, and Inferential Statistics is assumed.

## M

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

**Coordinators:** Prof. Dr. Martin Klarmann  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [Economics and Management \(Business Administration\)](#)

**Credits**  
9 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
2 terms

**Language**  
English

**Level**  
4

**Version**  
5

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

|               |                                     |        |          |
|---------------|-------------------------------------|--------|----------|
| T-WIWI-103139 | <a href="#">Marketing Analytics</a> | 4,5 CP | Klarmann |
| T-WIWI-107720 | <a href="#">Market Research</a>     | 4,5 CP | Klarmann |

**Assessment**

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.

**Recommendations**

None

## M

**5.48 Module: Data Science: Intelligent, Adaptive, and Learning Information Services [M-WIWI-105661]**

**Coordinators:** Prof. Dr. Andreas Geyer-Schulz  
**Organisation:** KIT Department of Business and Economics  
**Part of:** Economics and Management (Business Administration)

| Credits | Grading | Recurrence | Duration | Language       | Level | Version |
|---------|---------|------------|----------|----------------|-------|---------|
| 9 CP    | graded  | Each term  | 1 term   | German/English | 4     | 3       |

| Compulsory Elective Courses (Election: 9 credits) |                                                                                                          |        |                      |
|---------------------------------------------------|----------------------------------------------------------------------------------------------------------|--------|----------------------|
| T-WIWI-109921                                     | <a href="#">Advanced Machine Learning</a>                                                                | 4,5 CP | Geyer-Schulz, Nazemi |
| T-WIWI-114209                                     | <a href="#">Artificial Intelligence in Service Systems II: Generative AI Applications &amp; Adoption</a> | 4,5 CP | Satzger              |
| T-WIWI-102762                                     | <a href="#">Business Dynamics</a>                                                                        | 4,5 CP | Geyer-Schulz, Glenn  |
| T-WIWI-111267                                     | <a href="#">Intelligent Agent Architectures</a>                                                          | 4,5 CP | Geyer-Schulz         |
| T-WIWI-110915                                     | <a href="#">Intelligent Agents and Decision Theory</a>                                                   | 4,5 CP | Geyer-Schulz         |
| T-WIWI-102847                                     | <a href="#">Recommender Systems</a>                                                                      | 4,5 CP | Geyer-Schulz         |

**Assessment**

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

- models, analyzes and optimizes the structure and dynamics of complex economic changes.
- designs and develops intelligent, adaptive or learning agents as essential elements of information services.
- knows the essential learning methods for this and can apply them (also on modern architectures) in a targeted manner.
- develops and implements personalized services, especially in the area of recommender systems.
- develops solutions in teams.

**Content**

The Intelligent Architectures course addresses how to design modern agent-based systems. The focus here is on software architecture and design patterns relevant to learning systems. In addition, important machine learning methods that complete the intelligent system are discussed. Examples of systems presented include key-map architectures and genetic methods.

The impact of management decisions in complex systems is considered in Business Dynamics. Understanding, modeling, and simulating complex systems enables analysis, purposeful design, and optimization of markets, business processes, regulations, and entire enterprises.

Special problems of intelligent systems are covered in Personalization and Services and Recommendersystems. The content includes approaches and methods to design user-oriented services. The measurement and monitoring of service systems is discussed, the design of personalized offers is discussed and the generation of recommendations based on collected data from products and customers is shown. The importance of user modeling and recognition is addressed, as well as data security and privacy.

**Additional Information**

The module replaces from summer semester 2021 M-WIWI-101470 "Data Science: Advanced CRM".

**Workload**

The total workload for this module is approx. 270 hours (9 credits). The distribution is based on the credit points of the courses in the module. The workload for courses with 4.5 credits is approx. 135 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 for an average performance.

**Recommendations**

None



## M

**5.49 Module: Decentralized Systems: Fundamentals, Modeling, and Applications [M-INFO-105334]**

**Coordinators:** Prof. Dr. Hannes Hartenstein  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics Seminars](#)

| Credits | Grading | Recurrence       | Duration | Language | Level | Version |
|---------|---------|------------------|----------|----------|-------|---------|
| 6 CP    | graded  | Each summer term | 1 term   | English  | 4     | 4       |

| Mandatory     |                                                                                 |      |             |
|---------------|---------------------------------------------------------------------------------|------|-------------|
| T-INFO-110820 | <a href="#">Decentralized Systems: Fundamentals, Modeling, and Applications</a> | 6 CP | Hartenstein |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal****Fundamentals & Modeling**

1. The student is able to recognize and distinguish distributed, federated, and decentralized systems.
2. The student understands the role of consensus, consistency, and coordination within the context of networked and decentralized systems.
3. The student understands the concept of Sybil attacks.
4. The student is familiar with decentralized algorithms like leader election for execution contexts with various guarantees.
5. The student understands the formally proven limits of fault tolerance and their underlying assumptions. This includes an understanding of synchronous and asynchronous network models which underpin the respective proofs. The student also understands several models for fault tolerance within the context of decentralized and distributed systems.
6. The student has a basic understanding of state machine replication.
7. The student knows how conflict-free replicated data types employ mathematics to provide eventually consistent data to collaborative peer-to-peer applications.

**Applications**

1. The student understands how decentralized storage, replication, and coordination is employed in practice.
2. The student has a fundamental understanding of blockchain-based systems and payment channels, as well as decentralized systems for storage, communication, and machine learning.
3. The student understands trust relations in distributed and decentralized systems applications.
4. The student is able to understand how theoretical foundations relate to networked and decentralized systems in practice.

**Content**

Decentralized Systems (like blockchain-based systems) are distributed systems under the control of multiple, independent parties that act on their own, autonomous decisions. In this course, we cover fundamental theoretical aspects as well as up-to-date decentralized systems, and connect theory with current practice. We thereby address fault tolerance, security and trust, as well as performance aspects at the example of applications like Bitcoin, Ethereum, IPFS, Matrix, or the Fediverse. As a research-oriented lecture, we cover additional current topics like decentralizing artificial intelligence via decentralized, federated learning, or identity and access management in decentralized systems.

The lecture covers at least the following topics:

- Fundamentals
  - Peer-to-Peer Overlay Networks, Sybil and Eclipse Attacks
  - Formalization of decentralized systems, including models for their computation, communication, faults, and timing.
  - Leader election and broadcast in decentralized systems, based on different models for identities and timing.
  - Byzantine consensus in synchronous and asynchronous settings, including Bracha's fundamental algorithm for reliable broadcast, practical Byzantine fault tolerant consensus, and fundamental limits.
  - Consistency models and protocols, including conflict-free replicated data types.
- Applications
  - Decentralized storage systems, at the example of IPFS
  - Decentralized communication systems, at the example of Matrix for instant messaging
  - Distributed ledgers and blockchains, at the examples of Bitcoin and Ethereum, in particular Proof-of-Work and Proof-of-Stake consensus
  - Scaling techniques for distributed ledgers, at the example of payment channel networks and rollups
  - Decentralized, federated machine learning systems

**Workload**

1. Attendance time (Course, exercise, etc.)

Lecture: 3 SWS: 3,0h x 15 = 45h

Exercise: 1 SWS: 1,0h x 15 = 15h

2. Self-study (e.g. independent review of course material, work on homework assignments)

Weekly preparation and follow-up of the lecture: 15 x 1h x 3 = 45h

Weekly preparation and follow-up of the exercise: 15 x 2h = 30h

3. Preparation for the exam: 45 h

$\Sigma = 180h = 6$  ECTS

**Recommendations**

Basics according to the lectures "Information Security" and "Introduction to Computer Networks" are recommended.

## M

**5.50 Module: Deep Learning and Neural Networks [M-INFO-107197]**

**Coordinators:** Prof. Dr. Jan Niehues  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each summer term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                   |      |         |
|---------------|-----------------------------------|------|---------|
| T-INFO-114219 | Deep Learning and Neural Networks | 6 CP | Niehues |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students will learn about the structure and function of different types of neural networks.

Students should learn the methods for training the various networks and their application to problems.

Students should learn the areas of application of the different types of networks.

Given a concrete scenario, students should be able to select the appropriate type of neural network.

**Content**

This module introduces the use of neural networks for the solution of solving various problems in the field of machine learning, such as classification, prediction, control or inference. or inference. Different types of neural networks are covered and their areas of application are illustrated using examples.

**Workload**

Lecture with 4 SWS, 6 CP.

6 LP corresponds to approx. 180 hours, of which

approx. 60 hours lecture attendance

approx. 90 hours post-processing (self-study)

approx. 30 hours exam preparation (self-study)

**Recommendations**

Prior successful completion of the core module "Cognitive Systems" is recommended.

**M****5.51 Module: Deep Learning for Computer Vision: Advanced Topics [M-INFO-107695]****Coordinators:** Prof. Dr.-Ing. Rainer Stiefelhagen**Organisation:** KIT Department of Informatics**Part of:** Informatics**Credits**  
3 CP**Grading**  
graded**Recurrence**  
Each winter term**Duration**  
1 term**Language**  
German/English**Level**  
4**Version**  
1

| Mandatory     |                                                    |      |              |
|---------------|----------------------------------------------------|------|--------------|
| T-INFO-115078 | Deep Learning for Computer Vision: Advanced Topics | 3 CP | Stiefelhagen |

**Assessment**

See partial achievements.

**Prerequisites**

See partial achievements.

**Competence Goal**

Students gain an understanding of advanced deep learning methods and tasks, especially with regard to their applications in image processing (computer vision). Students are able to apply deep learning methods for special tasks, such as learning with little training data, changes in the data domain or uncertainty determination.

**Content**

Deep convolutional neural networks (CNNs) achieve excellent results in many areas of computer vision, but face challenges in real-world applications, such as dependence on costly annotated training data, high computing power or difficult traceability of decision paths. While for a long time the development of recognition algorithms was primarily driven by high recognition rates on large and cleanly annotated data sets, today application-relevant goals such as learning with little training data, explainability, uncertainty estimation or domain adaptation are becoming increasingly important.

The lecture deals with advanced network architectures, learning methods and research areas in the field of deep learning for computer vision. Among others, the following topics will be covered:

- Overview of deep learning, convolutional neural networks (CNN), problems of modern architectures
- Interpretability and explainability of CNNs
- Uncertainty in deep learning
- Learning with little training data
- Efficient architectures
- Advanced architectures (transformers, graph neural networks)
- Synergies of computer vision and language models
- Generative Adversarial Networks (GANs)
- Continuous learning

**Module Grade Calculation**

See partial achievements.

**Workload**

Attendance of the lectures: approx. 20 hours

Preparation and follow-up of the lecture: approx. 30 hours

Exam preparation: approx. 40 hours

Total: approx. 90 hours

**Recommendations**

Knowledge of deep learning basics is strongly recommended.

**M****5.52 Module: Design and Architectures of Embedded Systems (ESII) [M-INFO-107230]**

**Coordinators:** Prof. Dr.-Ing. Jörg Henkel  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

| Credits | Grading | Recurrence       | Duration | Language | Level | Version |
|---------|---------|------------------|----------|----------|-------|---------|
| 3 CP    | graded  | Each winter term | 1 term   | English  | 4     | 1       |

| Mandatory     |                                                     |      |        |
|---------------|-----------------------------------------------------|------|--------|
| T-INFO-114254 | Design and Architectures of Embedded Systems (ESII) | 3 CP | Henkel |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

The student learns methods for mastering complexity and applies these methods to the design of embedded systems. He/she evaluates and selects specific architectures for embedded systems. Furthermore, the student receives an introduction to current research topics.

**Content**

Nowadays, it is possible to integrate several billion transistors on a single chip and thus realize complete SoCs (systems-on-chip). The trend towards being able to use more and more transistors continues unabated, meaning that the complexity of such systems will also continue to increase. Computers will increasingly be ubiquitous, i.e. they will be integrated into the environment and will no longer be perceived as computers by humans. Examples include sensor networks, electronic textiles and many more. However, the physically possible complexity will not be readily achievable in practice, as there is currently a lack of powerful design processes capable of handling this high level of complexity. Powerful ESL tools ("Electronic System Level Design Tools") and novel architectures will be required. The focus of this lecture is therefore on high-level design methods and architectures for embedded systems. Since the power consumption of (mostly mobile) embedded systems is of crucial importance, one focus of the design methods will be on the design with regard to low power consumption.

**Workload**

90 hours:

30 hours of lectures (15 weeks\*2 hours)

30 hours of self study (15 weeks\*2 hours)

15 hours of deepening (coding low level C and embedded C) to grasp the theory with practical

15 hours exam preparation

## M

**5.53 Module: Designing Interactive Information Systems [M-WIWI-104080]**

**Coordinators:** Prof. Dr. Alexander Mädche  
**Organisation:** KIT Department of Business and Economics  
**Part of:** Economics and Management (Business Administration)

**Credits**  
9 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
6

| Compulsory Elective Courses (Election: at least 1 item) |                                                                                            |        |           |
|---------------------------------------------------------|--------------------------------------------------------------------------------------------|--------|-----------|
| T-WIWI-113465                                           | Designing Interactive Systems: Human-AI Interaction                                        | 4,5 CP | Mädche    |
| T-WIWI-113460                                           | Engineering Interactive Systems: AI & Wearables                                            | 4,5 CP | Mädche    |
| Supplementary Courses (Election: at most 1 item)        |                                                                                            |        |           |
| T-WIWI-114749                                           | (Gen)AI and Virtual Reality for Business                                                   | 4,5 CP | Pfeiffer  |
| T-WIWI-114210                                           | (Gen)AI-based Automation in Organizations                                                  | 4,5 CP | Mädche    |
| T-WIWI-111109                                           | KD <sup>2</sup> Lab Hands-On Research Course: New Ways and Tools in Experimental Economics | 4,5 CP | Weinhardt |
| T-WIWI-113459                                           | Practical Seminar: Human-Centered Systems                                                  | 4,5 CP | Mädche    |

**Assessment**

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.

**Prerequisites**

In this module, the courses "Designing Interactive Systems" or "Engineering Interactive Systems" must be compulsorily taken.

**Competence Goal**

The student

- has a comprehensive understanding of conceptual and theoretical foundations of interactive systems
- knows design processes for interactive systems
- is aware of the most important techniques and tools for designing interactive systems and knows how to apply them to real-world problems
- is able to apply design principles for the design of most important classes of interactive systems,
- creates new solutions of interactive systems teams

**Content**

Advanced information and communication technologies make interactive systems ever-present in the users' private and business life. They are an integral part of smartphones, devices in the smart home, mobility vehicles as well as at the working place in production and administration (e.g. in the form of dashboards).

With the continuous growing capabilities of computers, the design of the interaction between human and computer becomes even more important. This module focuses on design processes and principles for interactive systems. The contents of the module abstract from the technical implementation details and focus on foundational concepts, theories, practices and methods for the design of interactive systems. The students get the necessary knowledge to guide the successful implementation of interactive systems in business and private life.

Each lecture in the module is accompanied with a capstone project that is carried out with an industry partner.

**Additional Information**

See <http://issd.iism.kit.edu/305.php> for further information.

**Workload**

The total workload for this module is approximately 270 hours.

## M

**5.54 Module: Development of Business Information Systems [M-WIWI-101477]**

**Coordinators:** Prof. Dr. Andreas Oberweis  
**Organisation:** KIT Department of Business and Economics  
**Part of:** Informatics

**Credits**  
9 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
1 term

**Language**  
German

**Level**  
4

**Version**  
9

| Compulsory Elective Courses (Election: between 1 and 2 items) |                                                          |        |                                      |
|---------------------------------------------------------------|----------------------------------------------------------|--------|--------------------------------------|
| T-WIWI-113968                                                 | Management of IT-Projects                                | 4,5 CP | Alpers                               |
| T-WIWI-102895                                                 | Software Quality Management                              | 4,5 CP | Oberweis                             |
| Supplementary Courses (Election: at most 1 item)              |                                                          |        |                                      |
| T-WIWI-110346                                                 | Supplement Enterprise Information Systems                | 4,5 CP | Oberweis                             |
| T-WIWI-110548                                                 | Advanced Lab Informatics (Master)                        | 4,5 CP | Professorenschaft des Instituts AIFB |
| T-WIWI-112914                                                 | Advanced Lab Realization of Innovative Services (Master) | 4,5 CP | Oberweis                             |

**Assessment**

The assessment mix of each course of this module is defined for each course separately. The final mark for the module is the average of the marks for each course weighted by the credits and truncated after the first decimal.

**Prerequisites**

The course *Datenbanksysteme und XML* or the course *Software Quality Management* must be examined.

**Competence Goal**

Students

- describe the structure and the components of enterprise information systems,
- explain functionality and architecture of the enterprise information system components ,
- choose and apply relevant components to solve given problems in a methodic approach,
- describe roles, activities and products in the field of software engineering management,
- compare process and quality models and choose an appropriate model in a concrete situation,
- write scientific theses in the areas of enterprise information system components and software engineering management and find own solutions for given problems and research questions.

**Content**

An enterprise information system contains the complete application software to store and process data and information in an organisation including design and management of databases, workflow management and strategic information planning.

Due to global networking and geographical distribution of enterprises as well as the increasing acceptance of eCommerce the application of distributed information systems becomes particular important.

This module teaches concepts and methods for design and application of information systems.

**Additional Information**

The course T-WIWI-102759 "Requirements Analysis and Requirements Management" will no longer be offered in the module as of winter semester 2018/2019.

**Workload**

See German version

**M****5.55 Module: Digital Accessibility and Assistive Technologies [M-INFO-105882]****Coordinators:** Prof. Dr.-Ing. Rainer Stiefelhagen**Organisation:** KIT Department of Informatics**Part of:** Informatics**Credits**  
3 CP**Grading**  
graded**Recurrence**  
Each summer term**Duration**  
1 term**Language**  
German/English**Level**  
4**Version**  
1**Mandatory**

|               |                                                  |      |              |
|---------------|--------------------------------------------------|------|--------------|
| T-INFO-111830 | Digital Accessibility and Assistive Technologies | 3 CP | Stiefelhagen |
|---------------|--------------------------------------------------|------|--------------|

**Competence Goal**

- Die Studierenden erhalten eine Einführung in die Thematik Barrierefreiheit insbesondere die digitale Barrierefreiheit und inklusive Digitalisierung. Mit der Verdeutlichung der gesellschaftlichen Mehrwerte für alle Nutzenden.
- Die Studierenden werden befähigt, die rechtlichen Grundlagen im Bereich "Barrierefreiheit" zu verstehen und anzuwenden, um die Bedürfnisse von Menschen mit Behinderungen zu berücksichtigen.
- Die Studierenden erlangen ein fundiertes Verständnis über Sehschädigungen, einschließlich deren Ursachen und Auswirkungen, um angemessene Lösungen und Unterstützung für Betroffene bereitzustellen.
- Die Studierenden entwickeln Kompetenzen im Umgang mit existierenden Assistiven Technologien (AT) für verschiedene Anwendungsfelder, darunter AT für den Alltag, Mobilitätsunterstützung und Informationszugang. Und sie lernen die zugehörigen Feedback-Mechanismen kennen.
- Die Studierenden erlernen die Umsetzung von Richtlinien für die Entwicklung barrierefreier Webseiten und Softwareanwendungen, um sicherzustellen, dass digitale Inhalte für alle zugänglich sind.
- Die Studierenden erwerben Kenntnisse und Fertigkeiten in der barrierefreien Softwareentwicklung und Dokumentenerstellung, um inklusive Softwareprodukte und Dokumente zu gestalten.
- Die Studierenden werden mit aktuellen Forschungsansätzen im Bereich assistiver Technologien vertraut gemacht, insbesondere in Bezug auf die Nutzung von Methoden des Maschinellen Sehens (Computer Vision) zur Entwicklung innovativer AT-Lösungen.
- Die Studierenden sind in der Lage, Assistive Technologien zu evaluieren und deren Wirksamkeit und Nutzerfreundlichkeit zu bewerten, um sicherzustellen, dass sie den Bedürfnissen der Zielgruppen entsprechen.



**Content**

Digital accessibility is a topic that affects us all. Accessing information digitally, from childhood to old age. Assistive technologies, such as smartphones, tablets, smartwatches, wearables in general have become a part of our everyday life. Exactly these things should be operable and usable by all people. Regardless of any barriers.

But what are the details behind this? What are the rights and foundations for this? What all has to be done to be "barrier-free"?

This can all be best illustrated by the example of "visual impairment".

According to the World Health Organization, there are approximately 285 million people with visual impairments worldwide, including approximately 39 million people who are blind. The partial or complete loss of vision significantly restricts blind and visually impaired people in their working and social lives. It is difficult for blind and visually impaired people to orient themselves and move around in public spaces without assistance. The reasons for this are problems in perceiving obstacles and landmarks as well as the resulting fear of accidents and orientation difficulties. Other problems in everyday life are: reading texts, recognizing banknotes, food, clothes or finding objects in the household.

For support, blind and visually impaired people can already rely on a number of technical aids. For example, digitized texts can be made accessible through speech output or Braille output devices. There are also various devices made specifically for the blind. The most important aid for improving mobility is by far the cane for the blind. In recent years, some electronic aids for obstacle detection or orientation support have also been developed, but these offer only very limited functionality at a relatively high price and are therefore rather rarely in use.

The lecture gives an overview of IT-based Assistive Technologies (AT) by example and includes the following topics:

- Legal basics
- Basics of visual impairments, their causes and effects
- Existing assistive technologies for different fields of application
- AT for information access
- Accessible software development
- Accessible design of websites
- Accessible documents
- Use of machine learning methods
- Feedback systems and their basics
- Insights into current research topics around the topic of digital accessibility

For the latest information, visit <http://cvhci.anthropomatik.kit.edu/>

**M****5.56 Module: Digital Marketing [M-WIWI-106258]**

**Coordinators:** Prof. Dr. Ann-Kristin Kupfer  
**Organisation:** KIT Department of Business and Economics  
**Part of:** Economics and Management (Business Administration)

**Credits**  
9 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
2 terms

**Language**  
English

**Level**  
4

**Version**  
2

| Mandatory                                     |                                                      |        |                     |
|-----------------------------------------------|------------------------------------------------------|--------|---------------------|
| T-WIWI-112693                                 | Digital Marketing                                    | 4,5 CP | Kupfer              |
| Supplementary Courses (Election: 4,5 credits) |                                                      |        |                     |
| T-WIWI-106981                                 | Digital Marketing and Sales in B2B                   | 1,5 CP | Klarmann, Konhäuser |
| T-WIWI-114174                                 | Economic Decision Making                             | 4,5 CP | Scheibehenne        |
| T-WIWI-114893                                 | International Entrepreneurship and Brand Development | 6 CP   | Kupfer, Terzidis    |
| T-WIWI-107720                                 | Market Research                                      | 4,5 CP | Klarmann            |
| T-WIWI-112711                                 | Media Management                                     | 4,5 CP | Kupfer              |
| T-WIWI-111848                                 | Online Concepts for Karlsruhe City Retailers         | 3 CP   | Kupfer              |

**Assessment**

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 "Digital Marketing" module explores advanced marketing strategies within the context of digital transformation. Students develop a deep understanding of digital consumer behavior, the digital environment, and digital marketing strategies:

- **Principles of Digital Marketing:** In this mandatory course of the module, students learn about practices and strategies like search engine optimization, word-of-mouth, and influencer marketing.
- **Performance Analytics and Practical Applications:** Practical applications of SEO, SEA, and Content Management Systems. Students learn to monitor performance using Key Performance Indicators (KPIs), dashboards, and Return on Investment (RoI) calculations and apply their knowledge to real-world cases.
- **Contextualization:** Via course selections, students can learn about specific requirements for B2B digital strategies, media industries, and retailing.
- **Decision Psychology:** Students can decide to deepen their knowledge on consumer psychology, including heuristics, nudging, and risk perception.
- **Market Research & Methods:** Students can learn about advanced empirical techniques to interpret customer attitudes and prepare for scientific research.

By integrating these multidisciplinary perspectives, the module enables students to implement sophisticated marketing instruments and critically evaluate current practices in digital business environments.

**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.

## M

**5.57 Module: Digital Service Systems in Industry [M-WIWI-102808]**

**Coordinators:** Prof. Dr. Wolf Fichtner  
Prof. Dr. Stefan Nickel

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

**Part of:** Economics and Management (Business Administration)

**Credits**  
9 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
2 terms

**Language**  
German

**Level**  
4

**Version**  
9

| Compulsory Elective Courses (Election: 9 credits) |                                                |        |          |
|---------------------------------------------------|------------------------------------------------|--------|----------|
| T-WIWI-112757                                     | Digital Services: Innovation & Business Models | 4,5 CP | Satzger  |
| T-WIWI-107043                                     | Liberalised Power Markets                      | 5,5 CP | Fichtner |
| T-WIWI-106200                                     | Modeling and OR-Software: Advanced Topics      | 4,5 CP | Nickel   |
| T-WIWI-106563                                     | Practical Seminar Digital Service Systems      | 4,5 CP | Satzger  |
| T-WIWI-114109                                     | Service Operations and Cyber Security          | 4,5 CP | Mohr     |

**Assessment**

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**

This module can only be assigned as an elective module.

**Competence Goal**

Students

- understand the basics of the management of digital services applied on an industrial context
- gain an industry-specific insight into the importance and most relevant characteristics of information systems as key components of the digitalization of business processes, products and services
- are able to transfer and apply the models and methods introduced on practical scenarios and simulations.
- understand the control and optimization methods in the sector of service management and are able to apply them properly.

**Content**

This module aims at deepening the fundamental knowledge of digital service management in the industrial context. Various mechanisms and methods to shape and control connected digital service systems in different industries are discussed and demonstrated with real life application cases.

**Additional Information**

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](http://www.ksri.kit.edu/teaching)

From summer semester 2023, the course Service Innovation will be offered with a revised course concept and content. The focus will be on the closer integration of the topics of service innovation and digitalization. Current foundational content (e.g., on service innovation challenges or human-centered innovation methods) will remain. New content will cover topics such as digital platforms and ecosystems, IoT and smart service innovation, and business models.

**Workload**

Total workload for 9 credit points: approx. 270 hours. The allocation is based on the credit points of the courses in the module.

**Recommendations**

None

## M

**5.58 Module: Distributed Computing [M-INFO-107215]**

**Coordinators:** Prof. Dr. Achim Streit  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
4 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                       |      |        |
|---------------|-----------------------|------|--------|
| T-INFO-114235 | Distributed Computing | 4 CP | Streit |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students understand the basic concepts of distributed systems, in particular Grid and Cloud Computing as well as the management and analysis of big and distributed data. They apply underlying paradigms and services to given examples. Students analyze methods and technologies of Grid and Cloud Computing as well as distributed data management, which are suitable for use in everyday and industrial application areas or which are used today by Google, Facebook, Amazon, etc. For this purpose, students will compare web/grid services, elementary grid functionalities, data lifecycles, metadata, archiving, cloud service types (IaaS, SaaS, PaaS) and public/private clouds using real-world examples.

**Content**

The lecture introduces the world of distributed computing with a focus on fundamentals and technologies from Grid and Cloud Computing as well as the handling of Big Data. The lecture combines theory and application with the help of relevant examples from science and industry.

First, an introduction to the main characteristics of distributed systems is given. Then the topic of Grid Computing is discussed in more detail and the close relationship between Grid computing and distributed data management is illustrated using the example of the WLCG, the infrastructure for distributing, storing and analyzing data from the particle accelerator at CERN.

Subsequently, the topic of cloud computing is discussed and compared with the preceding. After the definition of basic terms and concepts, virtualization is introduced as one of the key technologies of Cloud Computing; finally, common architectures, services and components in the Cloud context are discussed using examples and in general.

Next, common methods for authorization and authentication in distributed environments will be discussed. The lecture includes the description of the basics of Authentication and Authorization Infrastructures (AAI) as well as different technologies, for example certificate- or token-based procedures.

In a further block of topics, concepts for the management and analysis of large or distributed data are presented. In this context tools and frameworks, as well as the lifecycle of data, its metadata and data storage are explained.

**Workload**

2 SWS = 120 h per semester

- 30 h in the weekly lecture during the semester
- 90 h post-processing of lectures and self-learning of the content due to its complexity

## M

**5.59 Module: Econometrics and Statistics I [M-WIWI-101638]**

**Coordinators:** Prof. Dr. Melanie Schienle  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [Economics and Management \(Statistics\)](#)

| Credits | Grading | Recurrence | Duration | Language       | Level | Version |
|---------|---------|------------|----------|----------------|-------|---------|
| 9 CP    | graded  | Each term  | 1 term   | German/English | 4     | 6       |

| Mandatory                                                   |                                                                       |        |          |
|-------------------------------------------------------------|-----------------------------------------------------------------------|--------|----------|
| T-WIWI-111388                                               | <a href="#">Applied Econometrics</a>                                  | 4,5 CP | Krüger   |
| Supplementary Courses (Election: between 4,5 and 5 credits) |                                                                       |        |          |
| T-WIWI-103064                                               | <a href="#">Financial Econometrics</a>                                | 4,5 CP | Schienle |
| T-WIWI-103126                                               | <a href="#">Non- and Semiparametrics</a>                              | 4,5 CP | Schienle |
| T-WIWI-103127                                               | <a href="#">Panel Data</a>                                            | 4,5 CP | Heller   |
| T-WIWI-110868                                               | <a href="#">Predictive Modeling</a>                                   | 4,5 CP | Krüger   |
| T-WIWI-111387                                               | <a href="#">Probabilistic Time Series Forecasting Challenge</a>       | 4,5 CP | Krüger   |
| T-WIWI-103065                                               | <a href="#">Statistical Modeling of Generalized Regression Models</a> | 4,5 CP | Heller   |
| T-WIWI-110939                                               | <a href="#">Financial Econometrics II</a>                             | 4,5 CP | Schienle |

**Assessment**

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 completed if it has not already been successfully completed in one of the modules 'Economics of Innovation and Growth' or 'Economics in a Connected World'. If the course 'Applied Econometrics' has already been completed in another module, the module cannot be chosen by the student. In this case, please contact the Examinations Office of the WIWI-Department, which will adjust the elective requirements in the module.

**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.

## M

**5.60 Module: Econometrics and Statistics II [M-WIWI-101639]**

**Coordinators:** Prof. Dr. Melanie Schienle  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [Economics and Management \(Statistics\)](#)

| Credits | Grading | Recurrence | Duration | Language       | Level | Version |
|---------|---------|------------|----------|----------------|-------|---------|
| 9 CP    | graded  | Each term  | 1 term   | German/English | 4     | 7       |

**Election Notes**

**Special note on elective regulations:** The partial achievement T-WIWI-111388 "Applied Econometrics" is generally a mandatory requirement for this module.

**Exception:** If this partial achievement has already been successfully completed as part of the module M-WIWI-101638 "Econometrics and Statistics I", the requirement for this module is waived. In this case, any other partial achievements from the module's offering may be selected instead to reach the required number of credits (LP).

**Important note on registration:** As the automated verification in the Campus System cannot account for this specific exception, students are unable to register for alternative partial achievements independently. In this case, please contact the **Examination Office of the KIT Department of Economics and Management** directly for manual registration.

| Mandatory                                               |                                                                       |        |          |
|---------------------------------------------------------|-----------------------------------------------------------------------|--------|----------|
| T-WIWI-111388                                           | <a href="#">Applied Econometrics</a>                                  | 4,5 CP | Krüger   |
| Compulsory Elective Courses (Election: at least 1 item) |                                                                       |        |          |
| T-WIWI-103064                                           | <a href="#">Financial Econometrics</a>                                | 4,5 CP | Schienle |
| T-WIWI-110939                                           | <a href="#">Financial Econometrics II</a>                             | 4,5 CP | Schienle |
| T-WIWI-103124                                           | <a href="#">Multivariate Statistical Methods</a>                      | 4,5 CP | Grothe   |
| T-WIWI-103126                                           | <a href="#">Non- and Semiparametrics</a>                              | 4,5 CP | Schienle |
| T-WIWI-103127                                           | <a href="#">Panel Data</a>                                            | 4,5 CP | Heller   |
| T-WIWI-103128                                           | <a href="#">Portfolio and Asset Liability Management</a>              | 4,5 CP | Safarian |
| T-WIWI-110868                                           | <a href="#">Predictive Modeling</a>                                   | 4,5 CP | Krüger   |
| T-WIWI-111387                                           | <a href="#">Probabilistic Time Series Forecasting Challenge</a>       | 4,5 CP | Krüger   |
| T-WIWI-103123                                           | <a href="#">Advanced Statistics</a>                                   | 4,5 CP | Grothe   |
| T-WIWI-103065                                           | <a href="#">Statistical Modeling of Generalized Regression Models</a> | 4,5 CP | Heller   |
| T-WIWI-103129                                           | <a href="#">Stochastic Calculus and Finance</a>                       | 4,5 CP | Safarian |

**Assessment**

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 partial achievement T-WIWI-111388 "Applied Econometrics" is generally a mandatory requirement for this module.

**Exception:** If this partial achievement has already been successfully completed as part of the module M-WIWI-101638 "Econometrics and Statistics I", the requirement for this module is waived. In this case, any other partial achievements from the module's offering may be selected instead to reach the required number of credits (LP).

**Important note on registration:** As the automated verification in the Campus System cannot account for this specific exception, students are unable to register for alternative partial achievements independently. In this case, please contact the **Examination Office of the KIT Department of Economics and Management** directly for manual registration.

**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**

Total workload for 9 credit points: approx. 270 hours. The allocation is based on the credit points of the courses in the module. The workload for courses with 4.5 credits is approx. 135 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 to achieve the learning objectives of the module for an average student for an average performance.



## M

**5.61 Module: Economic Theory and its Application in Finance [M-WIWI-101502]**

**Coordinators:** Prof. Dr. Kay Mitusch  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [Economics and Management \(Economics\)](#)

**Credits**  
9 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
6

| Compulsory Elective Courses (Election: 1 item) |                                                    |        |                       |
|------------------------------------------------|----------------------------------------------------|--------|-----------------------|
| T-WIWI-102609                                  | <a href="#">Advanced Topics in Economic Theory</a> | 4,5 CP | Brumm, Mitusch        |
| T-WIWI-102861                                  | <a href="#">Advanced Game Theory</a>               | 4,5 CP | Ehrhart, Puppe, Reiß  |
| Supplementary Courses (Election: )             |                                                    |        |                       |
| T-WIWI-113469                                  | <a href="#">Advanced Corporate Finance</a>         | 4,5 CP | Ruckes                |
| T-WIWI-102647                                  | <a href="#">Asset Pricing</a>                      | 4,5 CP | Ruckes, Uhrig-Homburg |
| T-WIWI-109050                                  | <a href="#">Corporate Risk Management</a>          | 4,5 CP | Ruckes                |
| T-WIWI-102623                                  | <a href="#">Financial Intermediation</a>           | 4,5 CP | Ruckes                |

**Assessment**

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**

Total workload for 9 credit points: approx. 270 hours

The exact distribution is based on the credit points of the courses in the module.

## M

**5.62 Module: Economics in a Connected World [M-WIWI-107010]**

**Coordinators:** Prof. Dr. Ingrid Ott  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [Economics and Management \(Economics\)](#)

**Credits**  
9 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory                                              |                                                                        |        |                |
|--------------------------------------------------------|------------------------------------------------------------------------|--------|----------------|
| T-WIWI-103107                                          | <a href="#">Spatial Economics</a>                                      | 4,5 CP | Ott            |
| Compulsory Elective Courses (Election: at most 1 item) |                                                                        |        |                |
| T-WIWI-102609                                          | <a href="#">Advanced Topics in Economic Theory</a>                     | 4,5 CP | Brumm, Mitusch |
| T-WIWI-111388                                          | <a href="#">Applied Econometrics</a>                                   | 4,5 CP | Krüger         |
| T-WIWI-109194                                          | <a href="#">Dynamic Macroeconomics</a>                                 | 4,5 CP | Brumm          |
| T-WIWI-112822                                          | <a href="#">Economics of Innovation</a>                                | 4,5 CP | Ott            |
| T-WIWI-112816                                          | <a href="#">Growth and Development</a>                                 | 4,5 CP | Ott            |
| T-WIWI-113147                                          | <a href="#">Telecommunications and Internet – Economics and Policy</a> | 4,5 CP | Mitusch        |

**Assessment**

The assessment is carried out as partial exams according to § 4 paragraph 2 Nr. 1 – Nr. 3 SPO of the examination regulation 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 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**

- Theoretical Understanding of Spatial and Network Economics:
  - develop a deep understanding of the economic forces shaping spatial distribution, locational choice, trade flows, and urban development in both physical and digital landscapes.
  - understand how processes of spatial concentration result from the interplay of agglomeration and dispersion forces.
- Equilibrium Analysis and Stability:
  - gain expertise in deriving economic equilibria and analyzing their stability properties
  - understand and identify bifurcation points, exploring their implications for dynamic changes in economic systems.
- Quantitative and Analytical Skills:
  - acquire advanced skills in applying mathematical and computational tools to model spatial and connected economics.
  - use simulations and calibrations to explore dynamic economic systems and assess the implications of policy interventions.
- Programming and Empirical Analysis:
  - build competence in programming tools (e.g., Python, MATLAB, or R) to implement economic models and analyze results.
  - use econometric methods to evaluate and interpret real-world data related to trade, locational choice, and infrastructure development.

Upon completion, these competence goals aim to prepare students for advanced research, policy-making, and strategic decision-making in economics, business engineering, and digital economics, enabling them to tackle real-world problems with a robust theoretical and quantitative foundation.

**Content**

This module explores the interplay of spatial, digital, and economic networks, focusing on trade, locational choice, and the role of physical and digital infrastructure in shaping economic outcomes. It combines theoretical and applied approaches, equipping students with advanced analytical tools and insights into interconnected economic systems. It investigates the economic forces shaping the spatial distribution of resources, firms, and individuals, with a focus on locational choice, trade flows, and urban development in physical landscapes.

A strong focus is laid on the derivation of economic equilibria, with particular attention to their stability properties. Stability analyses include the identification and exploration of bifurcation points to understand dynamic changes in economic systems. Furthermore, decentralized decisions are critically evaluated using the normative framework of social welfare, offering insights into trade-offs and efficiency in economic systems.

**Workload**

Total workload for 9 credit points: approx. 270 hours

The exact distribution is based on the credit points of the courses in the module.

**Recommendations**

Sound understanding of theoretical foundations in microeconomic theory, macroeconomic theory, and statistics according to international standards of a bachelor's degree in Economics, Business Administration or similar disciplines. Basic knowledge in programming (R, Python) is required.

## M

**5.63 Module: Economics of Innovation and Growth [M-WIWI-107011]**

**Coordinators:** Prof. Dr. Ingrid Ott  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [Economics and Management \(Economics\)](#)

**Credits**  
9 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Compulsory Elective Courses (Election: at least 1 item) |                                                    |        |                |
|---------------------------------------------------------|----------------------------------------------------|--------|----------------|
| T-WIWI-112822                                           | <a href="#">Economics of Innovation</a>            | 4,5 CP | Ott            |
| T-WIWI-112816                                           | <a href="#">Growth and Development</a>             | 4,5 CP | Ott            |
| Supplementary Courses (Election: )                      |                                                    |        |                |
| T-WIWI-102609                                           | <a href="#">Advanced Topics in Economic Theory</a> | 4,5 CP | Brumm, Mitusch |
| T-WIWI-111388                                           | <a href="#">Applied Econometrics</a>               | 4,5 CP | Krüger         |
| T-WIWI-109194                                           | <a href="#">Dynamic Macroeconomics</a>             | 4,5 CP | Brumm          |
| T-WIWI-114054                                           | <a href="#">Methods in Economics</a>               | 1,5 CP | Ott            |
| T-WIWI-102789                                           | <a href="#">Seminar in Economic Policy</a>         | 3 CP   | Ott            |

**Assessment**

The assessment is carried out as partial exams according to § 4 paragraph 2 Nr. 1 – Nr. 3 SPO of the examination regulation 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 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**

- Theoretical and Analytical Competences:
  - understand the key mechanisms underlying micro-based macro models.  
gain the ability to analyze formal theoretical models in economics, focusing on innovation, growth and development.
  - understand the identification of equilibria, assessing their stability characteristics, including their graphical derivations based on phase-diagrams.
  - understand the normative perspective of the models: get competence in evaluating decentralized decision-making processes based on the concept of social welfare and
  - understanding associated trade-offs between centralized and decentralized solutions.
- Quantitative and Computational Competences:
  - gain proficiency in calibrating models with real-world data and simulating outcomes to analyze dynamic economic systems.
  - gain experience in applying programming tools (e.g., Python, MATLAB, or R) to implement economic models, run simulations, and interpret computational results.
  - gain the ability to apply econometric techniques to evaluate the effects of physical and digital networks on trade, locational choices, and infrastructure investments.
- Regarding Content:
  - know the basic techniques for analyzing static and dynamic optimization models that are applied in the context of microeconomic and macroeconomic theories.
  - understand the important role of innovation to the overall economic growth and prosperity.
  - 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.

Upon completion, students will have gained a strong theoretical foundation and practical skills to evaluate innovation and growth processes that are incentive-based, micro-founded while addressing the macroeconomic perspective. The module prepares students for advanced research or professional applications in academia, policy, and practice.

**Content**

This module provides a comprehensive introduction to the economic foundations, processes, and quantitative methods that drive innovation and growth and thus shape the development of nations over time. Based on empirical recurring patterns (so-called stylized facts), the overall goal is to gain a sound understanding of the determinants of long-run prosperity, structural change, and the role of government.

The module covers key theoretical concepts, discusses the role of policy frameworks and instruments, and applies quantitative and econometric techniques. Some programming techniques are also applied (R, Python). The courses enable students to understand and analyze economic dynamics from an aggregate perspective, although the theories are consequently micro-founded. Theoretical foundations are indispensable tools for theory building and serve as a normative compass for economic policy making, especially in addressing complex societal challenges.

**Workload**

Total workload for 9 credit points: approx. 270 hours.

The exact distribution is based on the credit points of the courses in the module.

**Recommendations**

Sound understanding of theoretical foundations in microeconomic theory, macroeconomic theory, and statistics according to international standards of a bachelor's degree in Economics, Business Administration or similar disciplines. Basic knowledge in programming (R, Python) is required.

## M

**5.64 Module: eEnergy: Markets, Services and Systems [M-WIWI-103720]**

**Coordinators:** Prof. Dr. Christof Weinhardt  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [Economics and Management \(Business Administration\)](#)

**Credits**  
9 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
1 term

**Language**  
German

**Level**  
4

**Version**  
3

| Compulsory Elective Courses (Election: at least 9 credits) |                                                       |        |           |
|------------------------------------------------------------|-------------------------------------------------------|--------|-----------|
| T-WIWI-107501                                              | <a href="#">Energy Market Engineering</a>             | 4,5 CP | Weinhardt |
| T-WIWI-107503                                              | <a href="#">Energy Networks and Regulation</a>        | 4,5 CP | Weinhardt |
| T-WIWI-107504                                              | <a href="#">Smart Grid Applications</a>               | 4,5 CP | Weinhardt |
| T-WIWI-113726                                              | <a href="#">Special Topics in Information Systems</a> | 4,5 CP | Weinhardt |

**Assessment**

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

**Prerequisites**

None.

**Competence Goal**

The student

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

**Content**

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

**Additional Information**

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

**Workload**

The total workload for this module is approx. 270 hours (9 CP). The allocation is based on the credit points of the courses in the module. The workload for courses with 4.5 CP is approx. 135 hours.

The total number of hours per course results from the time required to attend the lectures and exercises, as well as the examination times and the time required to achieve the qualification objectives of the module for an average student for an average performance.

## M

**5.65 Module: Electronic Markets [M-WIWI-101409]**

**Coordinators:** Prof. Dr. Andreas Geyer-Schulz  
**Organisation:** KIT Department of Business and Economics  
**Part of:** Economics and Management (Business Administration)

| Credits | Grading | Recurrence | Duration | Language       | Level | Version |
|---------|---------|------------|----------|----------------|-------|---------|
| 9 CP    | graded  | Each term  | 2 terms  | German/English | 4     | 9       |

| Compulsory Elective Courses (Election: at least 9 credits) |                                                                       |        |                     |
|------------------------------------------------------------|-----------------------------------------------------------------------|--------|---------------------|
| T-WIWI-102762                                              | Business Dynamics                                                     | 4,5 CP | Geyer-Schulz, Glenn |
| T-WIWI-112823                                              | Platform & Market Engineering: Commerce, Media, and Digital Democracy | 4,5 CP | Weinhardt           |
| T-WIWI-105946                                              | Price Management                                                      | 4,5 CP | Geyer-Schulz, Glenn |
| T-WIWI-113147                                              | Telecommunications and Internet – Economics and Policy                | 4,5 CP | Mitusch             |

**Assessment**

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. 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

- knows coordination and motivation methods and analyzes them regarding their efficiency,
- classifies markets and describes the roles of the participants in a formal way,
- knows the conditions for market failure and knows and develops countermeasures,
- knows institutions and market mechanisms, their fundamental theories and empirical research results,
- knows the design criteria of market mechanisms and a systematical approach for creating new markets,
- models, analyzes and optimizes the structure and dynamics of complex business applications.

**Content**

What are the conditions that make electronic markets develop, and how can one analyze and optimize such markets?

In this module, the selection of the type of organization as an optimization of transaction costs is treated. Afterwards, the efficiency of electronic markets (price, information and allocation efficiency) as well as reasons for market failure are described. Finally, motivational issues like bounded rationality and information asymmetries (private information and moral hazard), as well as the development of incentive schemes, are presented. Regarding the market design, especially the interdependencies of market organization, market mechanisms, institutions and products are described, and theoretical foundations are lectured.

Electronic markets are dynamic systems that are characterized by feedback loops between many different variables. By means of the tools of business dynamics, such markets can be modelled. Simulations of complex systems allow the analysis and optimization of markets, business processes, policies, and organizations.

Topics include

- classification, analysis, and design of markets
- simulation of markets
- auction methods and auction theory
- automated negotiations
- nonlinear pricing
- continuous double auctions
- market-maker, regulation, control

**Workload**

The total workload for this module is approx. 270 hours (9 credits). The distribution is based on the credit points of the courses in the module. The workload for courses with 4.5 credits is approx. 135 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 for an average performance.

**Recommendations**

None



## M

**5.66 Module: Empirical Software Engineering [M-INFO-107685]**

**Coordinators:** Prof. Dr.-Ing. Anne Koziolk  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
4 CP

**Grading**  
graded

**Recurrence**  
Irregular

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                |      |          |
|---------------|------------------------------------------------|------|----------|
| T-INFO-115054 | <a href="#">Empirical Software Engineering</a> | 4 CP | Dehghani |

**Assessment**

See Partial Achievements (Teilleistung).

**Prerequisites**

See Partial Achievements (Teilleistung).

**Competence Goal**

- Be able to report empirical studies in software engineering and identify potential sources of error as well as appropriate mitigation strategies.
- Be able to explain and apply statistical analysis methods.
- Analyze and evaluate empirical studies.
- Be able to plan and carry out empirical studies.

**Content**

The lecture deals with the role of empiricism in software engineering. It introduces the most common empirical methods and points out common sources of error in empirical studies. The associated statistical methods for analyzing and presenting the data are taught. The lecture uses a number of scientific publications to illustrate the concepts and bring them to life.

**Workload**

The lecture will take place once (one 1.5h session) per week. The workload will amount to 4.0 CP, as students will also complete exercises in preparation for the exam.

## M

**5.67 Module: Energy Economics and Energy Markets [M-WIWI-101451]****Coordinators:** Prof. Dr. Wolf Fichtner**Organisation:** KIT Department of Business and Economics**Part of:** Economics and Management (Business Administration)**Credits**  
9 CP**Grading**  
graded**Recurrence**  
Each term**Duration**  
1 term**Language**  
German/English**Level**  
4**Version**  
9

| Mandatory                          |                                             |        |           |
|------------------------------------|---------------------------------------------|--------|-----------|
| T-WIWI-107043                      | Liberalised Power Markets                   | 5,5 CP | Fichtner  |
| Supplementary Courses (Election: ) |                                             |        |           |
| T-WIWI-114980                      | Behavioral Dimensions of Energy Transitions | 3,5 CP | Fichtner  |
| T-WIWI-107501                      | Energy Market Engineering                   | 4,5 CP | Weinhardt |
| T-WIWI-112151                      | Energy Trading and Risk Management          | 3,5 CP | N.N.      |
| T-WIWI-108016                      | Simulation Game in Energy Economics         | 3,5 CP | Genoese   |
| T-WIWI-107446                      | Quantitative Methods in Energy Economics    | 3,5 CP | Plötz     |
| T-WIWI-102712                      | Regulation Theory and Practice              | 4,5 CP | Mitusch   |

**Assessment**

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 Trading and Risk Management*: trade centres, trade products, market mechanisms, position and risk management
- *Simulation Game in Energy Economics*: Simulation of the German electricity system
- *Behavioral Dimensions of Energy Transitions*: Explores how energy consumers make decisions regarding their energy use and how these decisions can be influenced by psychological and economic factors, such as financial incentives; examines the social acceptance of energy technologies and policies, and what determines different levels of acceptance.
- *Quantitative Methods in Energy Economics*: The aim of the course is to help the students understand real-world usage of quantitative methods of energy economics and apply these methods

**Workload**

The total workload for this module is approx. 270 hours (9 credits). The allocation is based on the credit points of the courses in the module. The workload for courses with 3.5 credits is approx. 105 hours, for courses with 5.5 credits approx. 165 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 for an average performance.

**Recommendations**

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.

## M

**5.68 Module: Energy Economics and Technology [M-WIWI-101452]****Coordinators:** Prof. Dr. Wolf Fichtner**Organisation:** KIT Department of Business and Economics**Part of:** Economics and Management (Business Administration)**Credits**  
9 CP**Grading**  
graded**Recurrence**  
Each term**Duration**  
1 term**Language**  
German/English**Level**  
4**Version**  
5

| Compulsory Elective Courses (Election: at least 9 credits) |                                                     |        |                  |
|------------------------------------------------------------|-----------------------------------------------------|--------|------------------|
| T-WIWI-102793                                              | Efficient Energy Systems and Electric Mobility      | 3,5 CP | Jochem           |
| T-WIWI-102650                                              | Energy and Environment                              | 3,5 CP | Karl             |
| T-WIWI-113073                                              | Machine Learning and Optimization in Energy Systems | 3,5 CP | Fichtner         |
| T-WIWI-107464                                              | Smart Energy Infrastructure                         | 5,5 CP | Ardone, Pustisek |
| T-WIWI-102695                                              | Heat Economy                                        | 3,5 CP | Fichtner         |

**Assessment**

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**

None

**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 and Environment:** emission factors, emission reduction measures, environmental impact
- **Machine Learning and Optimization in Energy Systems:** Understanding and Applying the core principles of the most commonly used machine learning and optimization techniques within the energy sector

**Workload**

The total workload for this module is approx. 270 hours (9 credits). The allocation is based on the credit points of the courses in the module. The workload for courses with 3,5 credits is approx. 105 hours, and for courses with 5,5 credits approx. 165 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 for an average performance.

## M

**5.69 Module: Energy Informatics [M-INFO-106864]**

**Coordinators:** Prof. Dr. Veit Hagenmeyer  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

| Credits | Grading | Recurrence       | Duration | Language       | Level | Version |
|---------|---------|------------------|----------|----------------|-------|---------|
| 10 CP   | graded  | Each winter term | 2 terms  | German/English | 3     | 1       |

| Mandatory     |                                         |      |            |
|---------------|-----------------------------------------|------|------------|
| T-INFO-103582 | Energy Informatics 1                    | 5 CP | Hagenmeyer |
| T-INFO-110356 | Energy Informatics 1 - Preliminary Work | 0 CP | Hagenmeyer |
| T-INFO-106059 | Energy Informatics 2                    | 5 CP | Hagenmeyer |

**Assessment**

See Partial Achievements (Teilleistung)

**Prerequisites**

See Partial Achievements (Teilleistung)

**Competence Goal****Energy Informatics 1:**

After successful participation, students should

- be able to explain the physical and technical principles of different forms of energy, their storage, their transmission and the corresponding energy conversion processes,
- be able to represent, apply and evaluate physical and technical relationships using simple mathematical equations,
- be able to explain and evaluate the composition of the individual system components to form the overall energy system,
- be able to name typical use cases in energy informatics (e.g. power grid modeling, simulation and optimization, data analysis, security),
- be able to describe and analyze Germany's existing energy system,
- be able to explain and assess basic energy industry relationships,
- be able to explain and evaluate the smart grid as a concept for an intelligent energy supply system of the future.

**Energy Informatics 2:**

After successful participation, students should be able to

- be able to explain and classify architectures, protocols and standards of modern control center software and concepts,
- be able to explain and use hardware and software for the simulation and analysis of energy networks
- be able to assess big data in the environment of future energy systems and apply data analysis methods to energy data sets,
- be able to explain the basics of system theory, control engineering and mathematical optimization with reference to energy networks
- be able to discuss the fundamentals of real-time capable, reliable and secure software systems in energy systems,
- be able to evaluate the Energy Lab 2.0, future scenarios and the overall energy system,
- be able to assess the importance of information technology approaches and methods for the energy system of the future,
- be able to assess the relevance of energy informatics for their own academic career.

**Content****Energy Informatics 1:**

This module provides an overview of the physical and technical fundamentals of various forms of energy, their storage, their transmission and the corresponding energy conversion processes. In addition, this module examines the technical combination of various local energy systems to form an overall energy system and provides an outlook on typical information technology applications in the energy sector.

The following topics are covered in detail, each with examples:

- Forms, systems and storage of energy
- Energy conversion processes in power plants
- renewable energies
- Energy transmission (electricity/gas/heat networks)
- Electrical grids of the future, load management
- Use of information and communication technology (ICT)
- energy industry

**Energy informatics 2:**

- This module builds on the "Energy Informatics 1" module. Based on the physical and technical fundamentals of energy forms, conversion, storage and transmission described in this module, as well as an outlook on typical applications of energy informatics, this module teaches information technology approaches and methods that are required to transform the existing energy system into an energy system of the future (e.g. smart grid, microgrid). In detail, this includes the following topics:- modern control center software and concepts for use in the smart grid
- Hardware and software infrastructure for simulating and analyzing energy grids:
  - Power grid analysis, simulation and modeling
  - Measurement and monitoring in the microgrid
  - 3D building and district models
  - Building-based heat/cold storage for load control in smart grids
  - Energy system modeling
- Big data in the environment of future energy systems:
  - Energy data management, data types, data storage
  - Data analysis (forecasting, data mining)
- Control and optimization of energy systems
- Real-time capable, reliable and secure software systems in energy systems

**Workload****Energy Informatics 1:**

2 SWS lecture and 2 SWS exercise: 60 h

Preparation and follow-up time: 75 h

Exam preparation and exam: 15 h

Total: 150 h = 5 ECTS

**Energy Informatics 2:**

2 SWS lecture and 2 SWS exercise: 60 h

Preparation and follow-up time: 75 h

Exam preparation and exam: 15h

Total: 150 h = 5 ECTS

## M

**5.70 Module: Engineering Self-Adaptive Systems [M-INFO-106626]**

**Coordinators:** Prof. Dr. Raffaella Mirandola  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                   |      |           |
|---------------|---------------------------------------------------|------|-----------|
| T-INFO-113349 | <a href="#">Engineering Self-Adaptive Systems</a> | 3 CP | Mirandola |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

- Understand the motivation for self-adaptation
- Get familiar with the basic principles and conceptual model of self-adaptation
- Understand how to engineer self-adaptive software systems from a software engineering perspective
- Understand the decision-making process using formal analysis at runtime for quality assurance
- Understand the notion of uncertainty in self-adaptive systems and how to tame it with formal verification at runtime
- Understand the level of adoption of self-adaptive systems in industry.

**Content**

Self-adaptation is an important field of research and engineering that aims to address the challenging problem of how to engineer software systems that have to deal with uncertainties that can only be resolved at run time.

The course presents the basic principles of self-adaptation and introduces a conceptual feedback loop model of a self-adaptive system. It introduces quality models which can be used to estimate quality properties at runtime by a self-adaptive system to provide guarantees for the quality goals. The role played by the different types of uncertainties is then explored analyzing different possible approaches.

**Workload**

Course workload:

30h in Class (lectures)

45h self-study during the semester

15h preparation for the exam

## M

**5.71 Module: Entrepreneurship (EnTechnon) [M-WIWI-101488]**

**Coordinators:** Prof. Dr. Orestis Terzidis  
**Organisation:** KIT Department of Business and Economics  
**Part of:** Economics and Management (Business Administration)

| Credits | Grading | Recurrence | Duration | Language       | Level | Version |
|---------|---------|------------|----------|----------------|-------|---------|
| 9 CP    | graded  | Each term  | 2 terms  | German/English | 4     | 16      |

| Mandatory part (Election: 1 item)                             |                                                                                |      |                    |
|---------------------------------------------------------------|--------------------------------------------------------------------------------|------|--------------------|
| T-WIWI-102864                                                 | Entrepreneurship                                                               | 3 CP | Terzidis           |
| Compulsory Elective Courses (Election: between 1 and 2 items) |                                                                                |      |                    |
| T-WIWI-115110                                                 | Business Planning for Founders                                                 | 3 CP | Terzidis           |
| T-WIWI-102866                                                 | Design Thinking                                                                | 3 CP | Terzidis           |
| T-WIWI-113151                                                 | Entrepreneurship Seasonal School                                               | 3 CP | Terzidis           |
| T-WIWI-114893                                                 | International Entrepreneurship and Brand Development                           | 6 CP | Kupfer, Terzidis   |
| T-WIWI-109064                                                 | Joint Entrepreneurship Summer School                                           | 6 CP | Terzidis           |
| T-WIWI-111561                                                 | Startup Experience                                                             | 6 CP | Terzidis           |
| Supplementary Courses (Election: between 0 and 1 items)       |                                                                                |      |                    |
| T-WIWI-102894                                                 | Entrepreneurship Research                                                      | 3 CP | Terzidis           |
| T-MACH-112882                                                 | Innovation2Business – Innovation Strategy in the Industrial Corporate Practice | 4 CP | Albers             |
| T-WIWI-102852                                                 | Case Studies Seminar: Innovation Management                                    | 3 CP | Weissenberger-Eibl |
| T-WIWI-102893                                                 | Innovation Management: Concepts, Strategies and Methods                        | 3 CP | Weissenberger-Eibl |

**Assessment**

The module examination takes place in the form of partial examinations (according to §4, 1-3 SPO) on

1. the Entrepreneurship lecture (3 CP),
2. one of the seminars of the Chair of Entrepreneurship and Technology Management (3 CP or 6 CP) and, if applicable
3. another course listed in the module.

The seminars of the chair are

- Startup Experience
- Design Thinking
- Business Planning for Founders
- Entrepreneurship research (this can be credited mainly in the seminar module, but also in the entrepreneurship module)
- Joint Entrepreneurship School
- Entrepreneurship Seasonal School
- International Entrepreneurship and Brand Development

The latter three seminars take place irregularly, as they are offered as part of projects.

The assessment of success is described for each course in the module. For courses with 3 CP in the compulsory elective and supplementary courses, 1/2 of the overall grade results from the entrepreneurship lecture, 1/4 from one of the chair's seminars with 3 CP and 1/4 from another course with 3 CP permitted in the module. If a course with 6 CP is selected in the compulsory elective or supplementary offer, this is included in the overall grade with a weighting of 1/2. The overall grade is cut off after the first decimal place.

**Prerequisites**

None

**Competence Goal**

Students are familiar with the basics and contents of entrepreneurship and ideally are able to start a company during or after their studies. The courses are therefore structured sequentially in modules, although in principle they can also be attended in parallel. In this way, the skills are taught to generate business ideas, to develop inventions into innovations, to write business plans for start-ups and to successfully establish a company. In the lecture, the basics of entrepreneurship will be developed, in the seminars, individual contents will be deepened. The overall learning objective is to enable students to develop and implement business ideas.

**Content**

The lectures form the basis of the module and give an overview of the overall topic. The seminars deepen the phases of the foundation processes, in particular the identification of opportunities, the development of a value proposition (especially based on inventions and technical innovations), the design of a business model, business planning, the management of a start-up, the implementation of a vision as well as the acquisition of resources and the handling of risks. The lecture Entrepreneurship provides an overarching and connecting framework for this.

**Additional Information**

Please note: Seminars offered by Prof. Terzidis (or the members of his research group) are not eligible for crediting in a seminar module of the WiWi degree programs. Exception: Seminar "Entrepreneurship Research".

**Workload**

Total workload for 9 credit points: approx. 270 hours

The exact distribution is based on the credit points of the courses in the module.

**Recommendations**

None



## M

**5.72 Module: Environmental Economics [M-WIWI-101468]**

**Coordinators:** Prof. Dr. Kay Mitusch  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [Economics and Management \(Economics\)](#)

**Credits**  
9 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
1 term

**Language**  
German

**Level**  
4

**Version**  
2

| Compulsory Elective Courses (Election: at least 9 credits) |                                                            |        |                 |
|------------------------------------------------------------|------------------------------------------------------------|--------|-----------------|
| T-WIWI-102650                                              | <a href="#">Energy and Environment</a>                     | 3,5 CP | Karl            |
| T-WIWI-100007                                              | <a href="#">Transport Economics</a>                        | 4,5 CP | Mitusch, Szimba |
| T-WIWI-102615                                              | <a href="#">Environmental Economics and Sustainability</a> | 3 CP   | Walz            |
| T-WIWI-102616                                              | <a href="#">Environmental and Resource Policy</a>          | 4 CP   | Walz            |
| T-BGU-111102                                               | <a href="#">Environmental Law</a>                          | 3 CP   | Smeddinck       |

**Assessment**

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**

None

**Competence Goal**

The students

- understand the treatment of non-market resources as well as future resource shortages
- are able to model markets of energy and environmental goods
- are able to assess the results of government intervention
- know legal basics and are able to evaluate conflicts with regard to legal situation

**Content**

Environmental degradation and increasing resource use are global challenges, which have to be tackled on a worldwide level. The module addresses these challenges from the perspective of economics, and imparts the fundamental knowledge of environmental and sustainability economics, and environmental and resource policy to the students. Additional courses address environmental law, environmental pressure, and applications to the transport sector.

**Workload**

Total workload for 9 credit points: approx. 270 hours

The exact distribution is based on the credit points of the courses in the module.

**Recommendations**

Knowledge of microeconomics is a prerequisite. For this reason, successful participation in the course *Economics I (Microeconomics)* [2600012] or a comparable course is strongly recommended.

## M

**5.73 Module: Ethics of Information Technology [M-WIWI-107601]**

**Coordinators:** Dr. phil. Simon Derpmann  
Prof. Dr. Jella Pfeiffer

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

**Part of:** Economics and Management (Business Administration)

| Credits | Grading | Recurrence       | Duration | Language       | Level | Version |
|---------|---------|------------------|----------|----------------|-------|---------|
| 9 CP    | graded  | Each winter term | 1 term   | German/English | 4     | 1       |

| Mandatory         |                                                                       |        |                    |
|-------------------|-----------------------------------------------------------------------|--------|--------------------|
| T-WIWI-111385     | Responsible Artificial Intelligence                                   | 4,5 CP | Hoffmann, Pfeiffer |
| T-GEISTSOZ-114909 | The Ethics and Politics of Information Technology in Market Economies | 4,5 CP | Derpmann           |

**Assessment**

The assessment of success takes place in the form of partial examinations on the courses of the module amounting to a total of 9 CP. The assessment is described for each course in this module.

The overall grade of the module is calculated from the grades of the partial examinations weighted with credit points and cut off after the first decimal place.

**Prerequisites**

None

**Competence Goal****T-WIWI-111385 - Responsible Artificial Intelligence:**

After successfully completing the course, students should be able to:

- classify and evaluate the scientific discussion on ethics in artificial intelligence systems,
- understand the concept of trust and responsibility in the context of artificial intelligence and apply the relevant knowledge to change processes in companies,
- shape the social and entrepreneurial discussion on the use of AI themselves and
- know the legal requirements for AI and implement them in the corporate context.

**T-GEISTSOZ-114909 "The Ethics and Politics of Information Technology in Market Economies":**

Upon successful completion of the course, students will be able to:

- **Understand the Fundamentals of Digital Ethics:** They can identify and analyze the central ethical and political problems arising from the development and application of Information Technology (IT).
- **Analyze Ethical Issues in Business and Markets:** They are familiar fundamental of theories markets and business ethics and can apply them critically to current case studies and issues in Computer Science and Information Systems.
- **Critically Reflect on Responsibility:** They develop a critical awareness of their own ethical responsibility as future computer scientists, information systems specialists, or digital economists when designing and implementing digital systems.
- **Engage in a Structured Discussion of Arguments:** They are capable of presenting, evaluating, and defending different ethical viewpoints on topics such as data ownership, surveillance, informed consent, privacy, and freedom of expression,
- **Develop Application-Oriented Solutions:** They can formulate and justify solution approaches for ethical challenges in the IT sector, taking into account both technological and societal aspects.

**Content****T-WIWI-111385 - Responsible Artificial Intelligence:**

Can a technology really be trustworthy or even responsible? Since the success of LLMs at the latest, this question has been increasingly asked in society. With the increasing use of artificial intelligence, terms such as "Trustworthy AI", "Responsible AI" or "Ethical AI" are therefore gaining in importance. But what exactly is behind them? Technology is only ever used by people for specific purposes. So if we want to "trust" an AI solution, we need to understand how the people and organizations involved develop AI responsibly. According to the European Commission's HLEG AI, trustworthy AI must be lawful, ethical and robust.

This lecture sheds light on all these areas and thus provides an answer to the question of what a responsible and thus sustainable approach to AI can look like. After an introduction to AI and data, various approaches will be discussed with which actions and technology applications can be morally evaluated. The aim of this ethical reflection is to find out what we should do with AI, instead of limiting ourselves to what we can do with AI.

In the context of robustness, vulnerabilities of AI and measures to address them will be discussed. The lecture will cover other topics such as bias, adversarial attacks, transparency, privacy and human-computer interaction. Current developments in regulatory requirements at European level will also be discussed. Guest lectures and continuous insights into business practice complement the foundations laid.

**T-GEISTSOZ-114909 "The Ethics and Politics of Information Technology in Market Economies":**

This course examines moral and social issues arising from the use of information technologies in the modern market landscape. Information technologies are transforming social relationships, business, media, education, and politics, and they bring significant ethical and societal challenges.

The course addresses normative perspectives on topics such as digital data collection and usage, privacy, freedom of speech, intellectual property, platform monopolies, surveillance, automation, and current developments in artificial intelligence. Its aim is to provide an overview of these key questions and to offer methodological tools for analyzing their moral and societal dimensions.

At the core of the course is the practice of reflection and discourse, using real-life examples, case studies, and current developments. Participants are expected to develop a solid understanding of central ethical concepts and to gain confidence and autonomy in critically engaging with societal debates on the moral implications of information technologies. This enables them to identify and assess ethical challenges in digitization and to formulate and evaluate guidelines and strategies for responsible technology use in business and society.

The course is designed to foster discourse competence and relies on active participation. Successful completion requires regular attendance, engagement in discussion groups, and passing the final exam.

**Additional Information**

Please note that the course "Responsible Artificial Intelligence" has a **limited number of participants**.

**Workload**

Total workload for 9 ECTS credits: approx. 270 hours. The workload is distributed according to the credit points assigned to each course in the module.

## M

**5.74 Module: Experimental Economics [M-WIWI-101505]**

**Coordinators:** Prof. Dr. Johannes Philipp Reiß  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [Economics and Management \(Economics\)](#)

| Credits | Grading | Recurrence | Duration | Language       | Level | Version |
|---------|---------|------------|----------|----------------|-------|---------|
| 9 CP    | graded  | Each term  | 2 terms  | German/English | 4     | 6       |

| Compulsory Elective Courses (Election: 2 items) |                                                                            |        |           |
|-------------------------------------------------|----------------------------------------------------------------------------|--------|-----------|
| T-WIWI-115061                                   | <a href="#">Experimental Research in Economics and Information Systems</a> | 4,5 CP | Weinhardt |
| T-WIWI-105781                                   | <a href="#">Incentives in Organizations</a>                                | 4,5 CP | Nieken    |
| T-WIWI-102862                                   | <a href="#">Predictive Mechanism and Market Design</a>                     | 4,5 CP | Reiß      |
| T-WIWI-102863                                   | <a href="#">Topics in Experimental Economics</a>                           | 4,5 CP | Reiß      |

**Assessment**

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.

**Additional Information**

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

**Workload**

Total workload for 9 credit points: approx. 270 hours

The exact distribution is based on the credit points of the courses in the module.

**Recommendations**

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

## M

**5.75 Module: Explainable Artificial Intelligence [M-INFO-106302]****Coordinators:** TT-Prof. Dr. Rudolf Lioutikov**Organisation:** KIT Department of Electrical Engineering and Information Technology  
KIT Department of Informatics**Part of:** Informatics**Credits**  
3 CP**Grading**  
graded**Recurrence**  
Each summer term**Duration**  
1 term**Language**  
English**Level**  
4**Version**  
1

| Mandatory     |                                     |      |           |
|---------------|-------------------------------------|------|-----------|
| T-INFO-112774 | Explainable Artificial Intelligence | 3 CP | Lioutikov |

**Assessment**

See Partial Achievements (Teilleistung).

**Prerequisites**

See Partial Achievements (Teilleistung).

**Competence Goal**

- Students are able to understand problems and challenges of XAI
- Students can identify and differentiate different types and approaches of XAI
- Students can implement various XAI approaches
- Students understand current research questions and directions of XAI

**Content**

Recent advances in Machine Learning and Deep Learning in particular have lead to the imminent introduction of AI agents into a wide variety of applications. However, the apparent “black-box” nature of these approaches hinders their application in both critical systems and close human-robot interactions. The sub-field of eXplainable Artificial Intelligence (XAI) aims to address this shortcoming. This lecture will introduce and discuss various concepts and methods of XAI and consider them from perspective of Robot Learning and Human-Robot Interaction.

The lecture will start with a (brief) introduction into relevant deep learning approaches, before discussing interpretable scene, task and behavior representations. Afterward the lecture will consider itself with Data-Driven and Goal-Driven AI. Finally, first approaches that incorporate XAI and XAI-based human feedback directly into the learning process itself will be discussed. An exemplary list of topics is given below:

- Introduction to XAI
  - Interpretable Machine Learning vs Explainable Machine Learning
- Primer / Introduction to relevant Deep Learning Concepts
  - MLPs and CNNs
  - Graph Neural Networks
  - Transformers
  - Diffusion Models
  - Score Based Methods
- Interpretable Structures
  - Scene Representations
  - Task Representations
  - Behavior Representations
- Data-Driven Explainable AI: XAI Methods for
  - Shapley Values
  - Saliency Maps
  - Concept Activation Vectors
  - Linguistic Neuron Annotation
- Goal-Driven Explainable AI: XAI Methods for
  - Generative Explaining Models
  - Behavior Verbalization
  - Behavior Visualization
- Interactive Learning
  - Integrating Human Feedback
  - Explanatory Interactive Learning

**Workload**

Workload = 90h = 3 ECTS  
- ca 30h lecture attendance  
- ca 30h post-processing  
- ca 30h exam preparation

**Recommendations**

- Experience in Machine Learning is recommended, e.g. through prior coursework.
  - The Computer Science Department offers several great lectures e.g., “Maschinelles Lernen - Grundlagen und Algorithmen” and “Deep Learning”
- A good mathematical background will be beneficial
- Python / PyTorch experience could be beneficial when we discuss practical examples/implementations.

## M

**5.76 Module: Finance 1 [M-WIWI-101482]**

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

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

**Part of:** [Economics and Management \(Business Administration\)](#)

| Credits | Grading | Recurrence | Duration | Language       | Level | Version |
|---------|---------|------------|----------|----------------|-------|---------|
| 9 CP    | graded  | Each term  | 1 term   | German/English | 4     | 1       |

| Compulsory Elective Courses (Election: 9 credits) |                               |        |                       |
|---------------------------------------------------|-------------------------------|--------|-----------------------|
| T-WIWI-102643                                     | <a href="#">Derivatives</a>   | 4,5 CP | Uhrig-Homburg         |
| T-WIWI-102621                                     | <a href="#">Valuation</a>     | 4,5 CP | Ruckes                |
| T-WIWI-102647                                     | <a href="#">Asset Pricing</a> | 4,5 CP | Ruckes, Uhrig-Homburg |

**Assessment**

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 approx. 270 hours (9 credits). The distribution is based on the credit points of the courses in the module. The workload for courses with 4.5 credits is approx. 135 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 for an average performance.

## M

**5.77 Module: Finance 2 [M-WIWI-101483]**

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

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

**Part of:** [Economics and Management \(Business Administration\)](#)

Credits  
9 CPGrading  
gradedRecurrence  
Each termDuration  
1 termLanguage  
German/EnglishLevel  
4Version  
11

| Compulsory Elective Courses (Election: at least 9 credits) |                                                                      |        |                       |
|------------------------------------------------------------|----------------------------------------------------------------------|--------|-----------------------|
| T-WIWI-113469                                              | <a href="#">Advanced Corporate Finance</a>                           | 4,5 CP | Ruckes                |
| T-WIWI-114979                                              | <a href="#">Advanced Quantitative Finance</a>                        | 4,5 CP | Thimme                |
| T-WIWI-102647                                              | <a href="#">Asset Pricing</a>                                        | 4,5 CP | Ruckes, Uhrig-Homburg |
| T-WIWI-110995                                              | <a href="#">Bond Markets</a>                                         | 4,5 CP | Uhrig-Homburg         |
| T-WIWI-110997                                              | <a href="#">Bond Markets - Models &amp; Derivatives</a>              | 3 CP   | Uhrig-Homburg         |
| T-WIWI-110996                                              | <a href="#">Bond Markets - Tools &amp; Applications</a>              | 1,5 CP | Uhrig-Homburg         |
| T-WIWI-109050                                              | <a href="#">Corporate Risk Management</a>                            | 4,5 CP | Ruckes                |
| T-WIWI-102643                                              | <a href="#">Derivatives</a>                                          | 4,5 CP | Uhrig-Homburg         |
| T-WIWI-110797                                              | <a href="#">eFinance: Information Systems for Securities Trading</a> | 4,5 CP | Weinhardt             |
| T-WIWI-102900                                              | <a href="#">Financial Analysis</a>                                   | 4,5 CP | Luedecke              |
| T-WIWI-102623                                              | <a href="#">Financial Intermediation</a>                             | 4,5 CP | Ruckes                |
| T-WIWI-102646                                              | <a href="#">International Finance</a>                                | 3 CP   | Uhrig-Homburg         |
| T-WIWI-102621                                              | <a href="#">Valuation</a>                                            | 4,5 CP | Ruckes                |

**Assessment**

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**

Students may only start the module *Finance 2* after they have successfully completed the module *Finance 1*. Exceptions are subject to approval by the examination committee; for this purpose, students must contact the examination office of the KIT Faculty of Economics and Management.

**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.

**Workload**

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



## M

**5.78 Module: Finance 3 [M-WIWI-101480]**

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

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

**Part of:** [Economics and Management \(Business Administration\)](#)

Credits  
9 CPGrading  
gradedRecurrence  
Each termDuration  
1 termLanguage  
German/EnglishLevel  
4Version  
11

| Compulsory Elective Courses (Election: at least 9 credits) |                                                                      |        |                       |
|------------------------------------------------------------|----------------------------------------------------------------------|--------|-----------------------|
| T-WIWI-113469                                              | <a href="#">Advanced Corporate Finance</a>                           | 4,5 CP | Ruckes                |
| T-WIWI-114979                                              | <a href="#">Advanced Quantitative Finance</a>                        | 4,5 CP | Thimme                |
| T-WIWI-102647                                              | <a href="#">Asset Pricing</a>                                        | 4,5 CP | Ruckes, Uhrig-Homburg |
| T-WIWI-110995                                              | <a href="#">Bond Markets</a>                                         | 4,5 CP | Uhrig-Homburg         |
| T-WIWI-110997                                              | <a href="#">Bond Markets - Models &amp; Derivatives</a>              | 3 CP   | Uhrig-Homburg         |
| T-WIWI-110996                                              | <a href="#">Bond Markets - Tools &amp; Applications</a>              | 1,5 CP | Uhrig-Homburg         |
| T-WIWI-109050                                              | <a href="#">Corporate Risk Management</a>                            | 4,5 CP | Ruckes                |
| T-WIWI-102643                                              | <a href="#">Derivatives</a>                                          | 4,5 CP | Uhrig-Homburg         |
| T-WIWI-110797                                              | <a href="#">eFinance: Information Systems for Securities Trading</a> | 4,5 CP | Weinhardt             |
| T-WIWI-102900                                              | <a href="#">Financial Analysis</a>                                   | 4,5 CP | Luedecke              |
| T-WIWI-102623                                              | <a href="#">Financial Intermediation</a>                             | 4,5 CP | Ruckes                |
| T-WIWI-102646                                              | <a href="#">International Finance</a>                                | 3 CP   | Uhrig-Homburg         |
| T-WIWI-102621                                              | <a href="#">Valuation</a>                                            | 4,5 CP | Ruckes                |
| T-WIWI-110933                                              | <a href="#">Web App Programming for Finance</a>                      | 4,5 CP | Thimme                |

**Assessment**

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**

Students may only start the module *Finance 3* after they have successfully completed the modules *Finance 1* and *Finance 2*. Exceptions are subject to approval by the examination committee; for this purpose, students must contact the examination office of the KIT Faculty of Economics and Management.

**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.

## M

**5.79 Module: Formal Systems [M-INFO-100799]**

**Coordinators:** Prof. Dr. Bernhard Beckert  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
German

**Level**  
4

**Version**  
1

| Mandatory     |                                |      |         |
|---------------|--------------------------------|------|---------|
| T-INFO-101336 | <a href="#">Formal Systems</a> | 6 CP | Beckert |

## M

**5.80 Module: Formal Systems II: Application [M-INFO-100744]**

**Coordinators:** Prof. Dr. Bernhard Beckert  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
5 CP

**Grading**  
graded

**Recurrence**  
Each summer term

**Duration**  
1 term

**Language**  
German

**Level**  
4

**Version**  
1

| Mandatory     |                                                |      |         |
|---------------|------------------------------------------------|------|---------|
| T-INFO-101281 | <a href="#">Formal Systems II: Application</a> | 5 CP | Beckert |

**M****5.81 Module: Formal Systems II: Theory [M-INFO-100841]**

**Coordinators:** Prof. Dr. Bernhard Beckert  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
5 CP

**Grading**  
graded

**Recurrence**  
Each summer term

**Duration**  
1 term

**Language**  
German

**Level**  
4

**Version**  
1

| Mandatory     |                                           |      |         |
|---------------|-------------------------------------------|------|---------|
| T-INFO-101378 | <a href="#">Formal Systems II: Theory</a> | 5 CP | Beckert |

**M****5.82 Module: Foundations for Advanced Financial -Quant and -Machine Learning Research [M-WIWI-105894]**

**Coordinators:** Prof. Dr. Maxim Ulrich  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [Economics and Management \(Business Administration\)](#)

**Credits**  
9 CP

**Grading**  
graded

**Recurrence**  
see Annotations

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                                                  |      |        |
|---------------|----------------------------------------------------------------------------------|------|--------|
| T-WIWI-111846 | <a href="#">Fundamentals for Financial -Quant and -Machine Learning Research</a> | 9 CP | Ulrich |

**Assessment**

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 modul handbook.

**Additional Information**

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

**Workload**

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

**Teaching and Learning Methods**

Lecture and exercise.

**M****5.83 Module: Graph Partitioning and Graph Clustering in Theory and Practice [M-INFO-107211]**

**Coordinators:** Prof. Dr. Peter Sanders  
Dr. rer. nat. Torsten Ueckerdt

**Organisation:** KIT Department of Informatics

**Part of:** Informatics

| Credits | Grading | Recurrence       | Duration | Language | Level | Version |
|---------|---------|------------------|----------|----------|-------|---------|
| 5 CP    | graded  | Each summer term | 1 term   | English  | 4     | 1       |

| Mandatory     |                                                                            |      |                   |
|---------------|----------------------------------------------------------------------------|------|-------------------|
| T-INFO-114232 | Graph Partitioning and Graph Clustering in Theory and Practice             | 4 CP | Sanders, Ueckerdt |
| T-INFO-114233 | Graph Partitioning and Graph Clustering in Theory and Practice - Practical | 1 CP | Sanders, Ueckerdt |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

The aim of the lecture is to provide students with an initial insight into the problems of graph partitioning and graph clustering and to apply knowledge from graph theory and algorithmics.

On the one hand, the problems that arise are reduced to their algorithmic core and then solved efficiently. On the other hand, various modelling methods and their interpretations are discussed. After successfully completing the course, students will be able to apply the methods and techniques presented autonomously to related problems.

**Content**

Many applications in computer science involve the clustering and partitioning of graphs, e.g. the finite element method in scientific simulations, digital circuit design, route planning, web graph analysis or the analysis of social networks.

A well-known example where good partitioning of unstructured graphs is needed is parallel processing, where graphs must be partitioned to distribute computations evenly over a given number of processors and minimise communication between them.  $k$  processors, the graph must be divided into  $k$  blocks of approximately equal size so that the number of edges between the blocks is minimal.

Since many partitioning and clustering problems occur in practice, the problems discussed are introduced and motivated, and both the theoretical and practical aspects of graph partitioning and graph clustering are taught, including heuristics, meta-heuristics, evolutionary and genetic algorithms as well as approximation and streaming algorithms.

**Workload**

Lecture with project/experiment with 3 SWS, 5 CP correspond to approx. 150 working hours, of which

- approx. 30 hours attending the lecture
- approx. 60 hours of preparation and follow-up work
- approx. 30 hours working on the project/experiment
- approx. 30 hours exam preparation

## M

**5.84 Module: Hands-on Bioinformatics Practical [M-INFO-101573]****Coordinators:** Prof. Dr. Alexandros Stamatakis**Organisation:** KIT Department of Informatics**Part of:** Informatics**Credits**  
3 CP**Grading**  
graded**Recurrence**  
Irregular**Duration**  
1 term**Language**  
English**Level**  
4**Version**  
1

| Mandatory     |                                   |      |            |
|---------------|-----------------------------------|------|------------|
| T-INFO-103009 | Hands-on Bioinformatics Practical | 3 CP | Stamatakis |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

The participants develop and document an open-source tool or pipeline for sequence-based data analysis of biological data. The tool is likely to cover one or more of the main topics of the corresponding lecture and shall be useful to and usable for the biological user community. If possible, the tool should be published in a peer-reviewed scientific journal. Participants learn to work in teams of 2-3 programmers, to use version management tools such as github, to analyse and optimise the runtime behaviour of programs using appropriate tools, to test C/C++ programs for memory leaks (e.g., using valgrind), and to improve the quality of their code using SoftWipe (<https://www.nature.com/articles/s41598-021-89495-8>). Participants will be able to independently carry out and document larger software projects in the field of bioinformatics and evaluate as well as improve code quality. They are able to write a scientific paper in a team.

**Content**

In the practical course, we jointly develop an open-source tool (algorithms, analysis pipelines, parallelisation) with the aim of providing a new tool that is useful for biology and can be used by biologists at the end of the semester.

**Workload**

Weekly meetings with the supervisor 15 hours + internal team meetings 15 hours + programming time 45 hours + 15 hours writing paper or final report = 90 hours = 3 ECTS

**M****5.85 Module: Heterogeneous Parallel Computing Systems [M-INFO-100822]****Coordinators:** Prof. Dr. Wolfgang Karl**Organisation:** KIT Department of Informatics**Part of:** [Informatics](#)**Credits**  
3 CP**Grading**  
graded**Recurrence**  
Each winter term**Duration**  
1 term**Language**  
German**Level**  
4**Version**  
1

| Mandatory     |                                                          |      |      |
|---------------|----------------------------------------------------------|------|------|
| T-INFO-101359 | <a href="#">Heterogeneous Parallel Computing Systems</a> | 3 CP | Karl |



**M****5.86 Module: HRI and Social Robotics [M-INFO-106650]**

**Coordinators:** TT-Prof. Dr. Barbara Bruno  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each summer term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                |      |       |
|---------------|--------------------------------|------|-------|
| T-INFO-113396 | HRI and Social Robotics        | 4 CP | Bruno |
| T-INFO-113397 | HRI and Social Robotics - Pass | 2 CP | Bruno |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students know the foundations of Human-Robot Interaction (HRI) and Social Robotics, including: design principles and methodologies, human factors influencing HRI (anthropomorphization), sensors, actuators and software architecture for social robotics, challenges and solutions for key abilities of social robots (spatial interaction, engagement detection, non-verbal interaction, verbal interaction, emotion generation and detection), research methods (study design principles, statistical tools for analyses) and have seen state-of-the-art research topics in the field including social learning, theory of mind, trust and ethical considerations in HRI.

Thanks to the exercise sessions and assignments, students gain first-hand knowledge and can independently apply techniques related to the above theory items, including for collecting stakeholders' feedback for a robot design, programming the robot's social behaviour along multiple modalities, extracting relevant user information from available sensors, designing and analysing HRI experiments.

**Content**

The lectures cover all foundational topics in HRI (design principles and methodologies, human factors influencing HRI, sensors, actuators and software architecture for social robotics), challenges and solutions for key abilities of social robots (spatial interaction, engagement detection, non-verbal interaction, verbal interaction, emotion generation and detection), research methods (study design principles, statistical tools for analyses) and state-of-the-art topics including social learning, theory of mind and ethical considerations in HRI.

In the exercise sessions and related assignments students can experience first-hand how the theoretical concepts seen in the lectures can be applied in practice and learn how to collect stakeholders' feedback for a robot design, program the robot's social behaviour along multiple modalities, extract relevant user information from available sensors, design and analyse HRI experiments. At the end of the course, the students have a solid understanding of HRI, its principles, challenges and solutions and can autonomously apply such knowledge in practical contexts.

**Workload**

Course workload:

- 1) Attendance of the course: 22.5h (15x90min slots)
- 2) Attendance of the exercise sessions: 22.5h (15x90min slots)
- 3) Self-study of course material and work on homework assignments: 60h (4h/week)
- 4) Preparation for the exam: 80h

**Recommendations**

Knowledge of the content of modules Robotics I - Introduction to Robotics is helpful.

## M

**5.87 Module: Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy [M-INFO-100725]**

**Coordinators:** Prof. Dr.-Ing. Tamim Asfour  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

| Credits | Grading | Recurrence | Duration | Language | Level | Version |
|---------|---------|------------|----------|----------|-------|---------|
| 3 CP    | graded  | Each term  | 1 term   | German   | 4     | 1       |

| Mandatory     |                                                                                                                       |      |                  |
|---------------|-----------------------------------------------------------------------------------------------------------------------|------|------------------|
| T-INFO-101262 | Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy | 3 CP | Asfour, Spetzger |

**Assessment**

See Partial Achievements (Teilleistung).

**Prerequisites**

See Partial Achievements (Teilleistung).

**Competence Goal**

After successfully completing the course, students will have a basic understanding and basic information about the structure and complex functioning of the brain and the central nervous system (CNS). They will learn the basics of neurophysiology and sensory functions and, in particular, the technically complex modern diagnostics of the brain and CNS. In addition, students learn the basics of modern treatment modalities for various neurological and neurosurgical diseases and are able to understand the application and use of different medical equipment and devices. The overview of modern neuro-medicine allows interdisciplinary recognition and analysis of problems and allows the implementation of theoretical models in a concrete practical context.

**Content**

The course provides an overview of modern neuro-medicine and provides a basic understanding of neuroanatomy, sensory and neurophysiology, which represents an important interface to the innovative research areas of neuroprosthetics (optical, acoustic prostheses). There is also a close connection to motor systems in robotics. There are further links to the fields of imaging and image processing and intraoperative support systems. Practical relevance is established and specific application examples in medical diagnostics and therapy are presented.

**Workload**

Lecture with 2 SWS, 3 LP.

3 LP corresponds to approx. 90 hours, of which

approx. 12 \* 2h = 24 hrs. attendance time Lecture approx. 12 \* 3h = 36 hrs. preparation and follow-up time Lecture approx. 30 hrs. exam preparation and attendance in the same

**Recommendations**

See Partial Achievements (Teilleistung).

## M

**5.88 Module: Human Computer Interaction [M-INFO-107166]**

**Coordinators:** Prof. Dr.-Ing. Michael Beigl  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each summer term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                 |      |       |
|---------------|-------------------------------------------------|------|-------|
| T-INFO-114192 | <a href="#">Human-Computer-Interaction</a>      | 6 CP | Beigl |
| T-INFO-114193 | <a href="#">Human-Computer-Interaction Pass</a> | 0 CP | Beigl |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

After completing the course, students will be able to

- reproduce basic knowledge about the field of human-machine interaction
- name and apply basic techniques for analysing user interfaces
- apply basic rules and techniques for designing user interfaces
- analyse and evaluate existing user interfaces and their function

**Content**

Topics are:

1. human information processing (models, physiological and psychological principles, human senses, action processes),
2. design principles and design methods, input and output units for computers, embedded systems and mobile devices,
3. principles, guidelines and standards for the design of user interfaces
4. technical basics and examples for the design of user interfaces (text dialogues and forms, menu systems, graphical interfaces, interfaces in the WWW, audio dialogue systems, haptic interaction, gestures),
5. methods for modelling user interfaces (abstract description of interaction, embedding in requirements analysis and the software design process),
6. evaluation of systems for human-machine interaction (tools, evaluation methods, performance measurement, checklists).
7. practising the above basics using practical examples and developing independent, new and alternative user interfaces.

**Workload**

The total workload for this course unit is approx. 180 hours (6.0 credits).

Attendance time: Attendance of the lecture 15 x 90 min = 22 h 30 min

Attendance time: Attendance of the exercise 8 x 90 min = 12 h 00 min

Preparation / follow-up of the lecture 15 x 150 min = 37 h 30 min

Preparation / follow-up of the exercise 8x 360min =48h 00min

Go through slides/script 2x 2 x 12 h =24 h 00 min

Prepare exam = 36 h 00 min

SUM = 180h 00 min

## M

**5.89 Module: Human Factors in Security and Privacy [M-WIWI-104520]**

**Coordinators:** Prof. Dr. Melanie Volkamer  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [Informatics](#)

**Credits**  
9 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
2 terms

**Language**  
German

**Level**  
4

**Version**  
2

| Mandatory     |                                                              |        |          |
|---------------|--------------------------------------------------------------|--------|----------|
| T-WIWI-109270 | <a href="#">Human Factors in Security and Privacy</a>        | 4,5 CP | Volkamer |
| T-WIWI-108439 | <a href="#">Advanced Lab Security, Usability and Society</a> | 4,5 CP | Volkamer |

**Assessment**

The module examination is carried out in the form of partial examinations on the selected courses of the module, with which the minimum requirement at creditpoints is fulfilled. The learning control is described in each course. The overall score of the module is made up of the sub-scores weighted with creditpoints and is cut off after the first comma point.

**Prerequisites**

None

**Competence Goal**

Students ...

- know why many existing security and privacy mechanisms are not usable and why many awareness/education/training approaches are not effective
- can explain for concrete examples why these are not usable / not effective including why people are likely to face problems with these
- can explain what mental models are, why they are important and how they can be identified
- know how to conduct a cognitive walkthrough to identify problems with existing mechanisms and approaches
- know how to conduct semi-structured interviews
- know how user studies in the security context differ from those conducted in other contexts
- can explain the process of human centered security / privacy by design
- know the advantages and disadvantages of various graphical password schemes
- know concepts such as just in time and place security interventions

**Content**

The history of information security and privacy has taught us that it takes more than technological innovation to develop effective security and privacy mechanisms: Many aspects of information security and privacy actually depend on both technical and human factors. As a result of focusing on the technical factors, we are seeing a persistent gap between theoretical security and actual security in real world which becomes an increasing problem in the age of digitalization. The gap is mainly caused by strong and actually unrealistic assumptions regarding the users' knowledge and behavior.

Human factors in security and privacy research addresses several types of security and privacy mechanisms, e.g., authentication mechanisms including text and graphical passwords, security and privacy indicators (such as the icons in the address bar of nowadays web browsers) and security and privacy interventions like warning messages, permission dialogs and security and privacy policies as well as corresponding configuration interfaces. Besides security and privacy mechanisms, human factors in security and privacy researchers deal with security and privacy awareness, education, and training approaches.

'Human factors in security & privacy' research areas are:

- identifying users' mental models using techniques such as (semi-)structured interviews or focus groups,
- evaluating existing approaches regarding their effectiveness in supporting their users in making secure decisions / informed decisions in the context of privacy using techniques such as cognitive walkthroughs, lab user studies or even field studies,
- proposing improved / new approaches and evaluating their effectiveness using the so called human-centered security / privacy by design approach.

This module discusses the various problems of existing security and privacy mechanisms and security and privacy awareness/education/training approaches. The lecture addresses relevant psychological and sociological aspects which are important to know and to consider when developing more usable security/privacy mechanisms and more effective awareness/education/training approaches. The human centered security and privacy by design approach is introduced. Furthermore, some of the methodologies used in this area are explained and a subset of them is applied. Finally, positive examples, such as graphical passwords, are introduced and discussed. Note, the main part of the exercise is replicating an interview based study. The main focus of the lab will be to replicate a quantitative based user study.

**Additional Information****Please note:**

The course Human Factors in Security and Privacy is offered only **irregularly**. Therefore, completion of this module within two semesters cannot be guaranteed.

**Workload**

The total workload for this module is approximately 270 hours.

**M****5.90 Module: Human-Machine-Interaction in Anthropomatics: Basics [M-INFO-100824]**

**Coordinators:** Prof. Dr.-Ing. Jürgen Beyerer  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

| Credits | Grading | Recurrence       | Duration | Language | Level | Version |
|---------|---------|------------------|----------|----------|-------|---------|
| 3 CP    | graded  | Each winter term | 1 term   | German   | 4     | 1       |

| Mandatory     |                                                     |      |                      |
|---------------|-----------------------------------------------------|------|----------------------|
| T-INFO-101361 | Human-Machine-Interaction in Anthropomatics: Basics | 3 CP | Beyerer, van de Camp |

**Assessment**

See Partial Achievements (Teilleistung)

**Prerequisites**

See Partial Achievements (Teilleistung)

**Competence Goal**

The aim of the lecture is to provide students with in-depth knowledge of the phenomena, subsystems and interactions at the interface between humans and information-processing machines. To this end, they will learn about the human sensory organs and their capabilities and limitations in the perception process as well as the possibilities for humans to express themselves to machines. They are also taught about qualitative and quantitative models and characteristic system variables for the human-machine-human interaction and are introduced to the key standards and guidelines in this area. Students will be able to carry out a model-based system design approach and evaluate various designs using models with regard to the performance of the human-machine system and the strain on humans.

**Content**

The content of the lecture is basic knowledge of human-machine interaction as a branch of ergonomics:

- Subsystems and interactions in human-machine systems: Perception and action.
- Human sensory organs.
- Performance, stress and strain as system variables in the human-machine-human interaction.
- Quantitative models of human behavior.
- Human memory and its limits.
- Human error.
- Model-based design of human-machine systems.
- Qualitative design rules, guidelines and standards for human-machine systems.

**Workload**

Total: approx. 60h, of which

1. Attendance time in lectures: 23h
2. Preparation and follow-up of lectures: 12h
3. Exam preparation and attendance: 25h

**Recommendations**

See Partial Achievements (Teilleistung)

## M

**5.91 Module: Humanoid Robotics Laboratory [M-INFO-105792]**

**Coordinators:** Prof. Dr.-Ing. Tamim Asfour  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

| Credits | Grading | Recurrence       | Duration | Language       | Level | Version |
|---------|---------|------------------|----------|----------------|-------|---------|
| 6 CP    | graded  | Each winter term | 1 term   | German/English | 4     | 2       |

| Mandatory     |                              |      |        |
|---------------|------------------------------|------|--------|
| T-INFO-111590 | Humanoid Robotics Laboratory | 6 CP | Asfour |

**Competence Goal**

- Students will be able to independently understand, structure, analyze, and solve a complex humanoid robotics problem using existing programming skills, alone or in a small team.
- Students can convey complex technical content in a presentation.

**Content**

In this practical course, a is worked on alone or in small teams with up to 3 students. Questions of humanoid robotics are dealt with, such as semantic scene interpretation, active perception, planning of grasping and manipulation tasks, action representation with motion primitives, and programming by demonstration.

The project work (alone or in groups) is performed largely independently but supported by scientific staff of the H2T. At the end of the practical course, the work has to be documented and presented in a scientific talk.

**Additional Information**

- Internship dates are always by arrangement with the supervising staff member.
- An extension work of the topic as a master thesis is possible in principle.
- The number of participants in this practical course is generally **limited** and varies with the number of available research projects at the institute.

**Workload**

Practical course with 4 SWS, 6 LP.

6 LP corresponds to ca. 180 hours, thereof

ca. 10h Attendance time in project discussion meetings

ca. 10h Preparation and follow-up of the above

ca. 150h Self-study to work on the topic

ca. 10h Preparation and giving of a scientific presentation

**Recommendations**

- Very good programming skills in at least one high-level programming language are strongly recommended.
- Attendance of the lectures Robotics 1, Robotics 2, Robotics 3, as well as the robotics practical course are recommended.
- Project-specific recommendations (knowledge of C++, Python, ...) will be announced in the individual project descriptions

## M

**5.92 Module: Humanoid Robots - Locomotion and Whole-Body Control [M-INFO-106649]**

**Coordinators:** Prof. Dr. Katja Mombaur  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

| Credits | Grading | Recurrence       | Duration | Language | Level | Version |
|---------|---------|------------------|----------|----------|-------|---------|
| 6 CP    | graded  | Each summer term | 1 term   | English  | 4     | 2       |

| Mandatory     |                                                           |      |         |
|---------------|-----------------------------------------------------------|------|---------|
| T-INFO-113395 | Humanoid Robots - Locomotion and Whole-Body Control       | 6 CP | Mombaur |
| T-INFO-114282 | Humanoid Robots - Locomotion and Whole-Body Control -Pass | 0 CP | Mombaur |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

By the end of the course, students will be able to:

- Develop kinematic and dynamic models of humanoid robots
- Understand basic principles of human whole-body movement
- Control gaits and other whole-body motions for humanoid robots and maintain balance
- Explain advanced methods for humanoid motion generation, optimization, and learning
- Give an overview of the state of the art in locomotion and whole-body control of humanoid robotics
- Complete a graduate level research project on humanoid robots including simulation and real-robot implementation

**Content**

This course introduces fundamentals and recent developments in the field of humanoid robotics with a focus on locomotion and whole-body motions. We will cover kinematic and dynamic modeling of anthropomorphic systems, basic concepts of bipedal walking control, stability aspects, gait generation in different terrains, humanoid balance and push recovery, motion primitives and optimal control-based approaches, motion imitation and learning. The course will also give some insights in basic principles of passive dynamic walking, human motion generation and control and human motion modeling. Students will work with different robotics tools and perform a graduate level research project related to a whole-body humanoid robot.

This module is complementary to the course "4.290 Robotik II - Humanoide Robotik" which focuses on upper body motions and cognitive architectures while this course focuses on the specific aspects of legged humanoids and whole-body motions. The modules can be taken at the same time.

**Module Grade Calculation**

See partial achievements (Teilleistung)

**Additional Information**

For capacity reasons (supervision of computational projects), the lecture is limited to 30 students. If necessary, a selection process will be carried out. Places will be allocated taking into account the students' subject-specific skills.

**Workload**

Estimated effort for this module is 180 hours:

60h - Lecture and exercises (2+2 SWS)

40h - Repetition of lecture contents, preparation of assignments

80h - Work on final project, documentation and presentation

**Recommendations**

Attendance of the lectures Robotics I - Introduction to Robotics and Mechano-Informatics in Robotics is required.



## M

**5.93 Module: Humanoid Robots - Seminar [M-INFO-107152]**

**Coordinators:** Prof. Dr.-Ing. Tamim Asfour  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics Seminars](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                           |      |        |
|---------------|-------------------------------------------|------|--------|
| T-INFO-114170 | <a href="#">Humanoid Robots - Seminar</a> | 3 CP | Asfour |

**Assessment**

See partial Achievements (Teilleistung)

**Prerequisites**

See partial Achievements (Teilleistung)

**Competence Goal**

The students choose a topic from the field of humanoid robotics, e.g. robot design, motion generation, perception or learning. They conduct a literature research on this topic under the guidance of a scientific supervisor. At the end of the semester, they present the results and write a term paper in English in the form of a scientific publication.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

**Content**

The student gained experience with literature research on a current research topic. He/she explored, understood and compared different approaches to a selected scientific problem. The student is able to write a summary of their literature research in the form of a scientific publication in English and to give a scientific talk on it.

**Workload**

Seminar with 2 SWS, 3 LP  
 3 LP corresponds to 90 hours, including  
 45 hours literature research  
 25 hours manuscript preparation  
 10 hours preparation of the presentation  
 10 hours attendance time

**Recommendations**

Attending the lectures Robotics I – Introduction to Robotics, Robotics II: Humanoid Robotics, Robotics III – Sensors and Perception in Robotics, Mechano-Informatics and Robotics and Wearable Robotic Technologies is recommended.

## M

**5.94 Module: Incentives, Interactivity & Decisions in Organizations [M-WIWI-105923]****Coordinators:** Prof. Dr. Petra Nieken**Organisation:** KIT Department of Business and Economics**Part of:** Economics and Management (Business Administration)**Credits**  
9 CP**Grading**  
graded**Recurrence**  
Each term**Duration**  
2 terms**Language**  
German/English**Level**  
4**Version**  
5

| Elective Offer (Election:) |                                                                                            |        |                      |
|----------------------------|--------------------------------------------------------------------------------------------|--------|----------------------|
| T-WIWI-111912              | Advanced Topics in Digital Management                                                      | 3 CP   | Nieken               |
| T-WIWI-111913              | Advanced Topics in Human Resource Management                                               | 3 CP   | Nieken               |
| T-WIWI-113095              | Behavioral Lab Exercise                                                                    | 4,5 CP | Nieken, Scheibehenne |
| T-WIWI-113465              | Designing Interactive Systems: Human-AI Interaction                                        | 4,5 CP | Mädche               |
| T-WIWI-114174              | Economic Decision Making                                                                   | 4,5 CP | Scheibehenne         |
| T-WIWI-115061              | Experimental Research in Economics and Information Systems                                 | 4,5 CP | Weinhardt            |
| T-WIWI-105781              | Incentives in Organizations                                                                | 4,5 CP | Nieken               |
| T-WIWI-111109              | KD <sup>2</sup> Lab Hands-On Research Course: New Ways and Tools in Experimental Economics | 4,5 CP | Weinhardt            |
| T-WIWI-111385              | Responsible Artificial Intelligence                                                        | 4,5 CP | Hoffmann, Pfeiffer   |

**Assessment**

The assessment is carried out as partial exams of the courses in this module. The assessment procedures are described for each course in the module separately.

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

**Prerequisites**

Please refer to the course descriptions for potential restrictions regarding an individual course.

**Competence Goal**

The student

- understands and analyses challenges and objectives within organizations
- applies economic models and empirical methods to analyze and solve challenges with a focus on the workplace and future of work
- understands the impact of digitalization and new information and communication technology on the work life and management decisions
- knows how to apply scientific research methods and understands the underlying problems

**Content**

The module „Incentives, Interactivity & Decisions in Organizations” offers an interdisciplinary approach to study incentive structures, the role of interactivity in information systems, and decision making in organizations. The module specifically focuses on topics related to the workplace and the future of work in organizations. The topics range from designing incentive systems and interactive systems to leadership, decision making, as well as understanding human behavior. All courses in the module foster active participation and allow students to learn state-of-the-art research methods and apply them to real-world challenges.

**Workload**

Total workload for 9 credits: approx. 270 hours.

**Recommendations**

Knowledge of Human Resource Management, microeconomics, game theory, and statistics is recommended.

## M

**5.95 Module: Industrial Production II [M-WIWI-101471]**

**Coordinators:** Prof. Dr. Frank Schultmann  
**Organisation:** KIT Department of Business and Economics  
**Part of:** Economics and Management (Business Administration)

| Credits | Grading | Recurrence       | Duration | Language       | Level | Version |
|---------|---------|------------------|----------|----------------|-------|---------|
| 9 CP    | graded  | Each winter term | 1 term   | German/English | 4     | 8       |

| Mandatory                                        |                                                                                       |        |               |
|--------------------------------------------------|---------------------------------------------------------------------------------------|--------|---------------|
| T-WIWI-114618                                    | Design and Operation of Industrial Plants and Processes                               | 5,5 CP | Schultmann    |
| Supplementary Courses (Election: at most 1 item) |                                                                                       |        |               |
| T-WIWI-102763                                    | Supply Chain Management with Advanced Planning Systems                                | 3,5 CP | Bosch, Göbelt |
| T-WIWI-102826                                    | Risk Management in Industrial Supply Networks                                         | 3,5 CP | Schultmann    |
| T-WIWI-103134                                    | Project Management                                                                    | 3,5 CP | Schultmann    |
| Supplementary Courses (Election: at most 1 item) |                                                                                       |        |               |
| T-WIWI-114057                                    | Circular Economy – Challenges and Potentials                                          | 3,5 CP | Schultmann    |
| T-WIWI-102634                                    | Emissions into the Environment                                                        | 3,5 CP | Karl          |
| T-WIWI-112103                                    | Global Manufacturing                                                                  | 3,5 CP | Sasse         |
| T-WIWI-113107                                    | Life Cycle Assessment – Basics and Application Possibilities in an Industrial Context | 3,5 CP | Schultmann    |

**Assessment**

The assessment is carried out as partial exams (according to section 4 (2), 1 SPO) of the core course "Design and Operation of Industrial Plants and Processes" and one further single course 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**

The course "Design and Operation of Industrial Plants and Processes" and at least one additional activity are compulsory and must be examined.

**Competence Goal**

- Students shall be able to describe the tasks of tactical production management with special attention drawn upon industrial plants.
- Students shall understand the relevant tasks in plant management (projection, realisation and supervising tools for industrial plants).
- Students shall be able to describe the special need of a techno-economic approach to solve problems in the field of tactical production management.
- Students shall be proficient in using selected techno-economic methods like investment and cost estimates, plant layout, capacity planning, evaluation principles of production techniques, production systems as well as methods to design and optimize production systems.
- Students shall be able to evaluate techno-economical approaches in planning tactical production management with respect to their efficiency, accuracy and relevance for industrial use.

**Content**

- Planning and Management of Industrial Plants: Basics, circulation flow starting from projecting to techno-economic evaluation, construction and operating up to plant dismantling.

**Additional Information**

Apart from the core course the courses offered are recommendations and can be replaced by courses from the Module Industrial Production III.

**Workload**

Total effort will account to 270 hours (9 credit points) and can be allocated according to the credit point rating. Therefore, a course with 3.5 credits requires an effort of approximately 105h and a course with 5.5 credits 165h.

The total effort for each course consists of attending lectures and tutorials, examination times and the time an average student needs to prepare himself in order to pass the exam with an average grade.

## M

**5.96 Module: Industrial Production III [M-WIWI-101412]**

**Coordinators:** Prof. Dr. Frank Schultmann  
**Organisation:** KIT Department of Business and Economics  
**Part of:** Economics and Management (Business Administration)

| Credits | Grading | Recurrence       | Duration | Language       | Level | Version |
|---------|---------|------------------|----------|----------------|-------|---------|
| 9 CP    | graded  | Each summer term | 1 term   | German/English | 4     | 6       |

| Mandatory                                                                             |                                                                                       |        |               |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|--------|---------------|
| T-WIWI-102632                                                                         | Production and Logistics Management                                                   | 5,5 CP | Schultmann    |
| Supplementary Courses from Module Industrial Production II (Election: at most 1 item) |                                                                                       |        |               |
| T-WIWI-102634                                                                         | Emissions into the Environment                                                        | 3,5 CP | Karl          |
| T-WIWI-112103                                                                         | Global Manufacturing                                                                  | 3,5 CP | Sasse         |
| T-WIWI-113107                                                                         | Life Cycle Assessment – Basics and Application Possibilities in an Industrial Context | 3,5 CP | Schultmann    |
| Supplementary Courses (Election: at most 1 item)                                      |                                                                                       |        |               |
| T-WIWI-114057                                                                         | Circular Economy – Challenges and Potentials                                          | 3,5 CP | Schultmann    |
| T-WIWI-103134                                                                         | Project Management                                                                    | 3,5 CP | Schultmann    |
| T-WIWI-102826                                                                         | Risk Management in Industrial Supply Networks                                         | 3,5 CP | Schultmann    |
| T-WIWI-102763                                                                         | Supply Chain Management with Advanced Planning Systems                                | 3,5 CP | Bosch, Göbelt |

**Assessment**

The assessment is carried out as partial exams (according to section 4 (2), 1 SPO) of the core course *Production and Logistics Management* [2581954] 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**

The course *Production and Logistics Management* [2581954] and at least one additional activity are compulsory and must be examined.

**Competence Goal**

- Students describe the tasks concerning general problems of an operative production and logistics management.
- Students describe the planning tasks of supply chain management.
- Students use proficiently approaches to solve general planning problems.
- Students explain the existing interdependencies between planning tasks and applied methods.
- Students describe the main goals and set-up of software supporting tools in production and logistics management (i.e. APS, PPS-, ERP- and SCM Systems).
- Students discuss the scope of these software tools and their general disadvantages.

**Content**

- Planning tasks and exemplary methods of production planning and control in supply chain management.
- Supporting software tools in production and logistics management (APS, PPS- and ERP Systems).
- Project management in the field of production and supply chain management.

**Additional Information**

Apart from the core course the courses offered are recommendations and can be replaced by courses from the Module Industrial Production II.

**Workload**

The total amount of work for this module is approx. 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 results from the effort required to attend the lectures and exercises, as well as the examination times and the time required to achieve the learning objectives of the module for an average student for an average performance.

## M

**5.97 Module: Information Engineering [M-WIWI-101411]**

**Coordinators:** Prof. Dr. Christof Weinhardt  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [Economics and Management \(Business Administration\)](#)

**Credits**  
9 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
1 term

**Language**  
German/English

**Level**  
4

**Version**  
9

| Supplementary Courses (Election: ) |                                                                                           |        |           |
|------------------------------------|-------------------------------------------------------------------------------------------|--------|-----------|
| T-WIWI-107501                      | <a href="#">Energy Market Engineering</a>                                                 | 4,5 CP | Weinhardt |
| T-WIWI-112823                      | <a href="#">Platform &amp; Market Engineering: Commerce, Media, and Digital Democracy</a> | 4,5 CP | Weinhardt |
| T-WIWI-113727                      | <a href="#">Special Topics in Information Systems</a>                                     | 4,5 CP | Weinhardt |

**Assessment**

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

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

**Competence Goal**

The student

- understands and analyzes the central role of information as an economic good, a production factor, and a competitive factor,
- identifies, evaluates, prices, and markets information goods,
- analyze and evaluate existing markets regarding the missing incentives and the optimal solution of a given market mechanism, respectively,
- develop solutions in teams.

**Content**

In the courses of the module the student can deepen his knowledge on the one hand on the design and operation of markets and on the other hand on the impact of digital goods in network industries regarding the pricing policies, business strategies and regulation issues. If choosen, the course *Special Topics in Information Engineering & Management* additionally provides an opportunity of practical research in the aforementioned range of subjects.

**Additional Information**

All practical Seminars offered at the IM can be chosen for *Special Topics in Information Systems*. Please update yourself on [www.iism.kit.edu/im/lehre](http://www.iism.kit.edu/im/lehre).

**Workload**

Total workload for 9 credit points: approx. 270 hours

The exact distribution is based on the credit points of the courses in the module.

## M

**5.98 Module: Information Systems in Organizations [M-WIWI-104068]**

**Coordinators:** Prof. Dr. Alexander Mädche  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [Economics and Management \(Business Administration\)](#)

**Credits**  
9 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
2 terms

**Language**  
English

**Level**  
4

**Version**  
5

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

|               |                                                                     |        |        |
|---------------|---------------------------------------------------------------------|--------|--------|
| T-WIWI-105777 | <a href="#">Business Intelligence Systems</a>                       | 4,5 CP | Mädche |
| T-WIWI-113465 | <a href="#">Designing Interactive Systems: Human-AI Interaction</a> | 4,5 CP | Mädche |
| T-WIWI-114210 | <a href="#">(Gen)AI-based Automation in Organizations</a>           | 4,5 CP | Mädche |
| T-WIWI-113459 | <a href="#">Practical Seminar: Human-Centered Systems</a>           | 4,5 CP | Mädche |

**Assessment**

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.

**Additional Information**

New module starting summer term 2018.

**Workload**

The total workload for this module is approximately 270 hours.



**M****5.99 Module: Information Systems: AI & Data Science [M-WIWI-107530]**

**Coordinators:** Prof. Dr. Alexander Mädche  
Prof. Dr. Jella Pfeiffer

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

**Part of:** Information Systems

**Credits**  
9 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
2 terms

**Language**  
English

**Level**  
4

**Version**  
1

| Compulsory Elective Area (Election: ) |                                           |        |                    |
|---------------------------------------|-------------------------------------------|--------|--------------------|
| T-WIWI-114749                         | (Gen)AI and Virtual Reality for Business  | 4,5 CP | Pfeiffer           |
| T-WIWI-114210                         | (Gen)AI-based Automation in Organizations | 4,5 CP | Mädche             |
| T-WIWI-106187                         | Business Data Strategy                    | 4,5 CP | Weinhardt          |
| T-WIWI-105777                         | Business Intelligence Systems             | 4,5 CP | Mädche             |
| T-WIWI-114089                         | Data Science for Business                 | 4,5 CP | Pfeiffer           |
| T-WIWI-114892                         | Practical Seminar: AI & Data Science      | 4,5 CP | Mädche             |
| T-WIWI-111385                         | Responsible Artificial Intelligence       | 4,5 CP | Hoffmann, Pfeiffer |

**Assessment**

The module examination takes place in the form of partial examinations via courses of the module amounting to a total of at least 9 credits.

The overall score of the module is formed from the credit-weighted scores of the partial examinations and truncated after the first decimal place.

**Competence Goal**

Students

- know the design principles of selected classes of modern AI-based and decision-supporting information systems
- know the methods and techniques for designing corresponding information systems
- have knowledge of the fundamentals and advanced methods and techniques of data science

**Content**

In the module "Information Systems: Interactive Systems," students learn key design principles as well as methods and techniques for designing AI-based and decision-supporting information systems.

**Workload**

Total effort for 9 credit points: approx. 270 hours. The distribution is based on the credit points of the courses of the module (120-135h for courses with 4.5 credit points). The total number of hours per course results from the effort required to attend lectures and exercises, as well as the examination times and the time required to achieve the learning objectives of the module for an average student for an average performance.

**M****5.100 Module: Information Systems: Digital Markets & Services [M-WIWI-107528]**

**Coordinators:** Prof. Dr. Gerhard Satzger  
Prof. Dr. Christof Weinhardt

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

**Part of:** Information Systems

**Credits**  
9 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
2 terms

**Language**  
German/English

**Level**  
4

**Version**  
1

| Compulsory Elective Area (Election: ) |                                                                                      |        |           |
|---------------------------------------|--------------------------------------------------------------------------------------|--------|-----------|
| T-WIWI-108715                         | Artificial Intelligence in Service Systems                                           | 4,5 CP | Satzger   |
| T-WIWI-114209                         | Artificial Intelligence in Service Systems II: Generative AI Applications & Adoption | 4,5 CP | Satzger   |
| T-WIWI-113160                         | Digital Democracy                                                                    | 4,5 CP | Fegert    |
| T-WIWI-112757                         | Digital Services: Innovation & Business Models                                       | 4,5 CP | Satzger   |
| T-WIWI-110797                         | eFinance: Information Systems for Securities Trading                                 | 4,5 CP | Weinhardt |
| T-WIWI-107501                         | Energy Market Engineering                                                            | 4,5 CP | Weinhardt |
| T-WIWI-107503                         | Energy Networks and Regulation                                                       | 4,5 CP | Weinhardt |
| T-WIWI-102614                         | Experimental Economics                                                               | 4,5 CP | Weinhardt |
| T-WIWI-112823                         | Platform & Market Engineering: Commerce, Media, and Digital Democracy                | 4,5 CP | Weinhardt |

**Assessment**

The module examination takes place in the form of partial examinations on courses of the module totaling at least 9 credit points. The overall grade of the module is calculated from the grades of the partial examinations weighted with credit points and cut off after the first decimal place.

**Competence Goal**

Students

- understands the importance and potential of digitizing products and services
- can design digital markets and services with the associated business models
- know methods and tools for successfully managing the digital transformation of products and services
- acquire specific skills in digitizing domain-specific services, including healthcare and energy.

**Content**

The module "Information Systems: Digital Markets & Services" focuses on the design of digital services and markets from an economic and technical perspective.

**Workload**

Total effort for 9 credit points: approx. 270 hours. The distribution is based on the credit points of the courses of the module (120-135h for courses with 4.5 credit points). The total number of hours per course results from the effort required to attend lectures and exercises, as well as the examination times and the time required to achieve the learning objectives of the module for an average student for an average performance.

**M****5.101 Module: Information Systems: Interactive Systems [M-WIWI-107531]**

**Coordinators:** Prof. Dr. Alexander Mädche  
Prof. Dr. Jella Pfeiffer

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

**Part of:** [Information Systems](#)

**Credits**  
9 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
2 terms

**Language**  
German/English

**Level**  
4

**Version**  
2

| Compulsory Elective Area (Election: ) |                                                                     |        |        |
|---------------------------------------|---------------------------------------------------------------------|--------|--------|
| T-WIWI-113465                         | <a href="#">Designing Interactive Systems: Human-AI Interaction</a> | 4,5 CP | Mädche |
| T-WIWI-113460                         | <a href="#">Engineering Interactive Systems: AI &amp; Wearables</a> | 4,5 CP | Mädche |
| T-INFO-114192                         | <a href="#">Human-Computer-Interaction</a>                          | 6 CP   | Beigl  |
| T-INFO-114193                         | <a href="#">Human-Computer-Interaction Pass</a>                     | 0 CP   | Beigl  |
| T-INFO-107499                         | <a href="#">Context Sensitive Systems</a>                           | 5 CP   | Beigl  |
| T-WIWI-113459                         | <a href="#">Practical Seminar: Human-Centered Systems</a>           | 4,5 CP | Mädche |
| T-INFO-114188                         | <a href="#">Ubiquitous Computing</a>                                | 5 CP   | Beigl  |

**Assessment**

The module examination takes place in the form of partial examinations via courses of the module amounting to a total of at least 9 credits.

The overall score of the module is formed from the credit-weighted scores of the partial examinations and truncated after the first decimal place.

**Competence Goal**

Students

- know the design principles of selected classes of modern interactive information systems
- know the methods and techniques for designing interactive information systems
- have knowledge of the fundamentals and advanced methods and techniques of interactive information systems, especially context-sensitive and ubiquitous systems.

**Content**

In the module "Information Systems: Interactive Systems", students learn central design principles as well as methods and techniques for designing interactive information systems.

**Workload**

Total effort for 9 credit points: approx. 270 hours. The distribution is based on the credit points of the courses of the module (120-135h for courses with 4.5 credit points). The total number of hours per course results from the effort required to attend lectures and exercises, as well as the examination times and the time required to achieve the learning objectives of the module for an average student for an average performance.

**M****5.102 Module: Information Systems: Software & Systems Engineering [M-WIWI-107529]**

**Coordinators:** Prof. Dr. Sebastian Abeck  
Prof. Dr. Alexander Mädche

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

**Part of:** [Information Systems](#)

| Credits | Grading | Recurrence | Duration | Language       | Level | Version |
|---------|---------|------------|----------|----------------|-------|---------|
| 9 CP    | graded  | Each term  | 2 terms  | German/English | 4     | 3       |

| Compulsory Elective Area (Election: ) |                                                                          |        |             |
|---------------------------------------|--------------------------------------------------------------------------|--------|-------------|
| T-INFO-112775                         | <a href="#">Access Control Systems: Models and Technology</a>            | 5 CP   | Hartenstein |
| T-WIWI-109270                         | <a href="#">Human Factors in Security and Privacy</a>                    | 4,5 CP | Volkamer    |
| T-INFO-101337                         | <a href="#">Internet of Everything</a>                                   | 4 CP   | Zitterbart  |
| T-INFO-101323                         | <a href="#">IT-Security Management for Networked Systems</a>             | 5 CP   | Hartenstein |
| T-INFO-114261                         | <a href="#">Software Architecture and Quality</a>                        | 3 CP   | Reussner    |
| T-WIWI-102895                         | <a href="#">Software Quality Management</a>                              | 4,5 CP | Oberweis    |
| T-INFO-101271                         | <a href="#">Web Applications and Service-Oriented Architectures (II)</a> | 4 CP   | Abeck       |

**Assessment**

The module examination takes place in the form of partial examinations via courses of the module amounting to a total of at least 9 credits.

The overall score of the module is formed from the credit-weighted scores of the partial examinations and truncated after the first decimal place.

**Competence Goal**

Students

- learn techniques and procedures for the systematic development of high-quality software.
- can apply methods for assessing software quality, evaluate the results, and compare certification models.
- Know key concepts and technologies required for the development of service-oriented web applications and model corresponding architectures, implement web applications, and evaluate their service properties.

**Content**

The "Information Systems: Software & Systems Engineering" module focuses on the systematic development of software, information systems, and infrastructures.

**Workload**

Total effort for 9 credit points: approx. 270 hours. The distribution is based on the credit points of the courses of the module (120-135h for courses with 4.5 credit points). The total number of hours per course results from the effort required to attend lectures and exercises, as well as the examination times and the time required to achieve the learning objectives of the module for an average student for an average performance.

## M

**5.103 Module: Innovation Management [M-WIWI-101507]**

**Coordinators:** Prof. Dr. Marion Weissenberger-Eibl  
**Organisation:** KIT Department of Business and Economics  
**Part of:** Economics and Management (Business Administration)

| Credits | Grading | Recurrence | Duration | Language       | Level | Version |
|---------|---------|------------|----------|----------------|-------|---------|
| 9 CP    | graded  | Each term  | 1 term   | German/English | 4     | 14      |

| Mandatory                                      |                                                         |      |                    |
|------------------------------------------------|---------------------------------------------------------|------|--------------------|
| T-WIWI-102893                                  | Innovation Management: Concepts, Strategies and Methods | 3 CP | Weissenberger-Eibl |
| Compulsory Elective Courses (Election: 1 item) |                                                         |      |                    |
| T-WIWI-114977                                  | Digital Transformation of Public Administration         | 3 CP | Bauer              |
| T-WIWI-113663                                  | Development of Sustainable, Digital Business Models     | 3 CP | Weissenberger-Eibl |
| T-WIWI-111823                                  | Successful Transformation Through Innovation            | 3 CP | Busch              |
| T-WIWI-102852                                  | Case Studies Seminar: Innovation Management             | 3 CP | Weissenberger-Eibl |
| T-WIWI-110263                                  | Methods in Innovation Management                        | 3 CP | Weissenberger-Eibl |
| T-WIWI-114184                                  | Pioneering Leadership in German SMEs                    | 3 CP | Weissenberger-Eibl |
| T-WIWI-114748                                  | Science Communication in the Innovation Process         | 3 CP | Schwind            |
| Supplementary Courses (Election: 1 item)       |                                                         |      |                    |
| T-WIWI-102866                                  | Design Thinking                                         | 3 CP | Terzidis           |
| T-WIWI-114977                                  | Digital Transformation of Public Administration         | 3 CP | Bauer              |
| T-WIWI-102864                                  | Entrepreneurship                                        | 3 CP | Terzidis           |
| T-WIWI-111823                                  | Successful Transformation Through Innovation            | 3 CP | Busch              |
| T-WIWI-102852                                  | Case Studies Seminar: Innovation Management             | 3 CP | Weissenberger-Eibl |
| T-WIWI-110263                                  | Methods in Innovation Management                        | 3 CP | Weissenberger-Eibl |
| T-WIWI-114184                                  | Pioneering Leadership in German SMEs                    | 3 CP | Weissenberger-Eibl |
| T-WIWI-114748                                  | Science Communication in the Innovation Process         | 3 CP | Schwind            |

**Assessment**

The module examination takes the form of partial examinations (according to §4(2), 1-3 SPO) on the core course and other courses of the module totaling at least 9 CP. The assessment of success is described for each course of the module.

The overall grade is based 50% on the lecture "Innovation Management: Concepts, Strategies and Methods", 25% on one of the seminars of the Chair of Innovation and Technology Management and 25% on another course permitted in the module. The overall grade is cut off after the first decimal place.

**Prerequisites**

The lecture "Innovation Management: Concepts, Strategies and Methods" and one of the seminars of the chair for Innovation and Technology Management are compulsory. The third course can be chosen from the courses of the module.

**Competence Goal**

Students develop a comprehensive understanding of the innovation process and its conditionality. There is an additional focus on the concepts and processes which are of particular relevance with regard to shaping the entire process. Various strategies and methods are then taught based on this.

After completing the module, students should have developed a systemic understanding of the innovation process and be able to shape this by developing and applying suitable methods.

**Content**

The Innovation Management: Concepts, Strategies and Methods lecture course teaches concepts, strategies and methods which help students to form a systemic understanding of the innovation process and how to shape it. Building on this holistic understanding, the seminar courses then go into the subjects in greater depth and address specific processes and methods which are central to innovation management.

**Additional Information**

Seminars offered by Prof. Terzidis (or the members of his research group) are not eligible for crediting in a seminar module of the WiWi degree programs. Exception: Seminar "Entrepreneurship Research".

**Workload**

Total workload for 9 credit points: approx. 270 hours

The exact distribution is based on the credit points of the courses in the module.

**Recommendations**

None

**M****5.104 Module: Innovative Concepts for Programming Industrial Robots [M-INFO-100791]**

**Coordinators:** Prof. Dr.-Ing. Björn Hein  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

| Credits | Grading | Recurrence       | Duration | Language | Level | Version |
|---------|---------|------------------|----------|----------|-------|---------|
| 4 CP    | graded  | Each summer term | 1 term   | German   | 4     | 1       |

| Mandatory     |                                                                       |      |      |
|---------------|-----------------------------------------------------------------------|------|------|
| T-INFO-101328 | <a href="#">Innovative Concepts for Programming Industrial Robots</a> | 4 CP | Hein |

**Assessment**

See Partial Achievements (Teilleistung).

**Prerequisites**

See Partial Achievements (Teilleistung).

**Competence Goal**

**Qualification goals:** Participants will be familiar with new approaches to programming industrial robots and will be able to select and use these appropriately and independently master tasks in this context.

**Learning objectives:**

- master the theoretical principles necessary for the use of model-based planning methods (collision avoidance, path planning, path optimization, calibration).
- master current algorithms and model-based methods for collision-free path planning and path optimization in the field of off-line programming.
- have the ability to analyze the methods covered and assess when and in which context they should be used.
- Students will be able to implement the planning and optimization methods covered using given pseudocode in the Python programming language (400 - 800 lines of code) and analyze them graphically. They will be able to derive optimizations for the methods and further develop these methods independently.

**Content**

Advances in the performance of modern robot controllers are opening new possibilities for programming industrial robots. Many manufacturers are leveraging these additional computational resources to integrate advanced model-based algorithms. For example, embedding geometric models directly on the controller enables collision detection and collision avoidance even during manual programming. These models also serve as a foundation for automated collision-free path planning and path optimization.

Building on this context, the module begins with an introduction to the topic and then teaches the theoretical foundations of collision detection, automated path generation, and optimization—always in relation to the capabilities of current industrial robot controllers. The methods discussed are subsequently implemented and evaluated through small programming exercises in Python.

**Workload**

(2 SWS + 2.5 x 2 SWS) x 15 + 15 h exam preparation = 120h/30 = 4 ECTS

Effort 2.5/SWS is due in particular to the required implementation of the procedures in Python.

**Recommendations**

See Partial Achievements (Teilleistung).



## 5.105 Module: Intellectual Property Law [M-INFO-101215]

**Coordinators:** N.N.

**Organisation:** KIT Department of Informatics

**Part of:** Law

**Credits**  
9 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
2 terms

**Language**  
German

**Level**  
4

**Version**  
5

| Intellectual Property Law (Election: at least 1 item as well as at least 9 credits) |                                       |      |             |
|-------------------------------------------------------------------------------------|---------------------------------------|------|-------------|
| T-INFO-101308                                                                       | Copyright                             | 3 CP | N.N.        |
| T-INFO-101313                                                                       | Trademark and Unfair Competition Law  | 3 CP | Matz        |
| T-INFO-101307                                                                       | Internet Law                          | 3 CP | N.N.        |
| T-INFO-108462                                                                       | Selected Legal Issues of Internet Law | 3 CP | N.N.        |
| T-INFO-101310                                                                       | Patent Law                            | 3 CP | Straßburger |

### Assessment

see partial achievements

### Prerequisites

None

### Competence Goal

The student

- has detailed knowledge of the main intellectual property rights,
- analyzes and evaluates complex issues and leads them to a legal solution,
- translates the legal principles into contracts on the use of intellectual property and solves more complex infringement cases
- knows and understands the main features of registration procedures and has a broad overview of legal issues raised by the Internet.
- analyzes, assesses and evaluates relevant legal issues from a legal, information technology and legal policy perspective, economic and legal policy perspectives

### Content

The module provides knowledge in the core areas of intellectual property law and core topics of internet law. It explains the requirements and the necessary procedure for protecting inventions and industrial marks nationally and internationally. In addition, the necessary know-how is taught to use intellectual property rights and to defend intellectual property rights against attacks by third parties.

### Workload

The total workload for this module is approximately 270 hours (9 credits). The allocation is based on the credits of the courses of the module. The workload for courses with 3 credits is about 90 hours. The total number of hours per course results from the effort required to attend the lectures as well as the examination times and the time required to achieve the learning objectives of the module for an average student for an average performance.



## M

**5.106 Module: Intelligent Systems and Services [M-WIWI-101456]****Coordinators:** Dr.-Ing. Tobias Käfer**Organisation:** KIT Department of Business and Economics**Part of:** Informatics**Credits**  
9 CP**Grading**  
graded**Recurrence**  
Each term**Duration**  
1 term**Language**  
German/English**Level**  
4**Version**  
9**Compulsory Elective Courses (Election: between 9 and 10 credits)**

|               |                                                          |        |                                      |
|---------------|----------------------------------------------------------|--------|--------------------------------------|
| T-WIWI-114951 | <a href="#">Advanced Topics in Digital Twins</a>         | 4,5 CP | Lazarova-Molnar                      |
| T-WIWI-102666 | <a href="#">Knowledge Discovery</a>                      | 4,5 CP | Käfer                                |
| T-WIWI-114863 | <a href="#">Knowledge-Driven Artificial Intelligence</a> | 4,5 CP | Sack                                 |
| T-WIWI-112685 | <a href="#">Modeling and Simulation</a>                  | 4,5 CP | Lazarova-Molnar                      |
| T-WIWI-110548 | <a href="#">Advanced Lab Informatics (Master)</a>        | 4,5 CP | Professorenschaft des Instituts AIFB |
| T-WIWI-110848 | <a href="#">Semantic Web Technologies</a>                | 4,5 CP | Käfer                                |

**Assessment**

The assessment mix of each course of this module is defined for each course separately. The final mark for the module is the average of the marks for each course weighted by the credits and truncated after the first decimal.

Algorithms for Internet Applications [T-WIWI-102658]: The examination will be offered latest until summer term 2017 (repeaters only).

**Prerequisites**

None

**Competence Goal**

Students

- know the different machine learning procedures for the supervised as well as the unsupervised learning,
- identify the pros and cons of the different learning methods,
- apply the discussed network learning methods in specific scenarios,
- compare the practicality of methods and algorithms with alternative approaches.

**Content**

In the broader sense learning systems are understood as biological organisms and artificial systems which are able to change their behavior by processing outside influences. Network learning methods based on symbolic, statistic and neuronal approaches are the focus of Computer Sciences.

In this module the most important network learning methods are introduced and their applicability is discussed with regard to different information sources such as data texts and images considering especially procedures for knowledge acquirement via data and text mining, natural analogue procedures as well as the application of organic learning procedures within the finance sector.

**Additional Information**

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

**M****5.107 Module: Interactive Computer Graphics [M-INFO-100732]****Coordinators:** Prof. Dr.-Ing. Carsten Dachsbacher**Organisation:** KIT Department of Informatics**Part of:** [Informatics](#)**Credits**  
5 CP**Grading**  
graded**Recurrence**  
Each summer term**Duration**  
1 term**Language**  
German/English**Level**  
4**Version**  
1

| Mandatory     |                                               |      |             |
|---------------|-----------------------------------------------|------|-------------|
| T-INFO-101269 | <a href="#">Interactive Computer Graphics</a> | 5 CP | Dachsbacher |

## M

**5.108 Module: Internet of Everything [M-INFO-100800]**

**Coordinators:** Prof. Dr. Martina Zitterbart  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
4 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                        |      |            |
|---------------|------------------------|------|------------|
| T-INFO-101337 | Internet of Everything | 4 CP | Zitterbart |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students

- know the challenges of the Internet of Everything (IoE) from both a technical and legal perspective
- know and understand the risks to user privacy in the IoE as well as basic mechanisms and protocols to protect it
- are familiar with the basic architectures and protocols in the field of wireless sensor networks and the Internet of Things.

Students know the platforms and applications of the Internet of Everything. Students have an understanding the challenges of designing protocols and applications for the IoE.

Students know and understand the risks to the privacy of users of the future IoE. They know protocols and mechanisms to enable future applications, such as smart metering and smart traffic, while protecting the privacy of users.

Students know and understand classic sensor network protocols and applications, such as media access procedures, routing protocols, transport protocols and mechanisms for topology control. Students know and understand the interaction of individual communication layers and the influence on, for example, the energy requirements of the systems.

Students know protocols for the Internet of Things such as 6LoWPAN, RPL, CoAP and DICE. Students understand the challenges and assumptions that have led to the standardization of protocols.

Students have a basic understanding of security technologies in IoE. They know typical protection goals and attacks, as well as building blocks and protocols to implement the protection goals.

**Content**

The lecture deals with selected protocols, architectures, procedures and algorithms that are essential for IoE. In addition to classic topics from the field of wireless sensor-actuator networks, such as media access and routing, this also includes new challenges and solutions for the security and privacy of transmitted data in IoE. Socially and legally relevant aspects are also addressed.

**Workload**

Lecture with 2 SWS plus follow-up/exam preparation, 4 CP.

4 CP corresponds to approx. 120 working hours, of which

approx. 30 hours lecture attendance

approx. 60 hours preparation/follow-up work

approx. 30 hours exam preparation

**Recommendations**

See partial achievements (Teilleistung)

## M

**5.109 Module: Introduction to Bioinformatics for Computer Scientists [M-INFO-100749]****Coordinators:** Prof. Dr. Alexandros Stamatakis**Organisation:** KIT Department of Informatics**Part of:** [Informatics](#)**Credits**  
3 CP**Grading**  
graded**Recurrence**  
Each winter term**Duration**  
1 term**Language**  
English**Level**  
4**Version**  
1

| Mandatory     |                                                                        |      |            |
|---------------|------------------------------------------------------------------------|------|------------|
| T-INFO-101286 | <a href="#">Introduction to Bioinformatics for Computer Scientists</a> | 3 CP | Stamatakis |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students attain comprehensive knowledge of standard methods, algorithms, theoretical principles and open problems in the field of sequence-based bioinformatics (biological principles, sequence assembly, pairwise sequence alignment, multiple sequence alignment, phylogenetic tree reconstruction under parsimony, likelihood and Bayesian models, coalescent inference in population genetics). They develop the ability to categorise and evaluate algorithms and problems. They can select suitable models and methods for a given biological data analysis problem and can justify their choice. Students will be able to design analysis pipelines for biological data analysis.

**Content**

Initially, some basic concepts and mechanisms of biology are introduced. Subsequently, algorithms and models from the fields of sequence analysis (sequence alignment, dynamic programming, sequence assembly), population genetics, and discrete as well as numerical algorithms for inferring molecular phylogenetic trees (parsimony, likelihood, Bayesian inference) are discussed. Furthermore, discrete operations on trees are treated (e.g., topological distances between trees, consensus tree algorithms). A substantial part of the lectures will cover the practical implementation, the optimisation, and the parallelisation of the respective methods.

**Workload**
 $2 \text{ SWS lecture} + 1.5 * 2 \text{ SWS follow-up} * 15 + 15 \text{ hours exam preparation} = 90 \text{ hours} = 3 \text{ ECTS}$

**M****5.110 Module: Introduction to Quantum Computing (IQC) [M-INFO-106101]**

**Coordinators:** Prof. Dr. Bernhard Beckert  
Prof. Dr.-Ing. Ina Schaefer

**Organisation:** KIT Department of Informatics

**Part of:** [Informatics](#)

| Credits | Grading | Recurrence       | Duration | Language       | Level | Version |
|---------|---------|------------------|----------|----------------|-------|---------|
| 3 CP    | graded  | Each winter term | 1 term   | German/English | 4     | 1       |

| Mandatory     |                                                         |      |                   |
|---------------|---------------------------------------------------------|------|-------------------|
| T-INFO-112344 | <a href="#">Introduction to Quantum Computing (IQC)</a> | 3 CP | Beckert, Schaefer |



## 5.111 Module: Introduction to Video Analysis [M-INFO-100736]

**Coordinators:** Prof. Dr.-Ing. Jürgen Beyerer  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

| Credits | Grading | Recurrence       | Duration | Language | Level | Version |
|---------|---------|------------------|----------|----------|-------|---------|
| 3 CP    | graded  | Each summer term | 1 term   | German   | 4     | 1       |

| Mandatory     |                                                |      |         |
|---------------|------------------------------------------------|------|---------|
| T-INFO-101273 | <a href="#">Introduction to Video Analysis</a> | 3 CP | Beyerer |

### Assessment

See Partial Achievements (Teilleistung).

### Prerequisites

See Partial Achievements (Teilleistung).

### Competence Goal

After attending the lecture and working through the sources mentioned and discussed, students will have an overview of classical and current methods from various areas of image sequence analysis. These range from motion detection and correspondence formation to the estimation of three-dimensional structures from motion, the detection and tracking of objects in image sequences and the interpretation of visually observable actions and behavior.

Students analyze problems posed to them in the field of image sequence evaluation and evaluate known methods and groups of methods for their suitability to solve the problems and thus select suitable methods and procedures.

### Content

Image sequence analysis as a sub-area of machine vision refers to the automatic derivation of statements about the scene depicted in an image sequence and its development over time. The derived statements can be made available to the human user or directly transferred to the actions of technical systems. When analyzing image sequences, it is possible to include movements as part of the temporal change of the observed scene in the derivation of statements compared to the observation of individual images.

The subject of the lecture is initially the determination of an existing movement in the scene from the images of an image sequence. Both change-based and correspondence-based methods are covered. The use of motion estimation between individual images of an image sequence is then illustrated using examples such as mosaic formation, the determination of scene structures from motion and object detection based on motion cues.

The lecture focuses on object detection and, in particular, object tracking methods, which are used to automatically determine motion traces in the image and to estimate the three-dimensional motion of scene objects. The estimated two- and three-dimensional traces form the basis for methods that link the quantitative information about an observed scene with qualitative concepts. This is discussed using the example of action recognition in image sequences. The use of the conceptualization of image sequence evaluation results to inform the human user as well as for automatic conclusions within an image evaluation system is illustrated using examples.

### Workload

Total: approx. 90h, of which

1. Attendance time in lectures: 23h
2. Preparation and follow-up of the same: 23h
3. Exam preparation and attendance: 44h

### Recommendations

See Partial Achievements (Teilleistung).

**M****5.112 Module: IT Security [M-INFO-106998]**

**Coordinators:** Prof. Dr. Jörn Müller-Quade  
Prof. Dr. Christian Wressnegger

**Organisation:** KIT Department of Informatics

**Part of:** Informatics

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
2

| Mandatory     |             |      |                              |
|---------------|-------------|------|------------------------------|
| T-INFO-113960 | IT Security | 6 CP | Müller-Quade,<br>Wressnegger |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students

- have in-depth knowledge of cryptography and IT security
- know and understands sophisticated techniques and security primitives to achieve the protection goals
- know and understand scientific evaluation and analysis methods of IT security (game-based formalization of confidentiality and integrity, security and anonymity notions)
- have a good understanding of types of data, personal data, legal and technical fundamentals of privacy protection
- know and understand the fundamentals of system security (buffer overflow, return-oriented programming, ...)
- know different mechanisms for anonymous communication (TOR, Nym, ANON) and can assess their effectivity

**Content**

This advanced mandatory module deepens different topics of IT security. These include in particular:

- Elliptic curve cryptography
- Threshold cryptography
- Zero-knowledge proofs
- Secret sharing
- Secure multi-party computation and homomorphic encryption
- Methods of IT security (game-based analysis and the UC model)
- Crypto-currencies and consensus through proof-of-work/stake
- Anonymity on the Internet, anonymity with online payments
- Privacy-preserving machine learning
- Security of machine learning
- System security and exploits
- Threat modeling and quantification of IT security

**Workload**

Course workload:

1. Attendance time: 56 h
2. Self-study: 56 h
3. Preparation for the exam: 68 h

**Recommendations**

Attendance of the lecture Information Security is recommended.

**Literature**

Literature:

- Katz/Lindell: Introduction to Modern Cryptography (Chapman & Hall)
- Schäfer/Roßberg: Netzicherheit (dpunkt)
- Anderson: Security Engineering (Wiley, and online)
- Stallings/Brown: Computer Security (Pearson)
- Pfleeger, Pfleeger, Margulies: Security in Computing (Prentice Hall)

**M****5.113 Module: IT-Security Management for Networked Systems [M-INFO-100786]**

**Coordinators:** Prof. Dr. Hannes Hartenstein  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
5 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
German

**Level**  
4

**Version**  
1

| Mandatory     |                                                              |      |             |
|---------------|--------------------------------------------------------------|------|-------------|
| T-INFO-101323 | <a href="#">IT-Security Management for Networked Systems</a> | 5 CP | Hartenstein |



## M

**5.114 Module: Lab Project: Speech Translation [M-INFO-107176]**

**Coordinators:** Prof. Dr. Jan Niehues  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                 |      |         |
|---------------|-------------------------------------------------|------|---------|
| T-INFO-114205 | <a href="#">Lab Project: Speech Translation</a> | 6 CP | Niehues |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

The student

- is able to develop a language translation system using state-of-the-art methods.
- can evaluate language translation systems.
- can present his/her findings in a scientific lecture.

**Content**

The use of deep learning technologies has significantly improved the quality of machine translation of text and speech in recent years. In this internship, students will develop a language translation system for a new language pair using state-of-the-art methods.

In the first part of the internship, students are introduced step-by-step to the development of a translation system and its evaluation. To this end, the various subtasks must be solved. In the second part of the internship, the students are asked to independently analyse various improvements to the system.

**Workload**

180h

Approx. 15h presence

Approx. 15h pre/post processing

Approx. 140h self-study

Approx. 10h Preparation of scientific presentation

**Recommendations**

Students should have understood the theoretical principles as introduced in the lectures Deep Learning or Machine Translation.

M

5.115 Module: Lab: Graph Visualization in Practice [M-INFO-103302]

Coordinators:

Dr. rer. nat. Torsten Ueckerdt

Organisation:

KIT Department of Informatics

Part of:

Informatics

|         |         |            |          |          |       |         |
|---------|---------|------------|----------|----------|-------|---------|
| Credits | Grading | Recurrence | Duration | Language | Level | Version |
| 5 CP    | graded  | Irregular  | 1 term   | German   | 4     | 1       |

|               |                                      |      |          |
|---------------|--------------------------------------|------|----------|
| Mandatory     |                                      |      |          |
| T-INFO-106580 | Lab: Graph Visualization in Practice | 5 CP | Ueckerdt |

M

5.116 Module: Laboratory in Cryptoanalysis [M-INFO-101559]

Coordinators:

Prof. Dr. Dennis Hofheinz  
Prof. Dr. Jörn Müller-Quade

Organisation:

KIT Department of Informatics

Part of:

Informatics

| Credits | Grading | Recurrence | Duration | Language | Level | Version |
|---------|---------|------------|----------|----------|-------|---------|
| 3 CP    | graded  | Each term  | 1 term   | German   | 4     | 1       |

| Mandatory     |                              |      |              |
|---------------|------------------------------|------|--------------|
| T-INFO-102990 | Laboratory in Cryptoanalysis | 3 CP | Müller-Quade |

## M

**5.117 Module: Laboratory in Cryptography [M-INFO-101558]**

**Coordinators:** Prof. Dr. Jörn Müller-Quade  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
German

**Level**  
4

**Version**  
1

| Mandatory     |                                            |      |              |
|---------------|--------------------------------------------|------|--------------|
| T-INFO-102989 | <a href="#">Laboratory in Cryptography</a> | 3 CP | Müller-Quade |



## 5.118 Module: Introduction to Quantum Machine Learning [M-INFO-106742]

**Coordinators:** Prof. Dr. Achim Streit  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

| Credits | Grading | Recurrence       | Duration | Language | Level | Version |
|---------|---------|------------------|----------|----------|-------|---------|
| 3 CP    | graded  | Each summer term | 1 term   | German   | 4     | 1       |

| Mandatory     |                                                          |      |            |
|---------------|----------------------------------------------------------|------|------------|
| T-INFO-113556 | <a href="#">Introduction to Quantum Machine Learning</a> | 3 CP | Kühn, Kühn |

### Assessment

see partial achievement

### Competence Goal

Students have a systematic understanding of the issues surrounding the use of currently available quantum computers and of solution approaches from the field of hybrid quantum machine learning. They will be able to transfer these findings to other problems and, in particular, evaluate the efficiency and feasibility for different data sets in practice. In addition, they will be able to interpret and understand current research results in quantum machine learning with the knowledge you have acquired.

After successfully completing the course, students will be able to

- Explain the basic concepts, motivation and challenges of quantum computing and quantum machine learning as well as current hybrid approaches;
- Analyze problems, select suitable approaches, describe them mathematically and convert them into circuit notation and apply them;
- Design their own solutions based on the concepts learned in the lecture and evaluate their efficiency.

### Content

This module aims to familiarize students with the theoretical and practical aspects of the hybrid use of quantum circuits in classical machine learning algorithms. In the first part of the lecture, the necessary mathematical foundations of quantum systems and their representation by qubits and quantum circuits are summarized before the advantages and possibilities of quantum computing are demonstrated on the basis of known quantum algorithms. Finally, an overview of current hybrid approaches in the field of quantum machine learning (QML) and their possible applications and limitations is provided:

- Fundamentals and basic concepts
  - Theoretical and practical basics of quantum computing
  - Taxonomy of quantum machine learning
- Overview of QML algorithms, e.g.
  - Variational Quantum Eigensolver
  - Quantum Approximate Optimization Algorithm
  - Quantum Autoencoder
  - Quantum Convolutional Neural Networks
  - Quantum Generative Adversarial Neural Networks
  - Quantum Kernels
- Current challenges, e.g.
  - Noise
  - Barren Plateaus

The module focuses in particular on the applicability to today's quantum computers and the scalability of the approaches presented.

### Workload

- Lecture attendance: 23h (2 SWS x 15)
- Preparation and follow-up: 45h (2 x 2 SWS x 15)
- Exam preparation: 22h
- Total: 90h / 30 = 3 credits

### Recommendations

- Attendance of the lecture "Introduction to Quantum Computing" is recommended
- Knowledge of linear algebra is recommended
- Programming skills in Python are helpful



## 5.119 Module: Localization of Mobile Agents [M-INFO-107663]

**Coordinators:** Prof. Dr.-Ing. Uwe Hanebeck  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each summer term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                      |      |          |
|---------------|--------------------------------------|------|----------|
| T-INFO-115014 | Localization of Mobile Agents        | 6 CP | Hanebeck |
| T-INFO-115015 | Localization of Mobile Agents - Pass | 0 CP | Hanebeck |

### Assessment

See Partial Achievements (Teilleistung).

### Prerequisites

See Partial Achievements (Teilleistung).

### Competence Goal

Participants in this course will gain a broad overview of probabilistic machine learning tools and learn how to creatively combine them to solve a wide variety of problems.

### Content

This module provides a systematic introduction to the field of localization methods. To facilitate entry, the module is divided into four central topics. Dead reckoning (1) deals with the step-by-step determination of a vehicle's position from dynamic parameters such as speed or steering angle, as well as inertial measurement unit (IMU) data. Localization with the aid of measurements to external, known landmarks is part of static localization (2). Specifically, signal times of arrival (multilateration and GPS), distance measurements, and angle measurements (bearings) are covered. In addition to closed-form solutions for special measurements, the method of least squares for fusing arbitrary measurements is introduced. This also includes nonlinear optimization methods and certifiable global optimization. Dynamic localization (3) deals with the combination of dead reckoning and static localization using the Kalman filter, which is used in virtually all object tracking scenarios and other state estimation problems. General estimator properties are also discussed. The course concludes with simultaneous localization and mapping (SLAM) (4), which allows localization even when the location of landmarks is partially unknown. Thereby the measurement association problem is also addressed.

### Workload

Per week:

2 SWS Presence

2h Follow-up

6h Digital exercise with computation tasks

2h exam preparation

= 12h/week und 180h/semester

### Recommendations

Knowledge of a higher-level programming language with mature libraries for scientific and numerical computing (e.g., Julia, Matlab, Python) is an advantage.

## M

**5.120 Module: Logical Foundations of Cyber-Physical Systems [M-INFO-106102]**

**Coordinators:** Prof. Dr. André Platzer  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
3

| Mandatory     |                                               |      |         |
|---------------|-----------------------------------------------|------|---------|
| T-INFO-112360 | Logical Foundations of Cyber-Physical Systems | 6 CP | Platzer |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

**In modeling and control**, successful students will

- understand core principles behind CPS. A solid understanding of these principles is important for anyone who wants to integrate cyber and physical components to solve problems that no part could solve alone.
- develop models and controls. In order to understand, design, and analyze CPS, it is important to be able to develop models for the relevant aspects of a CPS design and to design controllers for the intended functionalities based on appropriate specifications, including modeling with differential equations.
- identify relevant dynamical aspects. It is important to be able to identify which types of phenomena influence a property of a system. These allow us to judge, for example, where it is important to manage adversarial effects, or where a nondeterministic model is sufficient.

**In computational thinking**, successful students should be able to

- identify safety specifications and critical properties. In order to develop correct CPS designs, it is important to identify what “correctness” means, how a design may fail to be correct, and how to make it correct.
- understand abstraction in system designs. The power of abstraction is essential for the modular organization of CPS, and the ability to reason about separate parts of a system independently.
- express pre- and post-conditions and invariants for CPS models. Pre- and post-conditions allow us to capture under which circumstance it is safe to run a CPS or a part of a CPS design, and what safety entails. They allow us to achieve what abstraction and hierarchies achieve at the system level: decompose correctness of a full CPS into correctness of smaller pieces. Invariants achieve a similar decomposition by establishing which relations of variables remain true no matter how long and how often the CPS runs.
- reason rigorously about CPS models. Reasoning is required to ensure correctness and find flaws in CPS designs. Both informal and formal reasoning in a logic are important objectives for being able to establish correctness, which includes rigorous reasoning about differential equations.

**In CPS skills**, successful students will be able to

- understand the semantics of a CPS model. What may be easy in a classical isolated program becomes very demanding when that program interfaces with effects in the physical world.
- develop an intuition for operational effects. Intuition for the joint operational effect of a CPS is crucial, e.g., about what the effect of a particular discrete computer control algorithm on a continuous plant will be.
- understand opportunities and challenges in CPS and verification. While the beneficial prospects of CPS for society are substantial, it is crucial to also develop an understanding of their inherent challenges and of approaches for minimizing the impact of potential safety hazards. Likewise, it is important to understand the ways in which formal verification can best help improve the safety of system designs.

**Content**

Cyber-physical systems (CPSs) combine cyber capabilities (computation and/or communication) with physical capabilities (motion or other physical processes). Cars, aircraft, and robots are prime examples, because they move physically in space in a way that is determined by discrete computerized control algorithms. Designing these algorithms to control CPSs is challenging due to their tight coupling with physical behavior. At the same time, it is vital that these algorithms be correct, since we rely on CPSs for safety-critical tasks like keeping aircraft from colliding. In this course we will strive to answer the fundamental question posed by Jeannette Wing:

“How can we provide people with cyber-physical systems they can bet their lives on?”

The cornerstone of this course design are hybrid programs (HPs), which capture relevant dynamical aspects of CPSs in a simple programming language with a simple semantics. One important aspect of HPs is that they directly allow the programmer to refer to real-valued variables representing real quantities and specify their dynamics as part of the HP.

This course will give you the required skills to formally analyze the CPSs that are all around us—from power plants to pacemakers and everything in between—so that when you contribute to the design of a CPS, you are able to understand important safety-critical aspects and feel confident designing and analyzing system models. It will provide an excellent foundation for students who seek industry positions and for students interested in pursuing research.

**Additional Information**

Course web page: <https://lfcps.org/course/lfcps.html>

**Workload**

6 ECTS from 180h of coursework consisting of

45h = 15 \* 3 from 3 SWS lectures

15h = 15 \* 1 from 1 SWS exercises

68h preparation, reading textbook, studying

40h solving exercises

12h exam preparation

**Recommendations**

The course assumes prior exposure to basic computer programming and mathematical reasoning. This course covers the basic required mathematical and logical background of cyber-physical systems. You will be expected to follow the textbook as needed: André Platzer. Logical Foundations of Cyber-Physical Systems. Springer 2018. DOI:10.1007/978-3-319-63588-0



**M****5.121 Module: Low Power Design [M-INFO-100807]**

**Coordinators:** Prof. Dr.-Ing. Jörg Henkel  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

| Credits | Grading | Recurrence       | Duration | Language | Level | Version |
|---------|---------|------------------|----------|----------|-------|---------|
| 3 CP    | graded  | Each summer term | 1 term   | English  | 4     | 1       |

| Mandatory     |                                  |      |        |
|---------------|----------------------------------|------|--------|
| T-INFO-101344 | <a href="#">Low Power Design</a> | 3 CP | Henkel |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students are made aware of various low power design optimizations employed in state-of-the-art embedded devices. This involves optimization techniques that incorporate embedded machine learning algorithms to enhance system performance. At the end of the lecture, the students will be able to recognize the challenges involved in crafting efficient low power designs and how to tackle them.

**Content**

The lecture provides an overview of design methods, synthesis tools, estimation models, software techniques, operating system strategies, scheduling algorithms, embedded machine learning methods, etc., with the aim of minimizing the power consumption of embedded devices without compromising their performance. Both the research-relevant and industry-prevalent topics at different level of abstractions (from circuit to system) are discussed in this lecture.

**Workload**

Attendance time: 30 hours (2 SWS × 15 weeks)

Self-study: 45 hours (1.5 × 2 SWS × 15 weeks)

Exam preparation: 15 hours

Total: 90 hours (3 ECTS)

## M

**5.122 Module: Machine Learning [M-WIWI-103356]**

**Coordinators:** Prof. Dr.-Ing. Johann Marius Zöllner  
**Organisation:** KIT Department of Business and Economics  
**Part of:** Informatics

**Credits**  
9 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
1 term

**Language**  
German/English

**Level**  
4

**Version**  
3

**Compulsory Elective Courses (Election: )**

|               |                                                              |        |         |
|---------------|--------------------------------------------------------------|--------|---------|
| T-WIWI-106340 | <a href="#">Machine Learning 1 - Basic Methods</a>           | 4,5 CP | Zöllner |
| T-WIWI-106341 | <a href="#">Machine Learning 2 - Advanced Methods</a>        | 4,5 CP | Zöllner |
| T-WIWI-109985 | <a href="#">Project Lab Cognitive Automobiles and Robots</a> | 5 CP   | Zöllner |
| T-WIWI-109983 | <a href="#">Project Lab Machine Learning</a>                 | 5 CP   | Zöllner |

**Assessment**

The module examination is carried out in the form of partial examinations on the selected courses of the module, with which the minimum requirement at creditpoints is fulfilled. The learning control is described in each course. The overall score of the module is made up of the sub-scores weighted with creditpoints and is cut off after the first comma point.

**Prerequisites**

None

**Competence Goal**

Students

- Gain knowledge of basic methods in the field of machine learning.
- Understand advanced machine learning concepts and their possible applications.
- Can classify, formally describe and evaluate machine learning methods.
- Can apply their knowledge for the selection of suitable models and methods for selected problems in the field of machine learning.

**Content**

The topic of machine learning considering real-world challenges of complex application domains is a rapidly expanding field of knowledge and the subject of numerous research and development projects. Large parts of modern AI methods are based on machine-learned models.

The Machine Learning 1 course introduces students to the rapidly evolving field of machine learning by providing a solid foundation that covers the major concepts and techniques in the field. Students will explore various methods of supervised, unsupervised, and reinforcement learning, as well as associated model types ranging from simple linear classifiers to more complex models, such as Deep Neural Networks.

The lecture "Machine Learning 2" covers advanced and modern machine learning methods. Modern learning methods like Self-Supervised-Learning and Contrastive Learning as well as model architectures like Diffusion Models, Transformers, Graph Neural Networks, are introduced.

In the practical courses, scientific tasks in the field of autonomous driving or robotics are solved with modern machine learning methods. There, the techniques of machine learning are practically oriented.

**Workload**

The total workload for this module is approximately 270 hours.

## M

**5.123 Module: Machine Learning - Foundations and Algorithms [M-INFO-107169]**

**Coordinators:** Prof. Dr. Gerhard Neumann  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

| Credits | Grading | Recurrence       | Duration | Language | Level | Version |
|---------|---------|------------------|----------|----------|-------|---------|
| 6 CP    | graded  | Each summer term | 1 term   | English  | 4     | 2       |

| Mandatory     |                                               |      |         |
|---------------|-----------------------------------------------|------|---------|
| T-INFO-114197 | Machine Learning - Foundations and Algorithms | 6 CP | Neumann |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

- Students acquire knowledge of the basic methods of Machine Learning
- Students acquire the mathematical knowledge to understand the theoretical foundations of Machine Learning
- Students can categorize, formally describe and evaluate methods of Machine Learning
- Students can apply their knowledge to select appropriate models and methods for selected problems in the field of Machine Learning.

**Content**

The field of Machine Learning has made enormous progress in recent years and good knowledge of Machine Learning is becoming increasingly in demand on the job market. Machine Learning describes the acquisition of knowledge by an artificial system based on experience or data. Rules or certain calculations no longer have to be manually coded but can be extracted from data by intelligent systems.

This lecture provides an overview of essential and current methods of Machine Learning. After reviewing the necessary mathematical background, the lecture primarily deals with algorithms for classification, regression, and density estimation, with a focus on the mathematical understanding of probabilistic methods and neural networks.

Examples of topics include:

- Basics in Linear Algebra, Probability Theory, Optimization and Constraint Optimization
- Linear Regression
- Linear Classification
- Model Selection, Overfitting, and Regularization
- Support Vector Machines
- Kernel Methods
- Bayesian Learning and Gaussian Processes
- Neural Networks
- Dimensionality Reduction
- Density estimation
- Clustering
- Expectation Maximization
- Graphical Models

**Workload**

180h, divided into:

- ca 45h lecture attendance
- approx. 15h attending exercises
- approx. 90h post-processing and working on the exercise sheets
- ca 30h exam preparation



## 5.124 Module: Machine Learning for Natural Sciences [M-INFO-106959]

**Coordinators:** Prof. Dr. Pascal Friederich  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each summer term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                              |      |            |
|---------------|----------------------------------------------|------|------------|
| T-INFO-113916 | Machine Learning for Natural Sciences        | 3 CP | Friederich |
| T-INFO-113917 | Machine Learning for Natural Sciences - Pass | 3 CP | Friederich |

### Assessment

See partial achievements (Teilleistung)

### Prerequisites

See partial achievements (Teilleistung)

### Competence Goal

Qualification Objectives

- Students are able to name relevant machine learning methods, describe them, as well as develop independent proposals on how questions in the natural sciences and material sciences can be answered using machine learning methods.

Learning Objectives

- Necessary knowledge for the selection and, if necessary, the adaptation of suitable machine learning models.
- Knowledge about data availability and, if necessary, planning of training data generation
- Knowledge of practical implementation, training, and systematic evaluation of machine learning models in python using common libraries (sklearn, TensorFlow, Keras, PyTorch, etc.)
- Knowledge of ways and means to systematically analyze and interpret results.

### Content

This module covers the theoretical and practical aspects of machine learning methods and their application to problems in natural sciences, especially in materials science and chemistry. Students gain insight into machine learning fundamentals as well as current research topics of this still young interdisciplinary field. Topics covered include the application of machine learning methods for medical image analysis, sequence analysis and generation, the prediction of material and molecular properties, generative models for materials design, Bayesian methods for decision making in autonomous experiments, as well as interpretation possibilities of all methods for gaining scientific understanding.

A practical exercise based on jupyter notebooks gives students insight into the practical aspects of machine learning for natural sciences and supports the learning process.

### Workload

4 SWS: (2 SWS Lecture + 2 SWS Exercise + 1,5 x 4 SWS Preparation) x 15 + 30 h exam preparation  
 = 180 h

### Recommendations

- Knowledge of the basics of machine learning is helpful but not required
- Interest in natural science topics is required
- Basic knowledge of python is recommended. It has to be acquired during the semester through self-study



## 5.125 Module: Machine Learning in Climate and Environmental Sciences [M-INFO-106470]

**Coordinators:** TT-Prof. Dr. Peer Nowack  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

| Credits | Grading | Recurrence       | Duration | Language | Level | Version |
|---------|---------|------------------|----------|----------|-------|---------|
| 6 CP    | graded  | Each summer term | 1 term   | English  | 4     | 1       |

| Mandatory     |                                                               |      |        |
|---------------|---------------------------------------------------------------|------|--------|
| T-INFO-113083 | Machine Learning in Climate and Environmental Sciences        | 6 CP | Nowack |
| T-INFO-113085 | Machine Learning in Climate and Environmental Sciences - Pass | 0 CP | Nowack |

### Assessment

See partial achievements (Teilleistung)

### Prerequisites

See partial achievements (Teilleistung)

### Competence Goal

Learning objectives:

Students will be able to effectively address complex data science challenges. They can design and use robust strategies/modelling pipelines for machine learning applications in the climate and environmental sciences, which are transferable to other disciplines. Their acquired knowledge will include major classes of machine learning techniques, how to choose and differentiate among algorithms in a variety of problem settings, ways of assessing important data properties that could for example help or interfere with modelling goals, and methods to combine data-driven modelling with prior scientific system understanding to increase performance and trustworthiness of machine learning.

Students will learn how to implement these approaches in Python, using major machine learning software packages.

### Content

This module covers key concepts for real-world applications of machine learning, focusing on environmental data science. These include:

- foundations of machine learning (e.g., curse of dimensionality, cross-validation, cost functions, feature engineering)
- several widely applied regression, classification, and unsupervised learning algorithms (e.g., LASSO, random forests, Gaussian processes, neural networks, LSTMs, transformers, self-organizing maps)
- time series forecasting and causal inference.
- explainable AI (e.g., SHAP value analyses, feature permutation methods, intrinsically interpretable methods).

These concepts will be discussed in applied contexts, using current research examples from the climate and environmental sciences, including: climate change modelling, machine learning emulation of numerical models, forecasting air pollution and wildfires, understanding coupled dynamical systems such as global teleconnections in climate science, challenges in modelling non-stationary systems (e.g., predicting extreme weather events under global warming), and anomaly detection in measurement data.

The lectures are accompanied by computer exercises in which students learn how to implement and modify machine learning modelling pipelines first-hand.

### Workload

Concerning in-person events, this is a 4 SWS module: 2 SWS for lectures, 2 SWS for exercises

Overall:

(2 SWS lectures + 2 SWS exercises + 1.5 x 4 SWS preparation and homework) x 15 +30 h preparation for the exam = 180 h = 6 ECTS

### Recommendations

- Previous programming experience, e.g. in scientific contexts or in computer science, is required.
- Knowledge of fundamentals about machine learning is an advantage.
- Knowledge of the Python programming language is an advantage.
- Good knowledge of mathematical concepts such as linear algebra is an advantage.
- An interest in scientific questions important for the climate- and environmental sciences.

**M****5.126 Module: Machine Translation [M-INFO-100848]**

**Coordinators:** Prof. Dr. Jan Niehues  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each summer term

**Duration**  
1 term

**Language**  
German

**Level**  
4

**Version**  
1

| Mandatory     |                                     |      |         |
|---------------|-------------------------------------|------|---------|
| T-INFO-101385 | <a href="#">Machine Translation</a> | 6 CP | Niehues |

## M

**5.127 Module: Management Accounting [M-WIWI-101498]**

**Coordinators:** Prof. Dr. Marcus Wouters  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [Economics and Management \(Business Administration\)](#)

**Credits**  
9 CP

**Grading**  
graded

**Recurrence**  
see Annotations

**Duration**  
2 terms

**Language**  
English

**Level**  
4

**Version**  
3

| Mandatory     |                                         |        |         |
|---------------|-----------------------------------------|--------|---------|
| T-WIWI-102800 | <a href="#">Management Accounting 1</a> | 4,5 CP | Wouters |
| T-WIWI-102801 | <a href="#">Management Accounting 2</a> | 4,5 CP | Wouters |

**Assessment**

The course "Management Accounting 1" and the corresponding assessment for first-time examinees will be offered for the last time in the **summer semester 2026**.

The course "Management Accounting 2" and the corresponding assessment for first-time examinees will be offered for the last time in the **winter semester 2026/2027**.

The assessment is carried out as partial exams (according to Section 4 (2), 13 SPO) of the courses of this module. The assessment procedures are described for each course of the module separately.

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

**Competence Goal**

Students

- are familiar with various management accounting methods,
- can apply these methods for cost estimation, profitability analysis, and product costing,
- are able to analyze short-term and long-decisions with these methods,
- have the capacity to devise instruments for organizational control.

**Content**

The module consists of two courses "Management Accounting 1" and "Management Accounting 2". The emphasis is on structured learning of management accounting techniques.

**Additional Information**

The course "Management Accounting 1" and the corresponding assessment for first-time examinees will be offered for the last time in the **summer semester 2026**.

The course "Management Accounting 2" and the corresponding assessment for first-time examinees will be offered for the last time in the **winter semester 2026/2027**.

**Workload**

Total workload for 9 credit points: approx. 270 hours

The exact distribution is based on the credit points of the courses in the module.

## M

**5.128 Module: Market Engineering [M-WIWI-101446]**

**Coordinators:** Prof. Dr. Christof Weinhardt  
**Organisation:** KIT Department of Business and Economics  
**Part of:** Economics and Management (Business Administration)

| Credits | Grading | Recurrence | Duration | Language       | Level | Version |
|---------|---------|------------|----------|----------------|-------|---------|
| 9 CP    | graded  | Each term  | 1 term   | German/English | 4     | 10      |

| Mandatory                                     |                                                                                            |        |           |
|-----------------------------------------------|--------------------------------------------------------------------------------------------|--------|-----------|
| T-WIWI-112823                                 | Platform & Market Engineering: Commerce, Media, and Digital Democracy                      | 4,5 CP | Weinhardt |
| Supplementary Courses (Election: 4,5 credits) |                                                                                            |        |           |
| T-WIWI-102613                                 | Auction Theory                                                                             | 4,5 CP | Ehrhart   |
| T-WIWI-113160                                 | Digital Democracy                                                                          | 4,5 CP | Fegert    |
| T-WIWI-110797                                 | eFinance: Information Systems for Securities Trading                                       | 4,5 CP | Weinhardt |
| T-WIWI-107501                                 | Energy Market Engineering                                                                  | 4,5 CP | Weinhardt |
| T-WIWI-107503                                 | Energy Networks and Regulation                                                             | 4,5 CP | Weinhardt |
| T-WIWI-115061                                 | Experimental Research in Economics and Information Systems                                 | 4,5 CP | Weinhardt |
| T-WIWI-111109                                 | KD <sup>2</sup> Lab Hands-On Research Course: New Ways and Tools in Experimental Economics | 4,5 CP | Weinhardt |
| T-WIWI-107504                                 | Smart Grid Applications                                                                    | 4,5 CP | Weinhardt |

**Assessment**

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

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

**Competence Goal**

The students

- know the design criterias of market mechanisms and the systematic approach to create new markets,
- understand the basics of the mechanism design and auction theory,
- analyze and evaluate existing markets regarding the missing incentives and the optimal solution of a given market mechanism, respectively,
- develop solutions in teams.

**Content**

This module explains the dependencies between the design von markets and their success. Markets are complex interaction of different institution and participants in a market behave strategically according to the market rules. The development and the design of markets or market mechanisms has a strong influence on the behavior of the participants. A systematic approach and a thorough analysis of existing markets is inevitable to design, create and operate a market place successfully. the approaches for a systematic analysis are explained in the mandatory course *Market Engineering* [2540460] by discussing theories about mechanism design and institutional economics. The student can deepen his knowledge about markets in a second course.

**Workload**

The total workload for this module is approx. 270 hours (9 credits). The distribution is based on the credit points of the courses in the module. The workload for courses with 4.5 credits is approx. 135 hours for courses with 5 credits approx. 150 hours.

The total number of hours per course results from the time required to attend the lectures and exercises, as well as the examination times and the time required to achieve the learning objectives of the module for an average student for an average performance.

**Recommendations**

None



**M****5.129 Module: Marketing and Sales Management [M-WIWI-105312]****Coordinators:** Prof. Dr. Martin Klarmann**Organisation:** KIT Department of Business and Economics**Part of:** Economics and Management (Business Administration)**Credits**  
9 CP**Grading**  
graded**Recurrence**  
Each summer term**Duration**  
1 term**Language**  
English**Level**  
4**Version**  
10

| Compulsory Elective Courses (Election: ) |                                                      |        |                     |
|------------------------------------------|------------------------------------------------------|--------|---------------------|
| T-WIWI-112693                            | Digital Marketing                                    | 4,5 CP | Kupfer              |
| T-WIWI-106981                            | Digital Marketing and Sales in B2B                   | 1,5 CP | Klarmann, Konhäuser |
| T-WIWI-114174                            | Economic Decision Making                             | 4,5 CP | Scheibehenne        |
| T-WIWI-107720                            | Market Research                                      | 4,5 CP | Klarmann            |
| T-WIWI-111848                            | Online Concepts for Karlsruhe City Retailers         | 3 CP   | Kupfer              |
| T-WIWI-102883                            | Pricing                                              | 4,5 CP | Klarmann            |
| T-WIWI-114893                            | International Entrepreneurship and Brand Development | 6 CP   | Kupfer, Terzidis    |

**Assessment**

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**

None

**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**

This module provides students with a profound understanding of key principles and concepts of marketing management and enables them to independently analyze, develop, and critically reflect on marketing and sales strategies. The focus is on combining theoretical knowledge with its practical application in various contexts, from digital markets and B2B environments to international brand development.

Students work on realistic case studies and application-oriented projects, present their ideas in group settings, and receive continuous feedback. Complemented by collaboration with external partners and the use of qualitative and quantitative market research methods, students learn to make data-driven and strategic marketing decisions.

The module consists of the following courses: Digital Marketing, Digital Marketing and Sales in B2B, International Entrepreneurship and Brand Development, Market Research, Online Concepts for Local Retailers in Karlsruhe, and Pricing. The choice of options within the module allows students to set individual priorities.

**Workload**

The total workload for this module is approximately 270 hours.

## M

**5.130 Module: Master's Thesis [M-WIWI-104833]**

**Coordinators:** Studiendekan der KIT-Fakultät für Informatik  
Studiendekan des KIT-Studienganges

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

**Part of:** [Master's Thesis](#)

**Credits**  
30 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
1 term

**Language**  
German

**Level**  
3

**Version**  
1

| Mandatory     |                                 |       |                                                                                     |
|---------------|---------------------------------|-------|-------------------------------------------------------------------------------------|
| T-WIWI-103142 | <a href="#">Master's Thesis</a> | 30 CP | Studiendekan der KIT-Fakultät für Informatik,<br>Studiendekan des KIT-Studienganges |

**Assessment**

At least one of the examiners must be a member of one of the two KIT faculties of Economics or Computer Science. The examiner must be involved in the degree program. The persons involved in the degree program are those who coordinate modules and/or are responsible for courses for the degree program.

If the Master's thesis is to be completed outside the KIT departments Economics and Management or Informatics, this requires the approval of the Examination Board.

If the thesis is not passed, it may be repeated once. A new topic must be issued. The same topic may not be repeated. This also applies to comparable topics. In case of doubt, the examination board will decide. The new topic may again be supervised by the examiners of the first thesis.

This regulation also applies analogously after an official withdrawal from a registered topic.

**Prerequisites**

Regulated in §14 of the examination regulation.

**Competence Goal**

The student can independently handle a complex and unfamiliar subject based on scientific criteria and the current state of research.

He/she is in a position to critically analyze and structure the researched information as well as derive principles and regularities. He/she knows how to apply the thereby achieved results to solve the task at hand. Taking into account this knowledge and his/her interdisciplinary knowledge, he/she can draw own conclusions, derive improvement potentials, propose and implement science-based decisions.

This is basically also done under consideration of social and/or ethical aspects.

He/she can interpret, evaluate and if required, graphically present the obtained results.

He/she is in a position to sensibly structure a research paper, document results and clearly communicate the results in scientific form.

**Content**

- The Master's thesis should demonstrate that the candidate is able to work independently on a problem from their subject within the specified time frame using scientific methods that correspond to the current state of research.
- The Master's thesis can also be written in English.
- The Master's thesis can be assigned by any examiner (within the meaning of the SPO). If the Master's thesis is to be written outside the two participating faculties (Computer Science or Economics), this requires the approval of the Examination Board. The candidate must be given the opportunity to make suggestions for the topic.
- The Master's thesis may also be approved in the form of a group thesis if the contribution of the individual candidate to be assessed as an examination achievement is clearly distinguishable on the basis of objective criteria that enable a clear distinction to be made and fulfills the requirements for a Master's thesis.
- At the candidate's request, the Chair of the Examination Board shall, by way of exception, ensure that the candidate receives a topic for the Master's thesis from a supervisor within four weeks of submitting the request. In this case, the topic is issued by the Chair of the Examination Board.
- The topic, task and scope of the Master's thesis must be limited by the supervisor in such a way that the Master's thesis can be completed with the specified workload of 30 CPs.
- When submitting the Master's thesis, the student must declare in writing that he/she has written the thesis independently and has not used any sources and aids other than those specified by him/her, has marked the passages taken verbatim or in terms of content as such and has observed the statutes of the University of Karlsruhe (TH) to ensure good scientific practice in the currently valid version. If this declaration is not included, the thesis will not be accepted. If an untrue declaration is submitted, the Master's thesis will be assessed as "insufficient" (5.0).
- The date on which the topic of the Master's thesis is issued and the date on which the Master's thesis is submitted must be recorded with the Examination Board. The candidate may only return the topic of the Master's thesis once, and only within the first two months of the completion period. Upon justified request by the candidate, the Examination Board may extend the completion period stipulated in the SPO by a maximum of three months. If the Master's thesis is not submitted on time, it will be graded as "insufficient", unless the candidate is not responsible for this failure (e.g. maternity leave).
- The Master's thesis is assessed and evaluated by a supervisor and, as a rule, by a further examiner. If the two examiners do not agree in their assessment, the Examination Board will determine the grade of the Master's thesis based on the assessment of the two examiners.
- The assessment period should not exceed 8 weeks.

**Workload**

A total of approx. 900 hours is expected for the preparation and presentation of the Master's thesis. In addition to writing the thesis, this figure includes all necessary activities such as literature research, familiarization with the topic, familiarization with any necessary tools, conducting studies/experiments, supervision meetings, etc.

## M

**5.131 Module: Mathematical Programming [M-WIWI-101473]**

**Coordinators:** Prof. Dr. Oliver Stein  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [Economics and Management \(Operations Research\)](#)

| Credits | Grading | Recurrence | Duration | Language       | Level | Version |
|---------|---------|------------|----------|----------------|-------|---------|
| 9 CP    | graded  | Each term  | 1 term   | German/English | 4     | 8       |

| Compulsory Elective Courses (Election: at most 2 items) |                                                                |        |           |
|---------------------------------------------------------|----------------------------------------------------------------|--------|-----------|
| T-WIWI-102719                                           | <a href="#">Mixed Integer Programming I</a>                    | 4,5 CP | Stein     |
| T-WIWI-102726                                           | <a href="#">Global Optimization I</a>                          | 4,5 CP | Stein     |
| T-WIWI-103638                                           | <a href="#">Global Optimization I and II</a>                   | 9 CP   | Stein     |
| T-WIWI-102856                                           | <a href="#">Convex Analysis</a>                                | 4,5 CP | Stein     |
| T-WIWI-111587                                           | <a href="#">Multicriteria Optimization</a>                     | 4,5 CP | Stein     |
| T-WIWI-102724                                           | <a href="#">Nonlinear Optimization I</a>                       | 4,5 CP | Stein     |
| T-WIWI-103637                                           | <a href="#">Nonlinear Optimization I and II</a>                | 9 CP   | Stein     |
| T-WIWI-102855                                           | <a href="#">Parametric Optimization</a>                        | 4,5 CP | Stein     |
| Supplementary Courses (Election: at most 2 items)       |                                                                |        |           |
| T-WIWI-106548                                           | <a href="#">Advanced Stochastic Optimization</a>               | 4,5 CP | Rebennack |
| T-WIWI-102720                                           | <a href="#">Mixed Integer Programming II</a>                   | 4,5 CP | Stein     |
| T-WIWI-102727                                           | <a href="#">Global Optimization II</a>                         | 4,5 CP | Stein     |
| T-WIWI-102723                                           | <a href="#">Graph Theory and Advanced Location Models</a>      | 4,5 CP | Nickel    |
| T-WIWI-106549                                           | <a href="#">Large-scale Optimization</a>                       | 4,5 CP | Rebennack |
| T-WIWI-111247                                           | <a href="#">Mathematics for High Dimensional Statistics</a>    | 4,5 CP | Grothe    |
| T-WIWI-103124                                           | <a href="#">Multivariate Statistical Methods</a>               | 4,5 CP | Grothe    |
| T-WIWI-102725                                           | <a href="#">Nonlinear Optimization II</a>                      | 4,5 CP | Stein     |
| T-WIWI-102715                                           | <a href="#">Operations Research in Supply Chain Management</a> | 4,5 CP | Nickel    |
| T-WIWI-112109                                           | <a href="#">Topics in Stochastic Optimization</a>              | 4,5 CP | Rebennack |

**Assessment**

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", "Multicriteria Optimization", "Convex Analysis", "Parametric Optimization", "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 make suggestions to adapt them to practical problems.

**Content**

This module provides an advanced education in mathematical foundations and sophisticated methods of optimization. It addresses complex decision-making situations where optimal solutions must be found under constraints, covering a wide range of specialized optimization classes.

The core content includes:

- **Global and Nonlinear Optimization:** Handling problems with non-convex structures where local optima are not necessarily global solutions. Teaching of methods for determining global optima.
- **Mixed-Integer Optimization:** Modeling and solving problems where both continuous and integer (discrete) variables occur, which is essential for many applications from engineering and economics.
- **Multicriteria Optimization:** Methods for solving problems with multiple, often conflicting objectives (Pareto optimization).

Students learn both the mathematical modeling of complex systems and the application and implementation of modern solution algorithms to efficiently handle real-world optimization problems.

**Additional Information**

The lectures are partly offered irregularly. The curriculum of the next three years is available online ([www.ior.kit.edu](http://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.



## 5.132 Module: Microeconomic Theory [M-WIWI-101500]

**Coordinators:** Prof. Dr. Clemens Puppe  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [Economics and Management \(Economics\)](#)

| Credits | Grading | Recurrence | Duration | Language | Level | Version |
|---------|---------|------------|----------|----------|-------|---------|
| 9 CP    | graded  | Each term  | 1 term   | English  | 4     | 4       |

| Compulsory Elective Courses (Election: at least 9 credits) |                                                    |        |                      |
|------------------------------------------------------------|----------------------------------------------------|--------|----------------------|
| T-WIWI-102609                                              | <a href="#">Advanced Topics in Economic Theory</a> | 4,5 CP | Brumm, Mitusch       |
| T-WIWI-102861                                              | <a href="#">Advanced Game Theory</a>               | 4,5 CP | Ehrhart, Puppe, Reiß |
| T-WIWI-102613                                              | <a href="#">Auction Theory</a>                     | 4,5 CP | Ehrhart              |
| T-WIWI-105781                                              | <a href="#">Incentives in Organizations</a>        | 4,5 CP | Nieken               |
| T-WIWI-113264                                              | <a href="#">Matching Theory</a>                    | 4,5 CP | Puppe                |
| T-WIWI-102859                                              | <a href="#">Social Choice Theory</a>               | 4,5 CP | Puppe                |

### Assessment

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

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

Attendance time: 90 h

Self-study: approx. 100 h

Exam preparation: approx. 80 h

Total: 270 h

## M

**5.133 Module: Mobile Communication [M-INFO-107245]**

**Coordinators:** Prof. Dr. Oliver Waldhorst  
Prof. Dr. Martina Zitterbart

**Organisation:** KIT Department of Informatics

**Part of:** [Informatics](#)

**Credits**  
4 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                      |      |                       |
|---------------|--------------------------------------|------|-----------------------|
| T-INFO-114271 | <a href="#">Mobile Communication</a> | 4 CP | Waldhorst, Zitterbart |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students

- know the basic concepts of mobile communication and can evaluate basic methods and influencing factors of wireless communication
- are familiar with the structure and functionality of prominent, practically relevant mobile communication systems (e.g. GSM, UMTS, WLAN)
- know typical problems in mobile communication systems and can evaluate, select and apply suitable methods to solve them

Students are familiar with typical problems in wireless transmission (e.g. signal propagation, attenuation) and can explain these using examples and relate them to each other. They can also recognize where these problems typically occur when designing different communication systems.

Students are familiar with a portfolio of methods for modulating digital data, multiplexing, coordinating competing media access and mobility management. They will be able to explain these in their own words, evaluate them and select suitable candidates when designing mobile communication systems.

Students master the basic concepts of wireless local networks according to IEEE 802.11 and wireless personal networks with Bluetooth. They can explain these and compare the respective variants with each other. They will also be able to analyze and evaluate media access in detail.

Students master the structure of digital telecommunications systems such as GSM, UMTS and LTE as well as the individual tasks of the respective components and their detailed interaction in the overall system. They are familiar with the conceptual differences between the systems presented and can explain in their own words why certain methods from the portfolio are used in the respective systems.

Students will be familiar with basic routing methods in self-organizing wireless ad hoc networks and will be able to analyse these comprehensively and evaluate their use depending on the application scenario. Furthermore, they master the basic concepts of mobility support on the Internet (Mobile IP and Mobile IPv6).

**Content**

The lecture first discusses typical problems in wireless transmission, such as signal propagation, attenuation, reflections and interference. Based on this, it develops a portfolio of methods for modulation of digital data, multiplexing, coordination of competing media accesses and mobility management. To illustrate where and how these methods are used in practice, typical mobile communication systems of great practical relevance are presented in detail. These include wireless local area networks according to IEEE 802.11, wireless personal networks with Bluetooth as well as wireless telecommunication systems such as GSM, UMTS with HSPA and LTE. Discussions of mechanisms at the network layer (mobile ad-hoc networks and MobileIP) and transport layer round off the lecture.

**Workload**

Lecture with 2 SWS plus follow-up/exam preparation, 4 CP.

4 CP corresponds to approx. 120 working hours, of which

approx. 30 hours lecture attendance

approx. 60 hours preparation/follow-up work

approx. 30 hours exam preparation

## M

**5.134 Module: Model-Driven Software Development [M-INFO-106931]**

**Coordinators:** Prof. Dr. Ralf Reussner  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
2

| Mandatory     |                                   |      |                  |
|---------------|-----------------------------------|------|------------------|
| T-INFO-113896 | Model-Driven Software Development | 3 CP | Burger, Reussner |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

- \* Students understand model-driven approaches for software and systems development, and they can use and assess them.
- \* Students can create metamodels and transformations using established model-driven development processes and standards of the OMG (MOF, QVT, XMI, UML, etc.), as well as state-of-the-art languages and tool} (Xtext, Xtend, Xpand, etc.)
- \* Students know the theoretical background of model transformation languages.
- \* Students know practical applications of model-driven technologies.
- \* Students can assess standards and technologies and can estimate their respective advantages and disadvantages.

**Content**

Model-driven software development pursues the development of software systems on the basis of models. The models are not only used to document, design and analyse an initial system, as is usual in conventional software development, but rather serve as primary development artefacts from which the final system can be generated in its entirety if possible. This focus on models offers a number of advantages, such as an increase in the level of abstraction at which the system is specified, improved communication options that can extend to the end customer through domain-specific languages (DSL), and an increase in the efficiency of software development through automated transformations of the created models to the source code of the system. However, there are still some unresolved challenges in the use of model-driven software development, such as model versioning, evolution of DSLs, maintenance of transformations or the combination of teamwork and MDSD. Although MDSD is already used in practice due to the advantages mentioned, the challenges mentioned also offer opportunities for current research.

The lecture introduces concepts and techniques that are part of MDSD. As a basis, the systematic creation of meta-models and DSLs including all necessary components (concrete and abstract syntax, static and dynamic semantics) is introduced. This is followed by a general discussion of the concepts of transformation languages and an introduction to some selected transformation languages. The embedding of MDSD in the software development process provides the necessary foundations for their practical use. The remaining lectures deal with further issues such as model versioning, model coupling, MDSD standards, teamwork based on models, testing of model-driven software, as well as the maintenance and further development of models, meta-models and transformations. Finally, model-driven methods for analysing software architecture models are covered as an advanced unit. The lecture deepens concepts from existing courses such as software engineering or compiler construction or transfers and extends them to model-driven approaches. Furthermore, formal techniques are applied in transformation languages, such as graph grammars, logical calculi or relational algebras.

**Workload**

(2 SWS + 1.5 x 2 SWS) x 15 + 15 h exam preparation = 90 h



## M

**5.135 Module: Modeling the Dynamics of Financial Markets [M-WIWI-106660]****Coordinators:** Prof. Dr. Maxim Ulrich**Organisation:** KIT Department of Business and Economics**Part of:** [Economics and Management \(Business Administration\)](#)**Credits**  
9 CP**Grading**  
graded**Recurrence**  
Each summer term**Duration**  
1 term**Language**  
English**Level**  
4**Version**  
1

| Mandatory     |                                                            |      |        |
|---------------|------------------------------------------------------------|------|--------|
| T-WIWI-113414 | <a href="#">Modeling the Dynamics of Financial Markets</a> | 9 CP | Ulrich |

**Assessment**

The module examination takes the form of a one-hour written comprehensive examination on the courses "Dynamic Capital Market Theory", "Essentials for Dynamic Financial Machine Learning" and "Exercises, Python, Research Frontier in Dynamic Capital Markets".

**Competence Goal****Dynamic Capital Market Theory:**

Professional competence:

- Understanding of the principles of Dynamic Asset Pricing Theory
- Mastery of concepts such as stochastic calculus and dynamic modeling in discrete and continuous time
- Application of dynamic programming theory to portfolio and investment decisions
- Knowledge of pricing bonds, stocks, futures and options markets.

Interdisciplinary skills:

- Develop analytical skills for working on and solving complex problems in finance
- Ability to apply theoretical models to real financial market scenarios.

**Essentials for Dynamic Financial Machine Learning:**

Professional Competence:

- Competencies in Multivariate Time Series Modeling and Dynamic Volatility Modeling.
- Skills in dealing with big financial data.
- Knowledge in the estimation of risk premia and the application of Kalman Filtering.

Interdisciplinary skills:

- Analytical skills in applying machine learning algorithms to dynamic financial market data.
- Development of problem-solving skills through the practical application of Python in financial data analysis.

## Content

### Dynamic Capital Market Theory:

The course "Dynamic Capital Market Theory" offers an introduction to the modeling of dynamic capital markets. Portfolio holdings and asset prices move dynamically across time and states. This course teaches basic financial economic thinking to help understand why this is the case and how to optimally act in such environments.

Next to the asset pricing focus, the second focus of the course is on optimal portfolio choice (robo advisory). For that, this course develops the theory of dynamic programming in discrete and continuous time and applies it to solve portfolio choice and corporate investment decisions. These concepts are key for financial engineering and the machine learning branch of Reinforcement Learning.

Students obtain proficiency in the following topics:

- Dynamic Valuation and Optimal Dynamic Asset Allocation
- Dynamic modeling in discrete time and continuous time
- Stochastic Calculus
- Markov Decision Processes and Dynamic Programming in discrete time and continuous time
- Pricing of bonds, equity, futures and options

Lectures (2 SWS) develop all concepts on the whiteboard.

### Essentials for Dynamic Financial Machine Learning:

The course "Essentials for Dynamic Financial Machine Learning" teaches students to work with financial data, algorithms and statistical concepts.

Students are exposed to algorithms to learn key quantities of dynamic capital markets, such as time-varying risk premia, time-varying volatility and unobserved realizations of random states. The course covers the following concepts:

- Multivariate time series modeling
- Dynamic volatility modeling
- Handling big financial data
- Estimating risk premia
- Kalman Filtering

Weekly lectures (2 SWS) develop all algorithmic material on the whiteboard.

### Exercises, Python, Research Frontier in Dynamic Capital Markets:

This course provides hands-on experience in implementing concepts from dynamic capital market theory and financial machine learning using Python. Students will develop practical skills in coding and data analysis that complement the theoretical knowledge gained in the companion courses. The course covers:

- Introduction to Python for financial applications Data manipulation and visualization with pandas and matplotlib.
- Implementing dynamic portfolio optimization algorithms.
- Coding stochastic processes and simulations.
- Building and testing time series models.
- Applying machine learning techniques to financial data.
- Developing Reinforcement Learning algorithms for trading strategies.
- Implementing and backtesting option pricing models.
- Creating interactive financial dashboards

Weekly computer lab sessions (2 SWS) will guide students through coding exercises and problem sets that directly relate to topics covered in "Dynamic Capital Market Theory" and "Essentials for Dynamic Financial Machine Learning". Students will work on individual and group projects, applying their programming skills to real-world financial problems and current research questions in dynamic capital markets.

This course forms an integral part of the module, complementing the theoretical components with practical implementation skills essential for modern quantitative finance.

## Workload

Total workload for 9 credit points: approx. 270 hours. The exact distribution is based on the credit points of the courses in the module:

- Dynamic Capital Market Theory: 3 CP
- Essentials for Dynamic Financial Machine Learning: 3 CP
- Exercises, Python, Research Frontier in Dynamic Capital Markets: 3 CP

The total number of hours per course is determined by the amount of time spent attending the lectures and tutorials, 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.

**Recommendations**

Recommendation: Knowledge in the fields of Advanced Statistics, Deep Learning, Financial Economics, Differential Equations, Optimization.

**Teaching and Learning Methods**

The module consists of two weekly lectures and respective tutorials:

1. **Dynamic Capital Market Theory and**
2. **Essentials for Dynamic Financial Machine Learning.**
3. **Exercises, Python, Research Frontier in Dynamic Capital Markets**

## M

**5.136 Module: Motion in Human and Machine - Seminar [M-INFO-102555]**

**Coordinators:** Prof. Dr.-Ing. Tamim Asfour  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics Seminars](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Each summer term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
3

| Mandatory     |                                                       |      |        |
|---------------|-------------------------------------------------------|------|--------|
| T-INFO-105140 | <a href="#">Motion in Human and Machine - Seminar</a> | 3 CP | Asfour |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students understand methods for modeling, processing, and analyzing human motions. They can explain approaches for capturing biological motion and biomechanical simulation.

Students can describe methods for learning motion primitives from human demonstrations and understand how human motion is mapped to robots with different kinematics and dynamics. They can apply these methods in new contexts.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

**Content**

This interdisciplinary block seminar addresses methods for modeling, generating, and controlling movements in human and robot systems. Students gain insight into this interdisciplinary field, learning fundamentals of capturing biological motion, biomechanical simulation, robotics, and machine learning.

The seminar begins with the generation of human movement as an effect of muscle contraction. It covers how observed movement patterns can be identified and categorized. Methods for learning movement primitives from human demonstrations are presented, including approaches for reproducing these patterns on humanoid robots. The seminar addresses the challenge of mapping human motion to robots with different kinematics and dynamics. Students learn how motion primitives enable transfer of human movements to robotic systems and their application to motion generation in humanoid robots.

Students work in small groups on collaborative projects that apply the learned methods. These projects allow students to deepen their understanding through practical application of the methods.

**Additional Information**

This interdisciplinary seminar is conducted in cooperation with the University of Stuttgart and the University of Tübingen.

**Workload**

Seminar with 3 SWS, 3 LP  
 3 LP corresponds to 90 hours, including  
 30 hours attendance time  
 15 hours group work  
 20 hours literature research  
 20 hours manuscript preparation  
 5 hours video creation

**Recommendations**

Programming experience in C++, Python or Matlab is recommended.

Attending the lectures Robotics I – Introduction to Robotics, Robotics II: Humanoid Robotics, Robotics III - Sensors and Perception in Robotics, Mechano-Informatics and Robotics and Wearable Robotic Technologies is recommended.



## 5.137 Module: Multimodal Artificial Intelligence [M-INFO-107676]

**Coordinators:** Prof. Dr. Jan Niehues  
Prof. Dr.-Ing. Rainer Stiefelhagen

**Organisation:** KIT Department of Informatics

**Part of:** [Informatics](#)

| Credits | Grading | Recurrence       | Duration | Language | Level | Version |
|---------|---------|------------------|----------|----------|-------|---------|
| 6 CP    | graded  | Each summer term | 1 term   | English  | 4     | 1       |

| Mandatory     |                                                    |      |                       |
|---------------|----------------------------------------------------|------|-----------------------|
| T-INFO-115041 | <a href="#">Multimodal Artificial Intelligence</a> | 6 CP | Niehues, Stiefelhagen |

### Assessment

See Partial Achievements (Teilleistung).

### Prerequisites

See Partial Achievements (Teilleistung).

### Competence Goal

- The students know the relevant elements of a multimodal AI .
- The students understand the algorithms and methods of multimodal AI.
- The students are able to understand the different sub-components to develop and analyze a system .
- The students can transfer this knowledge to new applications, as well as analyze and compare different methods.

### Content

Due to the successes in research, multimodal AI systems are increasingly integrated into our everyday lives. These are, for example, systems that can understand and generate language and speech or analyze images and videos. Furthermore, advanced video and image generation AI shows leads to new applications

Based on the knowledge of the lecture "Introduction to AI", the students learn to understand, develop and evaluate multimodal AI Systems.

In order to bring this knowledge closer to the students, the lecture is divided into 5 parts. First, the lecture investigates method of speech and language perception followed by a part about visual perception. The second part deals speech and language generation followed by a part about video processing. Finally, multimodal AI methods are presented.

### Workload

Lecture with 3 SWS + 1 SWS exercise , 6 CP.

6 LP corresponds to approx. 180 hours, of which

approx. 45 hours lecture attendance

approx. 15 hours exercise visit

approx. 90 hours post-processing and processing of the exercise sheets (self-study)

approx. 30 hours exam preparation (self-study)

### Recommendations

See Partial Achievements (Teilleistung).

## M

**5.138 Module: Natural Language Processing [M-INFO-107178]**

**Coordinators:** Prof. Dr. Jan Niehues  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                             |      |         |
|---------------|-----------------------------|------|---------|
| T-INFO-114207 | Natural Language Processing | 6 CP | Niehues |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

- To familiarise the student with the problems that exist in natural language processing
- The student should be introduced to the basic techniques for solving the problems.
- The student should gain an insight into current research in the field of natural language processing and be able to use the language processing and can use the acquired knowledge to work on current research topics

**Content**

Summarise today's lecture? When were neural networks invented? Artificial intelligence that can answer these questions has long been a dream of mankind. And today we are seeing the first programmes that can solve these problems. In this lecture we will provide the skills and knowledge to develop solutions to these problems of natural language processing using state-of-the-art methods.

After an introduction to the challenges of natural language processing, the different tasks in natural language processing are discussed. One focus of the course is on methods from the field of deep learning. Firstly, sequence classification tasks such as sentiment analysis are covered. Next, methods of sequence labelling are discussed, such as those used in the recognition of proper names or the determination of part-of-speech tags. The lecture will then discuss sequence-to-sequence methods. These models are used in many natural language processing tasks, such as machine translation, automatic summarisation and automatic question answering.

In this course, the important challenges in the development of systems will be addressed: The representation of words, neural architectures to model language, methods to train complex models, and finding the most likely output.

**Workload**

180hLecture with 4 SWS, 6 CP.

6 LP corresponds to approx. 180 hours, of which

approx. 60 hours lecture attendance

approx. 90 hours post-processing (self-study)

approx. 30 hours exam preparation (self-study)

**M****5.139 Module: Natural Language Processing and Software Engineering [M-INFO-107233]**

**Coordinators:** Prof. Dr.-Ing. Anne Koziolk  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

| Credits | Grading | Recurrence       | Duration | Language | Level | Version |
|---------|---------|------------------|----------|----------|-------|---------|
| 3 CP    | graded  | Each winter term | 1 term   | English  | 4     | 1       |

| Mandatory     |                                                                      |  |                |
|---------------|----------------------------------------------------------------------|--|----------------|
| T-INFO-114257 | <a href="#">Natural Language Processing and Software Engineering</a> |  | 3 CP   Koziolk |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students know basic concepts of linguistics such as syntax, semantics and pragmatics, and can explain and compare them. They are familiar with lexical relations such as polysemy, homonymy, and troponymy and can identify relevant examples. Furthermore, they can identify and compare connections between the relations.

Students are familiar with basic concepts of computational linguistics. Basic techniques such as part-of-speech tagging, lemmatization, word similarities and disambiguation can be explained. Associated methods (lexical, rule-based, or probabilistic) can be described and their respective strengths and weaknesses assessed. Different parsing methods can be named, explained and conceptually reproduced.

Students can describe and compare the structure, content and benefits of different knowledge bases. In addition to the overarching concepts of ontology, lexical databases and other knowledge representations, they are also familiar with specific representatives, such as WordNet, DBpedia and similar, and can use them.

Students understand the connection between the functionality of basic computational linguistics techniques and their applicability in software engineering. In addition, they can break down tool chains into individual components and evaluate them. In particular, students will be able to analyze and evaluate different applications. These include automated modeling, improving requirements specifications, and traceability link recovery. In addition, students can explain the concept of large language models (LLMs) and their application and use in the field of language processing. Students can identify application scenarios in software engineering for text analysis systems and design their own solutions.

**Content**

This lecture provides the basics for the automated processing of natural language texts. Language processing is becoming increasingly important.

Linguistic input plays a critical role in interactive systems, such as voice commands, assistance systems, and query interfaces. Additionally, the analysis and processing of text-based software artifacts represents an important field of research. Computational linguistics is therefore not only of great importance for software applications, but also for software engineering itself.

The aim of this lecture is to provide basic knowledge of natural language processing (NLP) and its potential applications in the development of software systems. Key topics include the automated analysis of texts, the challenges posed by the inherent ambiguity of natural language, the translation of natural language texts into software models, and the use of large language models (LLMs) in software engineering. The lecture will also explore current research developments and trends in the field.

**Workload**

3 ECTS correspond to approximately 90 hours of work, including:

approx. 30 hours of attending lectures

approx. 45 hours of preparation and follow-up work

approx. 15 hours of exam preparation

**M****5.140 Module: Network Economics [M-WIWI-101406]**

**Coordinators:** Prof. Dr. Kay Mitusch  
**Organisation:** KIT Department of Business and Economics  
**Part of:** Economics and Management (Economics)

| Credits | Grading | Recurrence | Duration | Language       | Level | Version |
|---------|---------|------------|----------|----------------|-------|---------|
| 9 CP    | graded  | Each term  | 1 term   | German/English | 4     | 3       |

| Compulsory Elective Courses (Election: 9 credits) |                                                        |        |                 |
|---------------------------------------------------|--------------------------------------------------------|--------|-----------------|
| T-WIWI-100005                                     | Competition in Networks                                | 4,5 CP | Mitusch         |
| T-WIWI-100007                                     | Transport Economics                                    | 4,5 CP | Mitusch, Szimba |
| T-WIWI-102609                                     | Advanced Topics in Economic Theory                     | 4,5 CP | Brumm, Mitusch  |
| T-WIWI-102712                                     | Regulation Theory and Practice                         | 4,5 CP | Mitusch         |
| T-WIWI-113147                                     | Telecommunications and Internet – Economics and Policy | 4,5 CP | Mitusch         |

**Assessment**

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**

None

**Competence Goal**

The students

- have acquired the basic knowledge for a future job in a network company or in a regulatory agency, ministry etc.
- recognize the specific characterizations of network sectors, know fundamental methods for an economic analysis of network sectors and recognize the interfaces for an interdisciplinary cooperation of economists, engineers and lawyers
- understand the interactions between infrastructures, control systems, and the users of networks, especially concerning their implications on investments, price setting and competitive behavior, and they can model or simulate exemplary applications
- can assess the necessity of regulation of natural monopolies and identify regulatory measures that are important for networks.

**Content**

The module is concerned with network or infrastructure industries in the economy, e.g. telecommunication, traffic and energy sectors. These sectors are characterized by close interdependencies of operators and users of infrastructure as well as on states. States intervene in various forms, by the public and regulation authorities, due to the importance of network industries and due to limited abilities of markets to work properly in these industries. The students are supposed to develop a broad knowledge of these sectors and of the political options available.

**Workload**

Total workload for 9 credit points: approx. 270 hours

The exact distribution is based on the credit points of the courses in the module.

**Recommendations**

Basics of microeconomics obtained within the undergraduate programme (B.Sc) of economics are required.



**M****5.141 Module: Network Security: Architectures and Protocols [M-INFO-107218]**

**Coordinators:** Prof. Dr. Martina Zitterbart  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
4 CP

**Grading**  
graded

**Recurrence**  
Each summer term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                               |      |            |
|---------------|-----------------------------------------------|------|------------|
| T-INFO-114238 | Network Security: Architectures and Protocols | 4 CP | Zitterbart |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students

- know basic challenges, protection goals and cryptographic building blocks that are relevant for the design of secure communication systems
- are proficient in security-relevant communication protocols (e.g. Kerberos, TLS, IPSec) and can identify and explain basic security mechanisms
- have the ability to analyze and evaluate communication protocols from a security perspective
- have the ability to assess and evaluate the quality of security mechanisms in relation to the required security objectives

In particular, students are familiar with typical attack techniques such as eavesdropping, interception or replaying and can explain these using examples. In addition, students are familiar with cryptographic primitives such as symmetric and asymmetric encryption, digital signatures, message authentication codes and can apply these in particular for the design of secure communication services.

Students are familiar with the Kerberos distributed authentication service and can explain the protocol flow in their own words and name basic concepts (e.g. tickets). In addition, students are familiar with relevant communication protocols for protecting communication on the Internet (e.g. IPsec, TLS) and can explain these and analyze and evaluate their security properties.

Students know different methods for network access protection and can explain and compare common authentication methods (e.g. CHAP, PAP, EAP). Furthermore, students are proficient in methods for protecting wireless access networks and can analyze and evaluate methods such as WEP, WPA and WPA2.

Students master different trust models and can explain and apply basic technical concepts (e.g. digital certificates, PKI) in their own words. In addition, students develop an understanding of data protection aspects in communication networks and can explain and apply technical procedures to protect privacy.

**Content**

The lecture "Network Security: Architectures and Protocols" looks at challenges and techniques in the design of secure communication protocols as well as data protection and privacy issues. Complex systems such as Kerberos are examined in detail and their design decisions with regard to security aspects are highlighted. Special focus is placed on PKI fundamentals, infrastructures and specific PKI formats. Further emphasis is placed on the common security protocols IPSec and TLS/SSL as well as protocols for infrastructure protection.

**Workload**

Lecture with 2 SWS plus follow-up/exam preparation, 4 CP.

4 CP corresponds to approx. 120 working hours, of which

approx. 30 hours lecture attendance

approx. 60 hours preparation/follow-up work

approx. 30 hours exam preparation

## M

**5.142 Module: Next Generation Internet [M-INFO-100784]**

**Coordinators:** Dr.-Ing. Roland Bless  
Prof. Dr. Martina Zitterbart

**Organisation:** KIT Department of Informatics

**Part of:** Informatics

| Credits | Grading | Recurrence       | Duration | Language | Level | Version |
|---------|---------|------------------|----------|----------|-------|---------|
| 4 CP    | graded  | Each summer term | 1 term   | English  | 4     | 1       |

| Mandatory     |                          |      |                   |
|---------------|--------------------------|------|-------------------|
| T-INFO-101321 | Next Generation Internet | 4 CP | Bless, Zitterbart |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students

- know the basic properties and architectural concepts of the Internet as well as its limitations, know newer transport protocols and current approaches to increase the flexibility of Internet-based communication and can apply this knowledge in practice, are familiar with concepts for quality of service support and group communications and can apply mechanisms for their implementation on the Internet, have the ability to analyze and evaluate peer-to-peer systems and advanced routing protocols, are familiar with concepts of satellite networking and quantum Internet. In particular,
- know important architectural concepts and design principles that are used on the Internet and can explain these using examples or apply them themselves when designing systems. In addition, students know the concept of quality of service and important quality of service parameters, are familiar with basic mechanisms for supporting quality of service (e.g. classifiers, traffic shapers, queuing and scheduling strategies, resource reservation), can analyze and evaluate them and can apply them to the design of communication systems.
- Moreover, students know the requirements and challenges for today's transport protocols and newer congestion control algorithms and can analyze and assess trade-offs of the presented approaches.
- know the characteristics of peer-to-peer systems, can explain them and can compare different forms of organization. Furthermore, students master routing procedures in such decentrally organized peer-to-peer systems and can explain how they work in detail in their own words.
- Similarly, students know inherent trade-offs for routing in the Internet and can explain newer approaches in their own words.
- In addition, students develop an understanding of the functioning of newer approaches to increase the flexibility of communication networks (e.g. network virtualization, software-defined networking, service function chaining) and can analyze, explain, and apply technical procedures for their implementation.
- Moreover, students know properties of satellite and quantum networks and their corresponding challenges.

**Content**

The lecture focuses on current developments in Internet-based network technologies. First, architectural principles of today's Internet are presented and discussed, subsequently nowadays and future challenges are motivated. The lecture also discusses approaches and paradigms beyond the current Internet architecture, methods for quality-of-service support, newer transport protocols and congestion control approaches as well as group communication support. Deployments of the presented technologies in IP-based networks are discussed. The lecture presents advanced approaches such as programmable networks, network virtualization as well as newer approaches and protocols for routing, satellite networking, and peer-to-peer networks. A brief introduction to the technology of a future quantum Internet is provided as well.

**Workload**

Lecture with 2 SWS plus follow-up/exam preparation, 4 CP.

4 CP corresponds to approx. 120 working hours, of which

approx. 30 hours lecture attendance

approx. 60 hours preparation/follow-up work

approx. 30 hours exam preparation

**Literature**

J.F. Kurose, K.W. Ross; Computer Networking: A Top-Down Approach. Pearson, 2022, 8th Edition, ISBN 978-1292405469

## M

**5.143 Module: Operations Research in Supply Chain Management [M-WIWI-102832]****Coordinators:** Prof. Dr. Stefan Nickel**Organisation:** KIT Department of Business and Economics**Part of:** [Economics and Management \(Operations Research\)](#)**Credits**  
9 CP**Grading**  
graded**Recurrence**  
Each term**Duration**  
2 terms**Language**  
German/English**Level**  
4**Version**  
10**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) |                                                                                                                          |        |              |
|---------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|--------|--------------|
| T-WIWI-102723                                                 | <a href="#">Graph Theory and Advanced Location Models</a>                                                                | 4,5 CP | Nickel       |
| T-WIWI-106200                                                 | <a href="#">Modeling and OR-Software: Advanced Topics</a>                                                                | 4,5 CP | Nickel       |
| T-WIWI-102715                                                 | <a href="#">Operations Research in Supply Chain Management</a>                                                           | 4,5 CP | Nickel       |
| Supplementary Courses (Election: at most 1 item)              |                                                                                                                          |        |              |
| T-MACH-112213                                                 | <a href="#">Applied material flow simulation</a>                                                                         | 4,5 CP | Baumann      |
| T-WIWI-106546                                                 | <a href="#">Introduction to Stochastic Optimization</a>                                                                  | 4,5 CP | Rebennack    |
| T-WIWI-102718                                                 | <a href="#">Discrete-Event Simulation in Production and Logistics</a>                                                    | 4,5 CP | Spieckermann |
| T-WIWI-102719                                                 | <a href="#">Mixed Integer Programming I</a>                                                                              | 4,5 CP | Stein        |
| T-WIWI-102720                                                 | <a href="#">Mixed Integer Programming II</a>                                                                             | 4,5 CP | Stein        |
| T-WIWI-106549                                                 | <a href="#">Large-scale Optimization</a>                                                                                 | 4,5 CP | Rebennack    |
| T-WIWI-111587                                                 | <a href="#">Multicriteria Optimization</a>                                                                               | 4,5 CP | Stein        |
| T-WIWI-114747                                                 | <a href="#">"Practical Seminar in Discrete Optimization: Implementing and Evaluating Solution Methods (with Python)"</a> | 4,5 CP | Bakker       |
| T-WIWI-112109                                                 | <a href="#">Topics in Stochastic Optimization</a>                                                                        | 4,5 CP | Rebennack    |

**Assessment**

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.

**Additional Information**

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

**Recommendations**

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

## M

**5.144 Module: Optimization and Synthesis of Embedded Systems (ESI) [M-INFO-107229]**

**Coordinators:** Prof. Dr.-Ing. Jörg Henkel  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                      |      |        |
|---------------|------------------------------------------------------|------|--------|
| T-INFO-114253 | Optimization and Synthesis of Embedded Systems (ESI) | 3 CP | Henkel |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

The student can develop embedded systems. They can specify, synthesize and optimize their own hardware. They learn the hardware description language and are familiar with the special boundary conditions of the design of embedded systems.

**Content**

The cost-effective and error-free development of embedded systems represents a challenge that should not be underestimated and which is having an ever greater influence on the added value of the overall system. In Europe in particular, the design of embedded systems is playing an increasingly important economic role in many sectors of the economy, such as the automotive industry, so that a number of well-known companies are already involved in the development of embedded systems.

The lecture deals comprehensively with all aspects of the development of embedded systems at hardware, software and system level. This includes diverse areas such as modelling, optimization and synthesis of systems.

**Workload**

90 hours:

30 hours of lectures (15 weeks\*2 hours)

30 hours of self study (15 weeks\*2 hours)

15 hours of deepening (coding RTL) to grasp the theory with practical

15 hours exam preparation

## M

**5.145 Module: Optimization Methods for Machine Learning and Engineering [M-INFO-105329]**

**Coordinators:** Prof. Dr.-Ing. Jürgen Beyerer  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

| Credits | Grading | Recurrence       | Duration | Language | Level | Version |
|---------|---------|------------------|----------|----------|-------|---------|
| 5 CP    | graded  | Each winter term | 1 term   | English  | 4     | 1       |

| Mandatory     |                                                                           |      |                   |
|---------------|---------------------------------------------------------------------------|------|-------------------|
| T-INFO-110809 | <a href="#">Optimization Methods for Machine Learning and Engineering</a> | 5 CP | Beyerer, Pfrommer |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students are able to formulate practical tasks as optimisation problems and solve them using suitable algorithmic methods.

**Learning objectives:** The students know

- The most important categories of (convex) optimisation problems and their mathematical foundations
- The associated algorithmic solution methods and their runtime complexity
- Techniques for modelling practical tasks as optimisation problems (machine learning, engineering, finance)
- Methods for transforming and approximating optimisation problems for the use of resource-efficient methods

**Content**

The term optimization refers to techniques for the identification of the best solution in a complex problem setting. Many applications from machine learning and engineering are based on solving an optimization problem. This lecture introduces the major theoretical and algorithmic tools for solving of convex optimization problems. Practical problems for machine learning, engineering and further application domains are used as illustration. The students apply their knowledge to practical optimization problems in tutorial exercises.

**Workload**

Lecture with 2 SWS + 1 SWS exercise  
 5 ECTS corresponds to approx. 150 hours  
 approx. 30 hours lecture attendance,  
 approx. 15 hours attending exercises,  
 approx. 90 hours of post-processing and working on the exercise sheets  
 approx. 30 hours exam preparation

**Literature**

- Boyd, Stephen, and Lieven Vandenberghe. Convex optimization. Cambridge university press, 2004.
- Luenberger, David G. Optimization by vector space methods. John Wiley & Sons, 1969.
- Sra, Suvrit, Sebastian Nowozin, and Stephen J. Wright, eds. Optimization for machine learning. MIT Press, 2012.

## M

**5.146 Module: Parallel Algorithms [M-INFO-107199]**

**Coordinators:** Prof. Dr. Peter Sanders  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
5 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                          |      |         |
|---------------|--------------------------|------|---------|
| T-INFO-114221 | Parallel Algorithms      | 4 CP | Sanders |
| T-INFO-114222 | Parallel Algorithms Pass | 1 CP | Sanders |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

The students acquire a systematic understanding for algorithmic problems and their solutions in the field of parallel algorithms, building on existing knowledge in algorithmics. Additionally, they are able to apply learned techniques to related problems and to interpret and comprehend current research topics.

After successful attendance of the course, the students are able to

- explain terms, structures, basic problem definitions and algorithms from the lecture;
- decide which algorithms and data structures are suitable for solving a given problem and, if necessary, adapt them to the requirements of a specific problem;
- execute algorithms and data structures, conduct a mathematically precise analysis, and prove their algorithmic properties;
- explain machine models from the lecture and analyze algorithms and data structures in them;
- analyze new problems from application contexts, reduce them to their algorithmic core and design an abstract model; design own solutions in this model using concepts and techniques from the lecture, analyze them and prove the algorithmic properties.

**Content**

Models and their relation to real machines:

- shared memory - PRAM
- message passing - BSP
- circuits

Analysis: speedup, efficiency, scalability

Basic techniques:

- SPMD
- parallel divide-and-conquer
- collective communication
- load balancing

Concrete algorithms (examples):

- collective communication (including large data volumes): broadcast,
- reduce, prefix sums, all-to-all exchange
- matrix computations
- sorting
- list ranking
- minimum spanning trees
- load balancing: master worker with adaptive problem size, random
- polling, random distribution

**Workload**

Lecture and exercise with 3 semester hours per week, 5 ECTS correspond to approx. 150 working hours, consisting of

- approx. 30 h attendance of the lecture and exercise session / block seminar
- approx. 60 h preparation and follow-up work
- approx. 30 h working on exercise sheets / preparation of seminar presentation
- approx. 30 h exam preparation

**Recommendations**

See partial achievements (Teilleistung)



**M****5.147 Module: Parallel Computer Systems and Parallel Programming [M-INFO-100808]****Coordinators:** Prof. Dr. Achim Streit**Organisation:** KIT Department of Informatics**Part of:** [Informatics](#)**Credits**  
4 CP**Grading**  
graded**Recurrence**  
Each summer term**Duration**  
1 term**Language**  
German**Level**  
4**Version**  
1

| Mandatory     |                                                                    |      |        |
|---------------|--------------------------------------------------------------------|------|--------|
| T-INFO-101345 | <a href="#">Parallel Computer Systems and Parallel Programming</a> | 4 CP | Streit |

## M

**5.148 Module: Parameterized Algorithms [M-INFO-107167]**

**Coordinators:** TT-Prof. Dr. Thomas Bläsius  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Irregular

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                 |      |         |
|---------------|---------------------------------|------|---------|
| T-INFO-114194 | Parameterized Algorithms        | 6 CP | Bläsius |
| T-INFO-114195 | Parameterized Algorithms - Pass | 0 CP | Bläsius |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students acquire a systematic understanding of the parameterised approach in the runtime analysis of algorithms, as well as the associated techniques for algorithm design, which build on existing knowledge in theoretical computer science and algorithmics. After successfully completing the course, students will be able to

- reproduce and explain basic algorithmic techniques and analysis techniques in the field of parameterised algorithms,
- execute parameterised algorithms by way of example, analyse them with mathematical precision and prove their properties,
- select which algorithms or algorithmic techniques are suitable for a given parameterised problem,
- analyse unknown problems with regard to their parameterised complexity.

**Content**

Many problems that arise in practice are NP-hard and therefore generally (presumably) cannot be solved in polynomial time. Nevertheless, these problems can often be solved efficiently because the inputs are "benign". One way to formally capture this benignity of the instances is to consider the parameterised complexity. This involves associating a parameter  $k$  with each instance, which represents a measure of the complexity of the input. The aim is then to find an algorithm whose runtime depends only polynomially on the input size  $n$  but possibly exponentially on the parameter  $k$ . Compared to the rough classification of a problem as polynomially solvable or NP-hard, the parameterised approach offers a much more differentiated view of hard problems.

**Workload**

Lecture with tutorial with 4 SWS, 6 CP  
 6 CP corresponds to approx. 180 working hours, of which  
 approx. 60 hours attending the lecture and tutorial  
 approx. 30 hours of preparation and follow-up work  
 approx. 60 hours working on the exercise sheets  
 approx. 30 hours exam preparation

**Recommendations**

Basic knowledge of algorithms and data structures (e.g. from the lectures Algorithms 1 + 2) is helpful.



## 5.149 Module: Participatory Technology Design [M-INFO-107170]

**Coordinators:** Prof. Dr. Kathrin Gerling  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                        |      |         |
|---------------|--------------------------------------------------------|------|---------|
| T-INFO-114199 | <a href="#">Participatory Technology Design</a>        | 6 CP | Gerling |
| T-INFO-114200 | <a href="#">Participatory Technology Design - Pass</a> | 0 CP | Gerling |

### Assessment

See partial achievements (Teilleistung)

### Prerequisites

See partial achievements (Teilleistung)

### Competence Goal

After completing the course, students will be able to reproduce basic and advanced theoretical concepts from human-machine interaction and participatory technology design. Furthermore, they will be able to apply relevant methods for participatory design and evaluation to given problems, taking into account the needs of users and ethical aspects, and derive concrete design recommendations from the results. Finally, students are able to recognise and critically reflect on the connections between participation, design, implementation and evaluation of technologies.

### Content

In human-machine interaction, the participatory development of new technologies - i.e. the direct and equal involvement of users in the development process - is becoming increasingly important. It is used, for example, in the development of body-centred and wearable systems, or contributes to the design of solutions in the field of smart and assisted living and personal robotics. Participation is often realised through interviews, focus groups and design workshops; new technologies are also regularly evaluated as part of user studies. The direct involvement of users is intended to ensure that the resulting technologies are better adapted to people's needs and that their benefits and relevance for individuals and society can be increased as a result.

The lecture deals with current research approaches to the participatory design of new technologies and covers the following topics in particular, while continuously taking ethical aspects into account:

- Design approaches, in particular theory-driven design, ethical approaches such as value-sensitive design, and future-oriented approaches such as speculative design and design fiction
- Typical methods of participation in the design and development of technologies, and reflection on the associated challenges and opportunities
- Participatory and user-centred evaluation of technologies and implications for society, research and development

In the associated exercise, students actively develop relevant concepts and reflect on theoretical aspects in their application in the context of practical examples. In addition, current research publications are analysed as part of the exercise.

### Workload

The total workload for this course is approx. 180 hours (6 credits).

Approximately...

28h for attending the lecture,

24 hours for attending the exercises,

40h for preparation and follow-up of the lecture,

40h for preparation and follow-up of the exercise,

48h for exam preparation.

### Recommendations

Knowledge of the basics of human-machine interaction is helpful.

**M****5.150 Module: Pattern Recognition [M-INFO-100825]**

**Coordinators:** Prof. Dr.-Ing. Jürgen Beyerer  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

| Credits | Grading | Recurrence       | Duration | Language | Level | Version |
|---------|---------|------------------|----------|----------|-------|---------|
| 6 CP    | graded  | Each summer term | 1 term   | German   | 4     | 3       |

| Mandatory     |                     |      |                 |
|---------------|---------------------|------|-----------------|
| T-INFO-101362 | Pattern Recognition | 6 CP | Beyerer, Zander |

**Assessment**

See Partial Achievements (Teilleistung)

**Prerequisites**

See Partial Achievements (Teilleistung)

**Competence Goal**

- Students have a sound knowledge of the selection, extraction and properties of features used to characterize objects to be classified. Students know how the feature space can be examined, how features can be transformed and how distances in the feature space can be determined. Furthermore, they can normalize features and construct features. In addition, students know how to reduce the dimension of the feature space.
- Students have a sound knowledge of how to select and adapt suitable classifiers for different tasks. They are familiar with Bayesian decision theory, parameter estimation and parameter-free methods, linear discriminant functions, support vector machines and matched filters. Students are also proficient in classification with nominal features.
- Students are able to solve pattern recognition problems, taking into account the efficiency of classifiers and the relationships in the processing chain object - pattern - feature - classifier on a task-specific basis. To this end, students are familiar with the principle for determining the performance of classifiers and the principle of boosting.

**Content**

Features:

- Feature types
- Examination of the feature space
- Transformation of the features
- Distance measurement in the feature space
- Normalization of features
- Selection and construction of features
- Reduction of the dimension of the feature space

Classifiers:

- Bayesian decision theory
- Parameter estimation
- Parameter-free methods
- Linear discriminant functions
- Support Vector Machine
- Matched Filter, Template Matching
- Classification with nominal features

General principles:

- Vapnik-Chervonenki's theory
- Performance determination of classifiers
- Boosting

**Workload**

Total: approx. 180h, of which

Lecture attendance time 31h

Preparation and follow-up 40h

Exercise attendance time 10h

Preparation, solving exercises, follow-up 40h

Exam preparation and attendance 59h

**Recommendations**

See Partial Achievements (Teilleistung)

M

5.151 Module: Penetration Testing Lab [M-INFO-104895]

Coordinators:

Dr.-Ing. Ingmar Baumgart  
Prof. Dr. Jörn Müller-Quade

Organisation:

KIT Department of Informatics

Part of:

Informatics

| Credits | Grading | Recurrence       | Duration | Language | Level | Version |
|---------|---------|------------------|----------|----------|-------|---------|
| 4 CP    | graded  | Each summer term | 1 term   | German   | 4     | 1       |

| Mandatory     |                         |      |                        |
|---------------|-------------------------|------|------------------------|
| T-INFO-109929 | Penetration Testing Lab | 4 CP | Baumgart, Müller-Quade |

**M****5.152 Module: Photorealistic Rendering [M-INFO-100731]****Coordinators:** Prof. Dr.-Ing. Carsten Dachsbacher**Organisation:** KIT Department of Informatics**Part of:** [Informatics](#)**Credits**  
5 CP**Grading**  
graded**Recurrence**  
Each winter term**Duration**  
1 term**Language**  
German/English**Level**  
4**Version**  
2

| Mandatory     |                                          |      |             |
|---------------|------------------------------------------|------|-------------|
| T-INFO-101268 | <a href="#">Photorealistic Rendering</a> | 5 CP | Dachsbacher |

## M

**5.153 Module: Post-quantum Cryptography from Lattices [M-INFO-107642]**

**Coordinators:** Prof. Dr. Jörn Müller-Quade  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Irregular

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                         |      |              |
|---------------|---------------------------------------------------------|------|--------------|
| T-INFO-114987 | <a href="#">Post-quantum Cryptography from Lattices</a> | 3 CP | Müller-Quade |

**Assessment**

See Partial Achievements (Teilleistung).

**Prerequisites**

See Partial Achievements (Teilleistung).

**Competence Goal**

The student

- knows the assumptions and framework underlying lattice-based cryptography.
- understands and is able to explain the common tools of the area.
- knows and understands the protocols and proofs presented in the lecture and can reproduce them.
- can apply the contents of the lecture to construct new (simple) schemes or analyze the security of given (simple) schemes.

**Content**

The lecture “Post-Quantum (Lattice-based) Cryptography” introduces the framework of lattice-based cryptography, its common tools and concepts, and important constructions of advanced cryptographic primitives. The central hardness assumptions underlying lattice-based cryptography are believed to be intractable even for quantum algorithms, and as such provide a foundation for post-quantum security. Beyond that, lattice-based cryptography enables a wealth of constructions of theoretical and practical interest.

**Workload**

90 h

Lectures: 24 h

Self-study during semester: 31 h

Preparation for the exam: 35 h

**Recommendations**

See Partial Achievements (Teilleistung).



**M****5.154 Module: Power Management [M-INFO-100804]**

**Coordinators:** Prof. Dr.-Ing. Frank Bellosa  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
German

**Level**  
4

**Version**  
1

| Mandatory     |                                  |      |         |
|---------------|----------------------------------|------|---------|
| T-INFO-101341 | <a href="#">Power Management</a> | 3 CP | Bellosa |

**Competence Goal**

The students describe the basic mechanisms and policies to manage the use of energy in computer systems. The student can assess the mechanisms offered by the hardware to control the energy consumption concerning their usability in operating systems. The student can extract power states and energy characteristics and assign this information to processes and services.

**Content**

Students assess the effects of throttling mechanisms of the CPU concerning efficiency, effectiveness and integration in operating system structures. The model the energy consumption of computers and predict the heat production.

Students can describe the energy savings mechanism of memory and assess the impact of various memory allocation policies on the energy consumption.

Students can describe the properties of batteries and assess the impact of scheduling strategies on the effective capacity of batteries.

The students structure an instruction set agnostic interfaces to power management mechanisms (ACPI) and assess their impact on scalable system architectures.

**M****5.155 Module: Practical Course Computer Vision for Human-Computer Interaction [M-INFO-102966]****Coordinators:** Prof. Dr.-Ing. Rainer Stiefelhagen**Organisation:** KIT Department of Informatics**Part of:** [Informatics](#)**Credits**  
6 CP**Grading**  
graded**Recurrence**  
Each summer term**Duration**  
1 term**Language**  
German**Level**  
4**Version**  
3

| Mandatory     |                                                                                 |      |              |
|---------------|---------------------------------------------------------------------------------|------|--------------|
| T-INFO-105943 | <a href="#">Practical Course Computer Vision for Human-Computer Interaction</a> | 6 CP | Stiefelhagen |

**M****5.156 Module: Practical Course Decentralized Systems and Network Services [M-INFO-103047]****Coordinators:** Prof. Dr. Hannes Hartenstein**Organisation:** KIT Department of Informatics**Part of:** [Informatics](#)**Credits**  
4 CP**Grading**  
graded**Recurrence**  
Irregular**Duration**  
1 term**Language**  
German**Level**  
4**Version**  
1

| Mandatory     |                                                                             |      |             |
|---------------|-----------------------------------------------------------------------------|------|-------------|
| T-INFO-106063 | <a href="#">Practical Course Decentralized Systems and Network Services</a> | 4 CP | Hartenstein |

## M

**5.157 Module: Practical Course on Network Security Research [M-INFO-107244]**

**Coordinators:** Prof. Dr. Martina Zitterbart  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Irregular

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

**Mandatory**

|               |                                                               |      |                  |
|---------------|---------------------------------------------------------------|------|------------------|
| T-INFO-114270 | <a href="#">Practical Course on Network Security Research</a> | 3 CP | Hock, Zitterbart |
|---------------|---------------------------------------------------------------|------|------------------|

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students are able to understand, justify, evaluate and classify the selected topic or the selected focus from the field of network security.

They know the basic principles relevant to the selected topic and can apply these in practice. Students are also able to derive concrete work steps from a task description and to document, summarize and present the results obtained.

**Content**

The research practical course on network security is offered alongside the module Network Security: Architectures and Protocols [M-INFO-100782]. The practical course gives students the opportunity to selectively deepen a specific topic from the above-mentioned lecture with current research relevance. The topic may vary and will be announced when registering for the practical course (example: "Attacks and Anomalies in the context of the Border Gateway Protocol").

The practical course consists of five sections:

- Familiarization with the topic
- Selection of a suitable practical focus in coordination
- with the supervising chair
- Practical implementation of the focus
- Presentation of the results in a colloquium (lecture)
- Preparation of a research report (3-5 pages)

**Workload**

3 ETCS:

Attendance time / meetings in large and small groups: 15h

Selection of the focus: 10h

Conception + specification of the focus: 10h

Implementation of the focus: 20h

Research report and colloquium: 20h

**Recommendations**

The module Network Security: Architectures and Protocols [M-INFO-100782] should have been started or completed.



## 5.158 Module: Practical Course on Telematics [M-INFO-107597]

**Coordinators:** Prof. Dr. Martina Zitterbart  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                |      |            |
|---------------|------------------------------------------------|------|------------|
| T-INFO-114894 | <a href="#">Practical Course on Telematics</a> | 3 CP | Zitterbart |

### Assessment

See partial achievements (Teilleistung)

### Prerequisites

See partial achievements (Teilleistung)

### Competence Goal

The student can use the tools learned to identify and evaluate the behavior of selected protocols, architectures, procedures and algorithms in practice. In doing so, the student applies the basic theoretical knowledge from the course Telematics [24128] in practice and thus deepens the concepts learned.

In addition, the student is able to examine, design and configure networks using the knowledge acquired and tools learned.

The student can independently transfer the skills acquired and tools learned to a self-conceived, experimental setup.

### Content

In a series of laboratory experiments, participants learn to apply their theoretical knowledge from the core module "Telematics" in practical experiments. The practical course is therefore an excellent complement to the core module. The lab experiments provide hands-on experience in a variety of topics, including protocols and algorithms for Internet routing, congestion control methods, access networks and traffic engineering.

Participants also configure their own networks and are introduced to the concept of software-defined networks, a novel approach to network design. At the same time, participants learn the various tools for measuring and analyzing the behavior of the protocols and algorithms presented in practical use.

The observations and results are discussed in small groups. At the end of the semester, participants deepen their knowledge in a small project.

### Workload

3 ECTS:

- Biweekly laboratory experiments + exercise sheets: 50h

- Final project + final report: 30h

### Recommendations

Previous or parallel attendance of the lecture "Telematics"

**M****5.159 Module: Practical Course on Telematics Research [M-INFO-107220]**

**Coordinators:** Prof. Dr. Martina Zitterbart  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Irregular

**Duration**  
1 term

**Language**  
English

**Level**  
3

**Version**  
1

| Mandatory     |                                         |      |            |
|---------------|-----------------------------------------|------|------------|
| T-INFO-114239 | Practical Course on Telematics Research | 3 CP | Zitterbart |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students are able to understand, justify, evaluate and classify the selected topic or focus from the field of telematics.

They know the basic principles relevant to the selected topic and can apply these in practice. Students are also able to derive concrete work steps from a task description and to document, summarize and present the results obtained.

**Content**

The telematics research internship is offered alongside the telematics module [M-INFO-100801]. The internship gives students the opportunity to selectively deepen a specific topic from the above-mentioned lecture with current research relevance. The topic may vary and will be announced when registering for the practical course (example: "Visualization and anomaly detection in the context of the Border Gateway Protocol").

The practical course consists of the following sections:

- Familiarization with the topic
- Selection of a suitable practical focus in coordination with the supervising chair
- Practical implementation of the focus
- Presentation of the results (colloquium, research report)

**Workload**

Attendance time / meetings in large and small groups: 15h

Selection of the focus: 10h

Conception + specification of the focus: 10h

Implementation of the focus: 20h

Research report / colloquium: 20h

**Recommendations**

A pronounced scientific interest in the topics of network security is a prerequisite: no prefabricated exercises are worked on, instead the internship requires a high degree of personal initiative.

**M****5.160 Module: Practical Course Protocol Engineering [M-INFO-102092]**

**Coordinators:** Prof. Dr. Martina Zitterbart  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
4 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
German

**Level**  
4

**Version**  
1

| Mandatory     |                                                       |      |            |
|---------------|-------------------------------------------------------|------|------------|
| T-INFO-104386 | <a href="#">Practical Course Protocol Engineering</a> | 4 CP | Zitterbart |

**M****5.161 Module: Practical Course: Advanced Software Development Tools [M-INFO-106023]****Coordinators:** Prof. Dr.-Ing. Ina Schaefer**Organisation:** KIT Department of Informatics**Part of:** [Informatics](#)**Credits**  
6 CP**Grading**  
graded**Recurrence**  
Each winter term**Duration**  
1 term**Language**  
German**Level**  
4**Version**  
1

| Mandatory     |                                                                       |      |          |
|---------------|-----------------------------------------------------------------------|------|----------|
| T-INFO-112209 | <a href="#">Practical Course: Advanced Software Development Tools</a> | 6 CP | Schaefer |



**M****5.162 Module: Practical Course: Advanced Topics in High Performance Computing, Data Management and Analytics [M-INFO-105870]**

**Coordinators:** Prof. Dr. Achim Streit  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

| Credits | Grading | Recurrence | Duration | Language | Level | Version |
|---------|---------|------------|----------|----------|-------|---------|
| 6 CP    | graded  | Each term  | 1 term   | English  | 4     | 1       |

| Mandatory     |                                                                                                |      |        |
|---------------|------------------------------------------------------------------------------------------------|------|--------|
| T-INFO-111803 | Practical Course: Advanced Topics in High Performance Computing, Data Management and Analytics | 6 CP | Streit |

**Assessment**

See partial achievements (Teilleitung)

**Prerequisites**

See partial achievements (Teilleitung)

**Competence Goal**

Students know and can apply tools and techniques in the fields of high-performance computing, data management and data analysis. They acquire the possibility to analyze complex scenarios and develop solutions for this. Besides working on the content, students improve their competences in communication and presentation.

**Content**

Participants will have the chance to deepen their knowledge of high-performance computing, data management and data analysis and to apply it in a practical way. The tasks to be worked on come from the subfields:

- HPC simulations (e.g., parallelization, MPI, performance engineering)
- HPC systems and operating environment (e.g., On Demand File Systems, Infiniband Networks, Job Scheduling)
- Machine Learning and Data Mining (e.g., RapidMiner, scikit)
- Data-Intensive Computing (e.g., Hadoop, Spark).
- HPC and data analysis with Python (e.g., Numpy, Scipy, Pandas, Dask, Parsl)
- Distributed & Parallel File Systems (e.g., glusterFS, BeeGFS)
- Object Storage (e.g., S3, CEPH)
- Data Management System (e.g., dCache, iRods)
- Databases (e.g., SQL, NoSQL)
- Workflow management systems for HPC and data analysis (e.g., FireWorks, AiiDA, SimStack)
- Opportunistic resource integration and utilization (e.g., using COBalD/TARDIS)
- Authentication and authorization infrastructure (e.g., OpenID, SAML)

Students are individually supervised by scientific staff of the Scientific Centre for Computing and can apply their skills in a practical and research-oriented way by being involved in current research tasks (e.g., Helmholtz program, BMBF and EU projects).

**Workload**

3 SWS = 150 h per semester

- 12 h in meetings during the semester (kick-off, regular meetings with the supervisor, final meeting including presentation)
- 18 h preparation of meetings
- 120 h working on the topic and preparation of the exam

**Recommendations**

Knowledge in the area of databases, data management, data analytics, parallel computing is helpful.

**M****5.163 Module: Practical Course: AI for Climate and Weather Predictions [M-INFO-106800]**

**Coordinators:** TT-Prof. Dr. Peer Nowack  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

| Credits | Grading | Recurrence | Duration | Language | Level | Version |
|---------|---------|------------|----------|----------|-------|---------|
| 6 CP    | graded  | Irregular  | 1 term   | English  | 4     | 1       |

| Mandatory     |                                                                          |      |        |
|---------------|--------------------------------------------------------------------------|------|--------|
| T-INFO-113659 | <a href="#">Practical Course: AI for Climate and Weather Predictions</a> | 6 CP | Nowack |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students will be able to

- define current opportunities and challenges in building advanced AI models for climate and weather predictions.
- explain advanced AI model architectures.
- generate and critically assess output of state-of-the-art AI models.
- professionally present their results both orally and in a concise scientific paper.

**Content**

Students will learn how to work with state-of-the-art AI models for climate science and weather forecasting.

For example, typical AI models will include recent releases of

- Foundation models for climate science and weather forecasting.
- Generative AI models for tasks such as ensemble generation of weather forecasts and of climate change simulations for uncertainty quantification.
- Transformer and graph neural network models for weather forecasting.
- Climate model emulators.

Each student will be able to select from a variety of topics to explore in their practical experiments. These could include, but are not limited to:

- The representation of physical concepts in data-driven AI models (e.g., does the model indirectly learn to “understand physics”?).
- Detecting and understanding failure modes of AI models.
- Forecast accuracy and uncertainty quantification for AI-generated ensembles of simulations.
- Effective solutions to post-processing AI results and/or to modifying AI model architectures.
- Assessing if certain AI architectures perform significantly better for specific tasks.

**Workload**

In-person introductory session, individual and group meetings, final presentation sessions: 30h

Practical tasks – getting started, implementation, experiments, analysis: 100h

Write up results in the style of a scientific paper and preparation of final presentation: 50h

**Recommendations**

- Knowledge of the Python programming language.
- Good knowledge of mathematical concepts such as linear algebra is an advantage.
- An interest in scientific questions around climate science and weather forecasting.



## 5.164 Module: Practical Course: Application Security [M-INFO-106996]

**Coordinators:** Prof. Dr. Jörn Müller-Quade  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
4 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                        |      |              |
|---------------|----------------------------------------|------|--------------|
| T-INFO-113958 | Practical Course: Application Security | 4 CP | Müller-Quade |

### Assessment

See partial achievements (Teilleistung)

### Prerequisites

See partial achievements (Teilleistung)

### Competence Goal

#### Qualification objective:

Students are able to identify security-relevant weaknesses and errors in a program analysis and suggest corrections.

#### Learning objectives:

- Students know and understand the programming model of x86 processors and their assembly language and can apply it.
- Students know and understand common error types, attack techniques and countermeasures and can reproduce these independently.
- Students are able to read and analyze a compiled program and examine it for vulnerabilities.
- Students are able to independently carry out attacks in simple scenarios to prove the relevance of the programming error.

### Content

This module is dedicated to techniques for exploiting programming errors and common countermeasures, such as:

- Buffer overflows
- Shellcode Injection
- Return Oriented Programming
- Address Space Layout Randomization
- Stack Canaries

### Workload

Attendance time: 15 h

Solving the tasks: 75

Preparation for exam: 30

(1 SWS + 5 SWS) x 15 + 30 h exam preparation = 120 h

### Recommendations

- The basics of IT security are assumed.
- The content of the lectures "Computer Organization" and "Operating Systems" should be known.

**M****5.165 Module: Practical Course: Artificial Intelligence & Security Lab (AISEC-Lab) [M-INFO-106867]****Coordinators:** Prof. Dr. Christian Wressnegger**Organisation:** KIT Department of Informatics**Part of:** [Informatics](#)**Credits**  
4 CP**Grading**  
graded**Recurrence**  
Each summer term**Duration**  
1 term**Language**  
English**Level**  
3**Version**  
1

| Mandatory     |                                                                                          |      |             |
|---------------|------------------------------------------------------------------------------------------|------|-------------|
| T-INFO-113760 | <a href="#">Practical Course: Artificial Intelligence &amp; Security Lab (AISEC-Lab)</a> | 4 CP | Wressnegger |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students know how to apply basic concepts of artificial intelligence and machine learning, and are able to evaluate the performance of such systems on real-world data from computer security research.

- Students know and understand concepts of machine learning for computer security.
- Students are able independently design, implement, and evaluate learning-based systems.
- Students understand limits of learning-based approaches.

**Content**

In this practical course, the students develop learning-based systems for different computer security tasks, thereby intensifying their knowledge gained in the corresponding lectures. The students have the unique opportunity to design, implement, and evaluate systems based on real-world data used in computer security research.

The module is composed of multiple units with several individual tasks/challenges covering different topics from classical computer security research to security of artificial intelligence. In each unit, the students develop an approach, train and validate it on known data, and submit their solution to the course platform, where the approach is tested against unknown data.

**Workload**

- 30h attendance time
- 70h Time to complete the exercises
- 15h Preparation of final presentation
- 5h attendance time (final event)

**Recommendations**

The basics of IT security and artificial intelligence are a prerequisite.



## 5.166 Module: Practical Course: Chip Design I [M-INFO-107265]

**Coordinators:** Prof. Dr. Mehdi Baradaran Tahoori

**Organisation:** KIT Department of Informatics

**Part of:** [Informatics](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                 |      |         |
|---------------|-------------------------------------------------|------|---------|
| T-INFO-114298 | <a href="#">Practical Course: Chip Design I</a> | 3 CP | Tahoori |

### Assessment

See partial achievements (Teilleistung)

### Prerequisites

See partial achievements (Teilleistung)

### Competence Goal

Hands-on, practical learning by working on hardware-related projects

### Content

The Project Lab is a unique opportunity for students to engage in hands-on, practical learning by working on hardware-related projects from various fields, including

- Hardware-based Neural-Networks implementation
- Neuromorphic computing
- Printed Electronics
- Computation in Memory
- Open-source electronic design automation (EDA) tools extension
- Field Programmable Gate Arrays (FPGA)
- Risc-V architecture
- Hardware Security
- Reliability and Test
- other Emerging Technologies

Students can work individually or in groups of 2-4, collaborating to tackle challenges based on a selected topic. The lab accepts a limited number of participants each term based on the number of offered projects, ensuring a focused and immersive experience for everyone involved.

Project topics are carefully defined and curated each term to align with active research initiatives within the Chair of Dependable Nano Computing (CDNC). Participants not only contribute to these projects but also have the potential to co-author research papers and make tangible contributions to the academic community.

The lab emphasizes practical skills, especially in hardware-related fields, offering students access to state-of-the-art tools and technologies. It provides an invaluable opportunity to bridge the gap between theory and practice while preparing for a future in research, development, or industry.

### Workload

4 SWS of practical workload including meetings with the supervisor. 90h



## 5.167 Module: Practical Course: Chip Design II [M-INFO-107266]

**Coordinators:** Prof. Dr. Mehdi Baradaran Tahoori

**Organisation:** KIT Department of Informatics

**Part of:** [Informatics](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                  |      |         |
|---------------|--------------------------------------------------|------|---------|
| T-INFO-114299 | <a href="#">Practical Course: Chip Design II</a> | 3 CP | Tahoori |

### Assessment

See partial achievements (Teilleistung)

### Prerequisites

See partial achievements (Teilleistung)

### Competence Goal

Hands-on, practical learning by working on hardware-related projects

### Content

The Project Lab is a unique opportunity for students to engage in hands-on, practical learning by working on hardware-related projects from various fields, including

- Hardware-based Neural-Networks implementation
- Neuromorphic computing
- Printed Electronics
- Computation in Memory
- Open-source electronic design automation (EDA) tools extension
- Field Programmable Gate Arrays (FPGA)
- Risc-V architecture
- Hardware Security
- Reliability and Test
- other Emerging Technologies

Students can work individually or in groups of 2-4, collaborating to tackle challenges based on a selected topic. The lab accepts a limited number of participants each term based on the number of offered projects, ensuring a focused and immersive experience for everyone involved.

Project topics are carefully defined and curated each term to align with active research initiatives within the Chair of Dependable Nano Computing (CDNC). Participants not only contribute to these projects but also have the potential to co-author research papers and make tangible contributions to the academic community.

The lab emphasizes practical skills, especially in hardware-related fields, offering students access to state-of-the-art tools and technologies. It provides an invaluable opportunity to bridge the gap between theory and practice while preparing for a future in research, development, or industry.

### Workload

4 SWS of practical workload including meetings with the supervisor. 90h

**M****5.168 Module: Practical Course: Continuous Software Engineering [M-INFO-107677]**

**Coordinators:** Prof. Dr.-Ing. Anne Koziolk  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

**Mandatory**

|               |                                                   |      |         |
|---------------|---------------------------------------------------|------|---------|
| T-INFO-115043 | Practical Course: Continuous Software Engineering | 6 CP | Koziolk |
|---------------|---------------------------------------------------|------|---------|

**Assessment**

See Partial Achievements (Teilleistung)

**Prerequisites**

See Partial Achievements (Teilleistung)

**Competence Goal**

Students are able to

- understand scientifically motivated problem statements and, in cooperation with supervisors, derive requirements for the software to be developed or extended.
- develop medium-sized programs using current development environments, or familiarize themselves with medium- to large-scale software systems and further develop them.
- present project progress to supervisors in regular meetings and identify and communicate potential obstacles.
- evaluate third-party code in the context of code reviews, identify potential weaknesses, and discuss them.
- present a (further) developed software system in a short presentation.
- document a (further) developed software system

**Content**

Agile software development methods refer to a class of iterative and incremental development approaches that place particular emphasis on executable software, early feedback from stakeholders, and embracing necessary changes. In these approaches, efforts that are not directly related to producing running software are viewed critically.

In this lab course, participants use and extend state-of-the-art tools from both practice and research to support agile software development. The following types of tools are considered:

- tools that leverage large language models (LLMs) to support agile software development methods, e.g., creating trace links from existing software engineering artifacts and models
- tools for semi-automatically deriving models from source code and runtime information, in particular performance data
- tools for simpler, domain-specific modeling
- tools for automatically maintaining consistency between development artifacts and models

Depending on the chosen topic, different technologies and programming languages are used, including:

- LLMs
- Java, Python, Java/TypeScript
- Spring Boot, React, Maven, EMF (Eclipse Modeling Framework)
- development of VS Code extensions or language servers
- Vitruvius
- Palladio Simulator
- ARDoCo
- JPlag

Course assessment is graded individually; group work is intended. The lab is embedded in the chair's ongoing research and offers plenty room for creativity. The assignments are practice-oriented and prepare students for realistic tasks in both research and industry.

The lab can be completed entirely in English. If preferred, supervision and presentations in German are also possible.

**Additional Information**

In earlier semesters, this course was named „Praktikum: Werkzeuge für agile Modellierung“.

**Workload**

Course workload:

20 hours of work for onboarding,  
120 hours of work for development,  
20 hours of work for weekly meetings and follow-up,  
10 hours for preparing and conducting a code review,  
10 hours for preparing and delivering the final presentation.

**Recommendations**

See Partial Achievements (Teilleistung)



**M****5.169 Module: Practical Course: Current Topics of Quantum Computing [M-INFO-106286]**

**Coordinators:** Prof. Dr.-Ing. Ina Schaefer  
Prof. Dr. Achim Streit

**Organisation:** KIT Department of Informatics

**Part of:** [Informatics](#)

| Credits | Grading | Recurrence       | Duration | Language | Level | Version |
|---------|---------|------------------|----------|----------|-------|---------|
| 6 CP    | graded  | Each summer term | 1 term   | English  | 4     | 2       |

| Mandatory     |                                                                       |      |                  |
|---------------|-----------------------------------------------------------------------|------|------------------|
| T-INFO-112741 | <a href="#">Practical Course: Current Topics of Quantum Computing</a> | 6 CP | Schaefer, Streit |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students can understand scientifically motivated problems and process relevant literature to address the problem and possible solutions in cooperation with their supervisors. Using current quantum software frameworks, students can implement and evaluate practical solutions. Using the acquired knowledge and referring to current research results, students are able to interpret and comprehend their results. At regular meetings, progress is presented and possible obstacles are explained. Students can document the theory behind the solutions they have developed and present them in a comprehensible way.

**Content**

This practical course focuses on the theoretical analysis and practical implementation of current topics in quantum computing. The introduction covers necessary mathematical foundations of quantum systems and their representation by qubits and quantum circuits before delving into the specifics of the topics offered. Possible topics include quantum algorithms, optimization of quantum systems, quantum software engineering, or quantum machine learning.

There are fixed dates for topic assignment and lectures to introduce the topic of quantum computing. Additional face-to-face meetings to discuss individual progress are coordinated individually between the participants and supervisors. Participants work on separate tasks that are defined on the basis of current research work and thus offer realistic problems from practice and research. Assignments are graded individually, group work is possible. Prior knowledge and areas of interest of the participants are taken into account when assigning the topics.

**Workload**

- Attendance time 20h (Kick-off, introduction to theoretical aspects and topical areas, supervision meetings, closing event)
- Familiarization 20h
- Preparation of report and presentation 20h
- Independent work on the topic 120h
- Total 180h / 30 = 6 ECTS

**Recommendations**

- Knowledge of linear algebra is recommended
- Programming experience is helpful.

**M****5.170 Module: Practical Course: Data Science [M-INFO-105632]**

**Coordinators:** Prof. Dr.-Ing. Klemens Böhm  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each summer term

**Duration**  
1 term

**Language**  
German

**Level**  
4

**Version**  
2

| Mandatory     |                                                |      |      |
|---------------|------------------------------------------------|------|------|
| T-INFO-111262 | <a href="#">Practical Course: Data Science</a> | 6 CP | Böhm |

M

5.171 Module: Practical Course: Data Science for Scientific Data [M-INFO-106329]

Coordinators:

Prof. Dr.-Ing. Klemens Böhm

Organisation:

KIT Department of Informatics

Part of:

Informatics

|         |         |            |          |          |       |         |
|---------|---------|------------|----------|----------|-------|---------|
| Credits | Grading | Recurrence | Duration | Language | Level | Version |
| 6 CP    | graded  | Irregular  | 1 term   | English  | 4     | 2       |

|               |                                                    |      |      |
|---------------|----------------------------------------------------|------|------|
| Mandatory     |                                                    |      |      |
| T-INFO-112844 | Practical Course: Data Science for Scientific Data | 6 CP | Böhm |

M

5.172 Module: Practical Course: Database Systems [M-INFO-101662]

**Coordinators:** Prof. Dr.-Ing. Klemens Böhm  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

|                        |                             |                                       |                           |                           |                   |                     |
|------------------------|-----------------------------|---------------------------------------|---------------------------|---------------------------|-------------------|---------------------|
| <b>Credits</b><br>4 CP | <b>Grading</b><br>pass/fail | <b>Recurrence</b><br>Each winter term | <b>Duration</b><br>1 term | <b>Language</b><br>German | <b>Level</b><br>4 | <b>Version</b><br>1 |
|------------------------|-----------------------------|---------------------------------------|---------------------------|---------------------------|-------------------|---------------------|

|                  |                                                    |      |      |
|------------------|----------------------------------------------------|------|------|
| <b>Mandatory</b> |                                                    |      |      |
| T-INFO-103201    | <a href="#">Practical Course: Database Systems</a> | 4 CP | Böhm |

**M****5.173 Module: Practical Course: Design and Evaluation of Interactive Systems [M-INFO-106290]****Coordinators:** Prof. Dr. Kathrin Gerling**Organisation:** KIT Department of Informatics**Part of:** [Informatics](#)**Credits**  
6 CP**Grading**  
graded**Recurrence**  
Each summer term**Duration**  
1 term**Language**  
German/English**Level**  
4**Version**  
1

| Mandatory     |                                                                                |      |         |
|---------------|--------------------------------------------------------------------------------|------|---------|
| T-INFO-112749 | <a href="#">Practical Course: Design and Evaluation of Interactive Systems</a> | 6 CP | Gerling |

## M

**5.174 Module: Practical Course: Digital Design & Test Automation Flow [M-INFO-102570]****Coordinators:** Prof. Dr. Mehdi Baradaran Tahoori**Organisation:** KIT Department of Informatics**Part of:** Informatics**Credits**  
3 CP**Grading**  
graded**Recurrence**  
Each term**Duration**  
1 term**Language**  
English**Level**  
4**Version**  
1

| Mandatory     |                                                         |      |         |
|---------------|---------------------------------------------------------|------|---------|
| T-INFO-105565 | Practical Course: Digital Design & Test Automation Flow | 3 CP | Tahoori |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

The objective of this lab is to have a hands-on practice on major steps in digital design and test automation flow, from system-level specification to physical design and verification.

**Content**

Electronic Design Automation (EDA) is used to develop nearly all novel electronic systems that we use in our daily lives, such as smartphones or laptops. In order to manage the high complexity of these systems, all steps in the design and verification phases are done automatically with the help of EDA tools.

The objective of this lab is to have a hands-on practice on major steps in digital design and test automation flow, from system-level specification to physical design and verification, using industrial EDA toolsets which are predominantly used in the industry and academia.

The students will work on some sample designs and go through all major design and test steps, one by one, in different sessions of the lab. So, by the end of this lab, they become familiar with the steps and tool chain in the digital design and test automation flow. The topics include system-level specification and simulation; high-level synthesis; logic-level synthesis and simulation; design for testability; test pattern generation and fault simulation; physical design and verification; timing analysis and closure; area, delay, and power estimation and analysis.

**Workload**

4 SWS / 3 CP = 90 h/week

**Recommendations**

Knowledge of "Dependable Computing" and "Fault Tolerant Computing" and Computer Architecture is helpful.

## M

**5.175 Module: Practical Course: Efficient Parallel C++ [M-INFO-107203]**

**Coordinators:** Prof. Dr. Peter Sanders  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Irregular

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                          |      |         |
|---------------|------------------------------------------|------|---------|
| T-INFO-114228 | Practical Course: Efficient Parallel C++ | 6 CP | Sanders |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

The students

- can use the methods of algorithm engineering in order to implement and evaluate given algorithmic problems and data structures in C++.
- recognize factors that lead to inefficient code and can, if possible, replace them with more efficient constructions.
- understand how to use the presented techniques for parallelization and to generate thread-safe codes with the given means.
- know the features of the standard library and are able to use them selectively.
- can test the codes generated by them for correctness and performance, furthermore they can represent and analyze the obtained results.

**Content**

In this practical course students solve multiple programming tasks in C++. The main focus is on the efficient implementation and their evaluation through extensive experiments. The programming tasks are motivated by scientific work in the field of algorithm engineering.

They cover complex algorithms as well as advanced data structures, furthermore advanced programming techniques and parallelization (thread management capabilities of the standard library).

**Workload**

- ~ 15h attendance time
- ~ 25h presentation/discussion/assessment of the solutions (with preparation)
- ~ 140h working on the tasks (implementation and evaluation)



## 5.176 Module: Practical Course: Engineering Approaches to Software Development [M-INFO-107678]

**Coordinators:** Prof. Dr. Ralf Reussner  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

| Credits | Grading | Recurrence | Duration | Language | Level | Version |
|---------|---------|------------|----------|----------|-------|---------|
| 6 CP    | graded  | Each term  | 1 term   | English  | 4     | 1       |

| Mandatory     |                                                                  |      |          |
|---------------|------------------------------------------------------------------|------|----------|
| T-INFO-115044 | Practical Course: Engineering Approaches to Software Development | 6 CP | Reussner |

### Assessment

See Partial Achievements (Teilleistung).

### Prerequisites

See Partial Achievements (Teilleistung).

### Competence Goal

Students are able to

- understand scientifically motivated problem statements and, in cooperation with supervisors, derive requirements for the software to be developed or extended.
- develop medium-sized programs using current development environments, or familiarize themselves with medium- to large-scale software systems and further develop them.
- present project progress to supervisors in regular meetings and identify and communicate potential obstacles.
- evaluate third-party code in the context of code reviews, identify potential weaknesses, and discuss them.
- present a (further) developed software system in a short presentation.

### Content

The engineering-oriented development of software is an indispensable prerequisite for building large systems. Accordingly, software engineers must systematically analyze the system's quality already during software design and, where possible, also predict it.

In this practical course, participants use and extend state-of-the-art tools from both practice and research to evaluate and predict the performance of software systems. These tools provide solutions for the following tasks:

- assessing the scalability of software depending on the execution environment
- maintaining consistency across different development artifacts

The development tasks are drawn from the following areas:

- MDSD (Model-Driven Software Development)
- plugin development
- benchmarking
- reverse engineering

The technologies used include:

- Java, Python, Java/TypeScript
- Spring Boot, React, Maven, EMF (Eclipse Modeling Framework)
- Development of VS Code extensions or language servers
- Vitruvius
- Palladio Simulator

Course assessment is graded individually; group work is intended. The lab is embedded in the chair's ongoing research and offers plenty room for creativity. The assignments are practice-oriented and prepare students for realistic tasks in both research and industry.

The lab can be completed entirely in English. If preferred, supervision and presentations in German are also possible.

### Additional Information

In earlier semesters, this course was named „Praktikum Ingenieursmäßige Software-Entwicklung“



**Workload**

Course workload:

20 hours of work for onboarding,

120 hours of work for development,

20 hours of work for weekly meetings and follow-up,

10 hours for preparing and conducting a code review,

10 hours for preparing and delivering the final presentation.

In total, this amounts to 180 hours of work.

**Recommendations**

See Partial Achievements (Teilleistung).

**M****5.177 Module: Practical Course: FPGA Programming [M-INFO-102661]****Coordinators:** Prof. Dr. Mehdi Baradaran Tahoori**Organisation:** KIT Department of Informatics**Part of:** Informatics**Credits**  
3 CP**Grading**  
graded**Recurrence**  
Each term**Duration**  
1 term**Language**  
English**Level**  
4**Version**  
1

| Mandatory     |                                    |      |         |
|---------------|------------------------------------|------|---------|
| T-INFO-105576 | Practical Course: FPGA Programming | 3 CP | Tahoori |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students will learn to design and to simulate digital circuits with FPGA.

**Content**

This lab emphasizes on the practical aspects of Field Programmable Gate Arrays (FPGAs). In the beginning, a short background introduction on FPGAs is given, followed by a tutorial on the workflow of configuring and programming an FPGA. This lab includes FPGA design using schematic layouts as well as several example of VHDL/Verilog programming to implement some sample digital circuits. Students will learn to design and to simulate digital circuits with FPGA. The design will be compiled on run a FPGA. The lab is designed around the DE2-115 prototyping board, which provides a programmer, program memory, and array of switches, buttons, LEDs, an LCD, and several I/O ports.

**Workload**

4 SWS / 3 CP = 90 h/week

**Recommendations**

Knowledge of "Dependable Computing" and "Fault Tolerant Computing" and Computer Architecture is helpful.

**M****5.178 Module: Practical Course: General-Purpose Computation on Graphics Processing Units [M-INFO-100724]****Coordinators:** Prof. Dr.-Ing. Carsten Dachsbacher**Organisation:** KIT Department of Informatics**Part of:** Informatics**Credits**  
3 CP**Grading**  
graded**Recurrence**  
Each term**Duration**  
1 term**Language**  
English**Level**  
4**Version**  
3

| Mandatory     |                                                                                            |      |             |
|---------------|--------------------------------------------------------------------------------------------|------|-------------|
| T-INFO-109914 | <a href="#">Practical Course: General-Purpose Computation on Graphics Processing Units</a> | 3 CP | Dachsbacher |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students should acquire the ability to use programmable graphics hardware using suitable interfaces (e.g. OpenCL, CUDA) to solve scientific and technical calculations. The students should thereby acquire the practical ability to systematically develop a parallel, efficient programme on the basis of suitable algorithms. Students learn basic algorithms for parallel architectures, are able to analyse and evaluate them, and practice their use in practical applications.

**Content**

The practical course covers basic concepts for the use of modern graphics hardware for technical and scientific calculations and simulations. Starting with basic algorithms, e.g. parallel reduction or matrix multiplication, the practical course imparts knowledge about the properties and capabilities of modern graphics processors (GPUs). As part of the practical course, students work on smaller sub-projects in which they acquire knowledge about the algorithms used and apply them to a specific problem; OpenCL or CUDA, for example, is used as a programming interface.

**Workload**

Attendance time = 12h

Preparation/post-processing = 78h

**M****5.179 Module: Practical Course: Graphics and Game Development [M-INFO-105384]****Coordinators:** Prof. Dr.-Ing. Carsten Dachsbacher**Organisation:** KIT Department of Informatics**Part of:** [Informatics](#)**Credits**  
6 CP**Grading**  
graded**Recurrence**  
Irregular**Duration**  
1 term**Language**  
German/English**Level**  
4**Version**  
1

| Mandatory     |                                                                 |      |             |
|---------------|-----------------------------------------------------------------|------|-------------|
| T-INFO-110872 | <a href="#">Practical Course: Graphics and Game Development</a> | 6 CP | Dachsbacher |

**M****5.180 Module: Practical Course: Hot Research Topics in Computer Graphics [M-INFO-104699]****Coordinators:** Prof. Dr.-Ing. Carsten Dachsbacher**Organisation:** KIT Department of Informatics**Part of:** [Informatics](#)**Credits**  
6 CP**Grading**  
graded**Recurrence**  
Irregular**Duration**  
1 term**Language**  
German/English**Level**  
4**Version**  
1

| Mandatory     |                                                                            |      |             |
|---------------|----------------------------------------------------------------------------|------|-------------|
| T-INFO-109577 | <a href="#">Practical Course: Hot Research Topics in Computer Graphics</a> | 6 CP | Dachsbacher |

**Competence Goal**

Students study scientific publications on currently hot topics of computer graphics, implement and evaluate state of the art methods, and compare them to newly developed approaches. The results of the practical course will be documented in the form of a scientific paper.

**Content**

Students in this practical course are introduced to theoretical and practical aspects of current research topics at the chair of computer graphics.



## 5.181 Module: Practical Course: Human-Centred Robotics [M-INFO-106646]

**Coordinators:** Prof. Dr. Katja Mombaur  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                          |      |         |
|---------------|----------------------------------------------------------|------|---------|
| T-INFO-113393 | <a href="#">Practical Course: Human-Centred Robotics</a> | 6 CP | Mombaur |

### Assessment

See partial achievements (Teilleistung)

### Prerequisites

See partial achievements (Teilleistung)

### Competence Goal

Students learn to understand and scrutinize complex scientific topics and to reproduce and verify published results. They gain in-depth knowledge and practical experience in the field of motion generation and control of human-centered robots while working on a specific project task. They also learn how to plan, work together and communicate in a team. Students will be able to present their project results in a scientific presentation, demonstrate the practical results and answer detailed questions. They can also summarize their project results in writing using Latex in the style of a scientific paper and place them in a scientific context.

### Content

Human-centered robots are robots that directly interact with humans or support humans in their motions. This includes humanoid robots, but also wearable robots (exoskeletons and prostheses) or external physical assistive devices. In this practical course, students learn how to implement theoretical knowledge about human-centered robots and use it to solve a given task based on a individual project with robot hardware. Projects can either focus on code development for a given hardware or on the development or modification of robot hardware along with the basic code. Students learn about the challenges of working with real robot hardware vs model computations, and about working principles and practical implementation of sensors and actuators.

### Additional Information

For capacity reasons (supervision of practical projects and workspace), the practical course is limited in terms of projects and number of students. Specific project topics will be different each term and will be announced in a presentation during the first semester week.

Subsequently, a selection and topic assignment will be carried out, taking into account the students' subject and topic specific skills.

### Workload

Estimated effort for this module is 180 hours:

20h – In person events (kickoff meeting, individual meetings with supervisor, presentations)

130h – Individual project work

30h – Writing report and preparing presentation

### Recommendations

Knowledge in Robotics (e.g. from the class Robotics 1 and follow-ups) are very helpful.



## 5.182 Module: Practical Course: Interactive Theorem Proving [M-INFO-107494]

**Coordinators:** Prof. Dr. Bernhard Beckert  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Irregular

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                               |      |                    |
|---------------|---------------------------------------------------------------|------|--------------------|
| T-INFO-114691 | <a href="#">Practical Course: Interactive Theorem Proving</a> | 3 CP | Beckert, Stübinger |

### Assessment

See partial achievements (Teilleistung)

### Prerequisites

See partial achievements (Teilleistung)

### Competence Goal

Students are able to use an interactive theorem prover such as Isabelle/HOL and can formulate and prove formal statements in the field of programming language technology (e.g. related to type safety, compilers, and semantics).

Students can name and describe the foundational features of the theorem prover, including its meta-logic, unification, resolution and rule application as well as the axiomatisations of higher-order logic.

Furthermore, students are able to write proofs themselves in the proof language. They can assess which proof methods (simplification, case distinction, induction, etc.) are appropriate for a given statement. They are also able to formulate statements which fit a given proof method. Students can apply advanced methods for structuring proofs (e.g. using Isar). They know the automatic and manual tactics of the theorem prover and can decide in which situations these should be applied.

Students are proficient in defining (recursive) data types, functions and inductive predicates and can prove statements about them. Students can implement simple algorithms from the field of program analysis (e.g. constant propagation) and verify its correctness with the help of the theorem prover.

### Content

In this lab course students are familiarized with the use of the interactive theorem prover Isabelle/HOL and use it to formalise and verify a project. In the first half of the course, important principles of theorem proving (e.g. simplification, recursion, inductive definitions and proofs) are learned and practiced via exercise sheets. In the second half of the course, students will work independently in teams formalising and verifying a topic in the area of formal methods, e.g. in programming language theory, type systems, or compilers. Project topics are set at the end of the first half of the course.

### Workload

3 CP equate to approximately 90 SWS. These are distributed as follows:

- approx. 15 h attendance time
- approx. 30 h work on the exercise sheets
- approx. 43 h work on the independent project
- approx. 2 h work on preparing the project presentation

### Recommendations

- Knowledge of functional programming is assumed.
- Some knowledge of logic (e.g. via courses such as Formale Systeme and/or Constructive Logic) will be helpful, but is not required

## M

**5.183 Module: Practical Course: Internet of Things (IoT) [M-INFO-103706]**

**Coordinators:** Prof. Dr.-Ing. Jörg Henkel  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
4 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                            |      |        |
|---------------|------------------------------------------------------------|------|--------|
| T-INFO-107493 | <a href="#">Practical Course: Internet of Things (IoT)</a> | 4 CP | Henkel |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

- Students will understand the core concepts of IoT systems, including design objectives, application domains, and requirements.
- They will gain skills in developing software programs for IoT embedded devices, debugging, and testing software on hardware.
- They will be capable of integrating and evaluating IoT systems comprising sensors, processors, wireless communication modules, and data storage.

**Content**

- The lab provides hands-on experience in IoT system design and development, focusing on the following aspects:
- Embedded, machine learning algorithms, intelligence, and connectivity in IoT systems.
- Challenges and optimization techniques for embedded software in resource-constrained IoT devices.
- Practical design and implementation of IoT devices with applications in smart environments, healthcare, and more.
- Integration of IoT components: sensors, processors, wireless radios, and storage systems.

**Workload**

Attendance time: 45 hours

Final project: 55 hours

Final presentation & Report: 20 hours

Total = 120 hours = 4 ECTS

**Recommendations**

- Familiarity with other (than C) languages like Python could be helpful as well.
- Basic knowledge from the modules "Design and Architectures of Embedded Systems (ESII)" and "Optimization and Synthesis of Embedded Systems (ESI)" are helpful but not essential for understanding the lab.





## 5.184 Module: Practical Course: Low Power Design and Embedded Systems [M-INFO-104031]

**Coordinators:** Prof. Dr.-Ing. Jörg Henkel  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

| Credits | Grading | Recurrence | Duration | Language | Level | Version |
|---------|---------|------------|----------|----------|-------|---------|
| 4 CP    | graded  | Each term  | 1 term   | English  | 4     | 2       |

| Mandatory     |                                                         |      |        |
|---------------|---------------------------------------------------------|------|--------|
| T-INFO-108323 | Practical Course: Low Power Design and Embedded Systems | 4 CP | Henkel |

### Assessment

See partial achievements (Teilleistung)

### Prerequisites

See partial achievements (Teilleistung)

### Competence Goal

Upon completion of this lab, students will:

- Apply and evaluate different hardware/software optimization techniques for low power and energy consumption under given constraints (e.g., performance) on embedded systems.
- Develop a deep understanding of system-level resource management techniques in modern systems. They will learn to apply machine learning methods to automate and optimize complex resource allocation decisions, thereby acquiring practical skills in data collection, model training, and iterative system tuning.
- Collaborate effectively in a team to practically solve technical problems related to power, temperature and energy optimizations on a real hardware platform.

### Content

This lab explores different software and hardware approaches for power reduction on modern embedded systems, considering other relevant metrics and constraints such as performance, power, temperature, chip area, among others, both on simulation and real-hardware platforms.

The course is divided in two main topics:

- Smart resource management (RM) for multi-/many-core computing systems: This topic covers system level techniques based on RM control knobs such as application mapping, dynamic task migration and dynamic voltage and frequency scaling (DVFS), using both from the heuristic and machine-learning methods.
- Hardware/Software design for low power systems: This topic includes the application of several design principles among the computing stack to optimize different metrics such as performance, power and energy in embedded systems. Techniques include compiler optimizations, HW/SW co-simulation, design-space exploration and high-level synthesis.

### Workload

Attendance time:

40 hours

Project work:

60 hours

Final Report preparation:

20 hours

Total: 120 hours (4 ECTS)

### Recommendations

Students should be familiar with software development practices under Linux-based systems. Practical knowledge in C/C++ as well as Python is required.

**M****5.185 Module: Practical Course: Machine Learning and Intelligent Systems [M-INFO-105958]**

**Coordinators:** Prof. Dr.-Ing. Uwe Hanebeck  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

| Credits | Grading | Recurrence | Duration | Language | Level | Version |
|---------|---------|------------|----------|----------|-------|---------|
| 8 CP    | graded  | Each term  | 1 term   | German   | 4     | 1       |

| Mandatory     |                                                            |      |                  |
|---------------|------------------------------------------------------------|------|------------------|
| T-INFO-112104 | Practical Course: Machine Learning and Intelligent Systems | 8 CP | Fennel, Hanebeck |

**Assessment**

See Partial Achievements (Teilleistung).

**Prerequisites**

See Partial Achievements (Teilleistung).

**Competence Goal**

The objective of the „Practical Course Machine Learning and Intelligent Systems“ is to work on current research-related topics in the areas of

- Extended Reality,
- Robotics,
- State estimation and
- Measurement and control systems.

The tasks are worked on by small groups of up to three students, by designing, implementing and testing suitable hardware and/or software components. Each group is supported by a designated supervisor regularly giving personal feedback and advice. The main goal of the course is the implementation of theoretical methods in real-world applications. An initial familiarization and brainstorming phase is followed by an extensive practical phase in which, in addition to the implementation work, project and time management skills are also trained. In parallel, interim and final results are documented in the form of presentations and a final report.

**Content**

This internship offers the opportunity to gain an insight into current research topics at ISAS. The projects to be worked on come from the fields of extended reality, robotics, state estimation and measurement and control systems. The specific tasks are based on current research work in the respective field. Current and completed projects are available at the following link:

<http://isas.iar.kit.edu/Praktikum>

**Workload**

240 hours

**M****5.186 Module: Practical Course: Model-Driven Software Development [M-INFO-106932]**

**Coordinators:** Prof. Dr. Ralf Reussner  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

| Credits | Grading | Recurrence       | Duration | Language | Level | Version |
|---------|---------|------------------|----------|----------|-------|---------|
| 6 CP    | graded  | Each summer term | 1 term   | English  | 4     | 1       |

| Mandatory     |                                                                     |      |                  |
|---------------|---------------------------------------------------------------------|------|------------------|
| T-INFO-113897 | <a href="#">Practical Course: Model-Driven Software Development</a> | 6 CP | Burger, Reussner |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students can

- understand and apply the model-driven development process
- Express facts as a metamodel and create a suitable domain-specific language (DSL)
- Formulate restrictions in the OCL language
- Create and apply model-to-model transformations
- Create model-to-text transformations
- Create graphical editors for metamodels
- Develop textual syntaxes for metamodels and DSLs
- use current tools in the field of model-driven software development

**Content**

Model-driven development methods have become particularly popular thanks to the Eclipse Modelling Framework (EMF) and the OMG standards MOF, UML and QVT. Advanced software development concepts such as product lines, generative programming and model transformations now make it possible to develop software more flexibly and quickly and to use it on different platforms. Domain-specific languages (DSL) and the graphical and textual editors generated from them can be easily created.

This practical course deals with current techniques of model-driven software development (MDSD). Students work with current frameworks and languages such as EMF, QVT, ATL and XText and create a domain-specific language and model transformations.

**Workload**

96 working hours for exercises, 48 working hours for project work, 16 working hours for preparing the final presentation, 20 working hours for weekly meetings and final presentation. This results in a total of 180 working hours.

## M

**5.187 Module: Practical Course: Movement and Technology [M-INFO-106648]**

**Coordinators:** Prof. Dr. Katja Mombaur  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each summer term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                           |      |         |
|---------------|-------------------------------------------|------|---------|
| T-INFO-113394 | Practical Course: Movement and Technology | 6 CP | Mombaur |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students learn to analyze and understand complex scientific topics in the area of human motion capture and motion analysis. They gain in-depth knowledge and practical experience with motion capture technology, experiment planning, and analysis. They also learn how to plan, work together and communicate in an interdisciplinary team. Students will be able to present their project results in a scientific presentation, demonstrate the practical results and answer detailed questions. They can also summarize their project results in writing using Latex and place them in a scientific context.

**Content**

In this joint course between Informatics and Sports Science, and in the sense of research-oriented teaching, students learn about current research projects of the BioRobotics Lab (Informatics) and the BioMotion Center (Sports Science) at the interface of motor control and biomechanics of human movement. This research involves the use of latest motion capture technology, advanced analysis tools, and partly also assistive robotics technology. Students work in teams (interdisciplinary teams between students from different study programs are highly encouraged) to carry out motion capture experiments, analyze the data and present the results in written and oral form. Depending on the specific project, these motion capture studies are either stand-alone studies just for this course or part of a larger research project at one of the organizing research groups.

**Additional Information**

Limited number of projects and participants. Specific project topics will be different each term and will be announced in a presentation during the first semester week.

**Workload**

Estimated effort for this module is 180 hours:

20h – In person events (kickoff meeting, individual meetings with supervisor, presentations)

120h – Individual project work

40h – Writing report and preparing presentation

**Recommendations**

Knowledge in Robotics (e.g. from the class Robotics 1 and follow-ups) are very helpful.

Programming skills.

**M****5.188 Module: Practical Course: Natural Language Dialog Systems [M-INFO-107177]**

**Coordinators:** Prof. Dr. Jan Niehues  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Irregular

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                   |      |         |
|---------------|---------------------------------------------------|------|---------|
| T-INFO-114206 | Practical Course: Natural Language Dialog Systems | 6 CP | Niehues |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

The student

- is able to develop a dialogue system using state-of-the-art methods.
- develop a dialogue system.
- can evaluate dialogue systems.
- can present his/her findings in a scientific lecture.

**Content**

Thanks to major advances in the field of deep learning and, in particular, large language models, it is now possible to develop dialogue systems and chatbots that can support people in many situations.

As part of this internship, students will develop a personal assistant for various application scenarios. To do this, students must first deal with data collection and data preparation. This data should then be used to develop a chatbot for the addressed application using freely available pre-trained models. In addition, the students will investigate various options for evaluating the systems.

In the final part of the internship, students can independently choose a focus to improve their initial system. The final systems will be presented in a final presentation.

**Workload**

180h

**M****5.189 Module: Practical Course: Programme Verification [M-INFO-101537]**

**Coordinators:** Prof. Dr. Bernhard Beckert  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Irregular

**Duration**  
1 term

**Language**  
German/English

**Level**  
4

**Version**  
1

| Mandatory     |                                                          |      |         |
|---------------|----------------------------------------------------------|------|---------|
| T-INFO-102953 | <a href="#">Practical Course: Programme Verification</a> | 3 CP | Beckert |

**M****5.190 Module: Practical Course: Realtime Computer Graphics [M-INFO-106851]****Coordinators:** Prof. Dr.-Ing. Carsten Dachsbacher**Organisation:** KIT Department of Informatics**Part of:** [Informatics](#)**Credits**  
6 CP**Grading**  
graded**Recurrence**  
Each term**Duration**  
1 term**Language**  
German/English**Level**  
4**Version**  
1

| Mandatory     |                                                              |      |             |
|---------------|--------------------------------------------------------------|------|-------------|
| T-INFO-113737 | <a href="#">Practical Course: Realtime Computer Graphics</a> | 6 CP | Dachsbacher |

**M****5.191 Module: Practical Course: Real-world Vulnerability Discovery and Exploits [M-INFO-106627]****Coordinators:** Prof. Dr. Christian Wressnegger**Organisation:** KIT Department of Informatics**Part of:** Informatics**Credits**  
4 CP**Grading**  
graded**Recurrence**  
Each term**Duration**  
1 term**Language**  
English**Level**  
4**Version**  
1

| Mandatory     |                                                                   |      |             |
|---------------|-------------------------------------------------------------------|------|-------------|
| T-INFO-113350 | Practical Course: Real-world Vulnerability Discovery and Exploits | 4 CP | Wressnegger |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

- ← Students know and understand exploitation techniques.
- ← Students are able to independently research software vulnerabilities.
- ← Students are comfortable engaging with software vendors in vulnerability disclosure.

**Content**

Students understand modern exploitation techniques and can apply them. Furthermore, they get familiar with the vulnerability disclosure process of prominent software vendors, reporting their findings.

**Workload**

- 2h attendance time/ week (lectures)
- 5h project work/ week
- 10h preparation for final presentation
- 5h attendance time (final event)

Total 120h

**Recommendations**

Application security internship



**M****5.192 Module: Practical Course: Rendering in CGI [M-INFO-106687]****Coordinators:** Prof. Dr.-Ing. Carsten Dachsbacher**Organisation:** KIT Department of Informatics**Part of:** [Informatics](#)**Credits**  
6 CP**Grading**  
graded**Recurrence**  
Each term**Duration**  
1 term**Language**  
German/English**Level**  
4**Version**  
1

| Mandatory     |                                                    |      |             |
|---------------|----------------------------------------------------|------|-------------|
| T-INFO-113443 | <a href="#">Practical Course: Rendering in CGI</a> | 6 CP | Dachsbacher |

**M****5.193 Module: Practical Course: Route Planning [M-INFO-107600]**

**Coordinators:** TT-Prof. Dr. Thomas Bläsius  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Irregular

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                  |      |                   |
|---------------|--------------------------------------------------|------|-------------------|
| T-INFO-114899 | <a href="#">Practical Course: Route Planning</a> | 6 CP | Bläsius, Ueckerdt |

**Assessment**

See partial achievements. (Teilleistung)

**Prerequisites**

See partial achievements. (Teilleistung)

**Competence Goal**

The students

- can practically apply the knowledge from the the module "Algorithmen für Routenplanung",
- are capable of efficiently implementing given topics in route planning (e.g., separator computation, shortest path acceleration techniques, ...),
- master the steps from design to implementation and evaluation in the practical application of algorithmic methods,
- possess the ability to act in a results-oriented manner within a team, critically assess their own actions, and demonstrate strong communication skills.

The participants are furthermore able to efficiently implement algorithms with consideration for modern computer architectures, as well as to plan and conduct meaningful experimental evaluations.

**Content**

In the practical course route planning, various topics from route planning are assigned, which are to be implemented independently by small student groups.

A main focus is placed on efficient programming in C++ or Rust.

**Workload**

Practical course with 4 SWS, 6 LP

6 LP corresponds to approx. 180 working hours, of which  
 approx. 10 hours attendance time,  
 approx. 12 hours working on the exercises,  
 approx. 128 hours implementation phase,  
 approx. 30 hours elaboration and preparation of the presentation

M

5.194 Module: Practical Course: Scientific Data Management [M-INFO-106312]

**Coordinators:** Prof. Dr.-Ing. Klemens Böhm  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

| Credits | Grading   | Recurrence | Duration | Language | Level | Version |
|---------|-----------|------------|----------|----------|-------|---------|
| 4 CP    | pass/fail | Irregular  | 1 term   | German   | 4     | 1       |

| Mandatory     |                                              |      |      |
|---------------|----------------------------------------------|------|------|
| T-INFO-112810 | Practical Course: Scientific Data Management | 4 CP | Böhm |

**M****5.195 Module: Practical Course: Scientific Visualization [M-INFO-106686]****Coordinators:** Prof. Dr.-Ing. Carsten Dachsbacher**Organisation:** KIT Department of Informatics**Part of:** [Informatics](#)**Credits**  
6 CP**Grading**  
graded**Recurrence**  
Each term**Duration**  
1 term**Language**  
German/English**Level**  
4**Version**  
1

| Mandatory     |                                                            |      |             |
|---------------|------------------------------------------------------------|------|-------------|
| T-INFO-113442 | <a href="#">Practical Course: Scientific Visualization</a> | 6 CP | Dachsbacher |



## 5.196 Module: Practical Course: Smart Data Analytics [M-INFO-103235]

**Coordinators:** Prof. Dr.-Ing. Michael Beigl  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each summer term

**Duration**  
1 term

**Language**  
German

**Level**  
4

**Version**  
1

| Mandatory     |                                                        |      |       |
|---------------|--------------------------------------------------------|------|-------|
| T-INFO-106426 | <a href="#">Practical Course: Smart Data Analytics</a> | 6 CP | Beigl |

### Workload

The total workload for this course unit is approx. 180 hours (6.0 credits).

Attendance time: Presentation/discussion:  
15 x 45 min; 11 h 15 min

Personal follow-up of the slides/tasks:  
15 x 30 min; 7 h 30 min

Individual presentation of a scientific article relevant to the implementation: 30 h 0 min Practical work on tasks in a group and individually: 15 x 8h; 120 h 0 min Documenting and preparing results for presentation: 15 x 45 min; 11 h 15 min Individual presentation of a scientific article relevant to implementation: 30 h 0 min

Practical work on the tasks in groups and individually:  
15 x 8h; 120 h 0 min

Documenting results and preparing them for presentation:  
15 x 45 min; 11 h 15min

SUM: 180 h 00 min



## 5.197 Module: Practical Course: Smart Energy System [M-INFO-105955]

**Coordinators:** Prof. Dr. Veit Hagenmeyer  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

| Credits | Grading | Recurrence | Duration | Language | Level | Version |
|---------|---------|------------|----------|----------|-------|---------|
| 6 CP    | graded  | Each term  | 1 term   | English  | 4     | 1       |

| Mandatory     |                                       |      |       |
|---------------|---------------------------------------|------|-------|
| T-INFO-112030 | Practical Course: Smart Energy System | 6 CP | Jumar |

### Assessment

See partial achievements (Teilleistung)

### Prerequisites

See partial achievements (Teilleistung)

### Competence Goal

After successfully completing the course, students will be able to

- explain and categorize a set of current research issues in modern energy systems
- explain structure and objectives of the KIT Energy Lab and its role in smart grid research
- conduct selected research activities in the field of innovative, application-oriented information, automation and system technology for sustainable energy systems
- isolate a research activity / hypothesis suitable for evaluation in the Smart Energy System Simulation and Control Center
- plan, organize and manage their laboratory / experimental work to fit a given time-frame
- concisely present and defend their research activity and results in front of a peer audience
- structure and writeup their work in research-paper-style
- work in team

### Content

As part of the two-week lab course, students work in teams of two on a project topic derived from current research questions of the Smart Energy System Simulation and Control Centre of the Energy Lab (<https://www.iai.kit.edu/RPE.php>). A list of topics is made available in advance via the Campus Plus Portal. Interested students should indicate their preferences based on which the topics will be assigned.

The group of students typically goes through the following phases: Concept development/experiment preparation, implementation/experiment execution, evaluation/experiment analysis, presentation of results and write-up. The teams will work independently on the assigned project - supervision is provided by research assistants.

The course begins with a joint kick-off event. This includes an organizational introduction, a tour of the Energy Lab and a brief presentation of all project topics. For the following preparation phase students are provided with literature and material to thoroughly familiarize themselves with the topic, research background and literature, plan and prepare experiments etc. In the two lab weeks the experiments are conducted and a scientific writing workshop is held. At the end of the lab course each team has to defend their work in a 10 min presentation followed by 5 minutes of discussion in front of peers and examiners. Additionally, the work needs to be documented in the style of a scientific paper.

### Workload

6 credit points corresponds to approx. 180 working hours, of which

- Attendance time / meetings in large and small groups: 10h
- Select and carry out project work: 140h
- Writing a research report and preparing a presentation: 30 hours

### Recommendations

- Knowledge of the fundamentals of energy informatics is a prerequisite.
- Knowledge of the fundamentals of electrical engineering and energy technology is required.
- Knowledge of the basics of mechatronics, data analysis and signal processing is helpful.
- Knowledge of power systems or power electronics is helpful.



## 5.198 Module: Practical Course: Software Defined Networking [M-INFO-107221]

**Coordinators:** Prof. Dr. Martina Zitterbart  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each summer term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                               |      |            |
|---------------|---------------------------------------------------------------|------|------------|
| T-INFO-114240 | <a href="#">Practical Course: Software Defined Networking</a> | 6 CP | Zitterbart |

### Assessment

See partial achievements (Teilleistung)

### Prerequisites

See partial achievements (Teilleistung)

### Competence Goal

The student understands the concepts behind the SDN approach and applies this knowledge to design solutions for new problems. He/she is able to develop an application in group work that implements a specific functionality in an SDN network. From the outset, the student plans his/her solution approaches from the point of view of interoperability with the solutions of the other groups. The participants jointly decide on compromise solutions, if these are necessary, in order to be able to operate the applications of the different groups together without disruption.

### Content

The internship deals with the realization of a software project in the field of Software-Defined Networking (SDN). With SDN, the control and monitoring of a network is outsourced to a controller. The actual forwarding hardware can then be programmed via the OpenFlow interface.

As part of the internship, we want to find out together to what extent this technology can also be used within our own four walls. To this end, we will design and develop an SDN home router that enables users to monitor and control their network using SDN applications. In small groups, we will build or recreate various functions from the home network sector, e.g. a firewall or parental control. A monitoring system that breaks down the Internet consumption of all connected computers is also conceivable. Or a traffic engineering mechanism that ensures that you can still enjoy YouTube even when your younger brother is downloading a 100 GB game. Many other variants are conceivable. We decide together in the internship what will be implemented in the end. Your own ideas are very welcome!

### Workload

180h

**M****5.199 Module: Practical Course: Visual Computing [M-INFO-101567]****Coordinators:** Prof. Dr.-Ing. Carsten Dachsbacher**Organisation:** KIT Department of Informatics**Part of:** Informatics**Credits**  
6 CP**Grading**  
graded**Recurrence**  
Each term**Duration**  
1 term**Language**  
English**Level**  
4**Version**  
1

| Mandatory     |                                    |      |             |
|---------------|------------------------------------|------|-------------|
| T-INFO-103000 | Practical Course: Visual Computing | 6 CP | Dachsbacher |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

In this course, practical problems from the core area of computer graphics and the broader field of visual computing are solved where graphics hardware is used. In individual sub-projects, or self-defined larger projects, the application of various computer graphics techniques and the use of modern graphics hardware are practised. In addition, students can work together in a team to solve the tasks of the work placement.

**Content**

The practical course deals with specific topics, some of which were addressed in corresponding lectures on the specialisation subject of computer graphics, and explores these in greater depth. Previous attendance of the respective lecture is helpful, but not a prerequisite for attendance.

**Workload**

Attendance time = 30h

Preparation/follow-up = 150h

**Recommendations**

Programming skills in C/C++ are recommended.



**M****5.200 Module: Practical Course: Wearable Computing [M-INFO-107527]**

**Coordinators:** Prof. Dr.-Ing. Michael Beigl  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
1 term

**Language**  
German/English

**Level**  
4

**Version**  
1

| Mandatory     |                                                      |      |       |
|---------------|------------------------------------------------------|------|-------|
| T-INFO-114744 | <a href="#">Practical Course: Wearable Computing</a> | 6 CP | Beigl |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

- Students learn about different wearables and their areas of application, e.g. in the fields of human-machine interaction or healthcare.
- They are able to plan, carry out, evaluate and assess an independent project using wearables.
- They also learn to implement appropriate programs on the wearables based on their study results and to present their results in an appealing way.

**Content**

While small wearable computers were the exception a few years ago, they are now ubiquitous in everyday life. The smartwatch is particularly common, but other wearable gadgets such as headphones or rings are now also often computerized. In this practical course, students learn how to use the biosignals recorded in this way and their scientific potential. To this end, students work together in small groups. Each small group is given a specific project in which a specific question is to be worked on using a wearable. To answer this question, the students must abstract the requirements at device level, analyze data and evaluate the associated results. Depending on the project, small user studies may have to be carried out, algorithms implemented directly on the wearables or other scientific tasks performed by the students. The results achieved in this way must then be presented in a final presentation or demonstrated in a final demo. In addition, a final report must be written.

**Workload**

- Attendance time: Presentation/discussion
- 15 x 45 min = 11 h 15 min
- Practical work on the tasks in groups
- 15 x 8 h = 120 h
- Personal follow-up of the slides/projects
- 15 x 30 min = 7 h 30 min
- Document results and prepare for presentation
- 15 x 45 min = 11 h 15 min
- Writing a final report
- 15 x 2h = 30 h
- TOTAL = 180 h 00 min

**Recommendations**

Experience with ML frameworks, signal processing and embedded systems is an advantage

**M****5.201 Module: Practical Course: Web Applications and Service-Oriented Architectures (II) [M-INFO-101635]****Coordinators:** Prof. Dr. Sebastian Abeck**Organisation:** KIT Department of Informatics**Part of:** [Informatics](#)**Credits**  
5 CP**Grading**  
graded**Recurrence**  
Each summer term**Duration**  
1 term**Language**  
German**Level**  
4**Version**  
2

| Mandatory     |                                                                                            |      |       |
|---------------|--------------------------------------------------------------------------------------------|------|-------|
| T-INFO-103121 | <a href="#">Practical Course: Web Applications and Service-Oriented Architectures (II)</a> | 5 CP | Abeck |

## M

**5.202 Module: Practical Introduction to Hardware Security [M-INFO-107241]****Coordinators:** Prof. Dr. Mehdi Baradaran Tahoori**Organisation:** KIT Department of Informatics**Part of:** Informatics**Credits**  
6 CP**Grading**  
graded**Recurrence**  
Each term**Duration**  
1 term**Language**  
English**Level**  
4**Version**  
1

| Mandatory     |                                             |      |         |
|---------------|---------------------------------------------|------|---------|
| T-INFO-114267 | Practical Introduction to Hardware Security | 6 CP | Tahoori |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

The goal of this course, which is a combination of lectures and lab assignments, is to have a hands-on experience on basic concepts and new developments in hardware security, by combining both theory and practice in a coherent course. The theoretical concepts for each topic will be presented to the students in form of lectures, followed by a set of lab assignments on both hardware and software platforms to be performed by the students for each topic.

**Content**

1. Hardware security primitives (PUF, TRNG)
2. Hardware Implementation of encryption modules (AES)
3. Passive Attack with side channel (on AES)
4. Active fault attack (on AES)

**Workload**

4 SWS / 6 ECTS = 180h

2 SWS lecture (1,5h) + 2 SWS practical course (1,5h) / week

**Recommendations**

Knowledge of Digital Design (lecture TI)

Practical Course "FPGA Programming"

## M

**5.203 Module: Practical SAT Solving [M-INFO-107238]**

**Coordinators:** Prof. Dr. Peter Sanders  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
5 CP

**Grading**  
graded

**Recurrence**  
Irregular

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
2

| Mandatory     |                       |      |                                 |
|---------------|-----------------------|------|---------------------------------|
| T-INFO-114262 | Practical SAT Solving | 5 CP | Balyo, Iser, Sanders, Schreiber |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students are able to evaluate combinatorial problems, assess their complexity, and solve them using computers.

Students learn how to solve combinatorial problems efficiently using SAT Solving. Students are able to assess the practical complexity of decision and optimization problems, encode problems as SAT problems, and implement efficient solution procedures for combinatorial problems.

Students gain insight into state-of-the-art solution methods for SAT and related problems and their implementations in SAT solvers.

**Content**

The problem of propositional satisfiability (SAT) is an outstanding problem of computer science from a theoretical as well as practical perspective. Being the first problem proven to be NP-complete, it serves as a fundamental tool for research in complexity theory. Moreover, SAT solving has been established as one of the most important fundamental methods in hardware and software verification, and is used to solve hard combinatorial problems in industrial practice as well. This module aims to provide students with the theoretical and practical aspects of SAT-Solving. Covered are:

1. basics, historical development
2. encodings, e.g. cardinality constraints
3. phase transitions in random problems
4. local search (GSAT, WalkSAT, ..., ProbSAT)
5. resolution, Davis-Putnam algorithm, DPLL algorithm, look-ahead algorithm
6. efficient implementations, data structures
7. heuristics in the DPLL algorithm
8. CDCL algorithm, clause learning, implication graphs
9. restarts and heuristics in the CDCL algorithm
10. preprocessing, inprocessing
11. generation of proofs and their checking
12. parallel SAT solving (guiding paths, portfolios, cube-and-conquer)
13. related problems: MaxSAT, MUS, #SAT, QBF
14. advanced applications: Bounded model checking, planning, satisfiability-modulo-theories

**Workload**

Lecture (2 SWS) + exercise (1 SWS)

(Preparation and follow-up: 4h/week, exercises: 2h/week, preparation for exam: 15h)

Total workload: (2 SWS + 1 SWS + 4 SWS + 2 SWS) x 15 h + 15h preparation = 9x15h + 15h = 150h = 5 ECTS

**M****5.204 Module: Private Business Law [M-INFO-101216]****Coordinators:** N.N.**Organisation:** KIT Department of Informatics**Part of:** Law**Credits**  
9 CP**Grading**  
graded**Recurrence**  
Each term**Duration**  
2 terms**Language**  
German**Level**  
4**Version**  
6

| Private Business Law (Election: at least 1 item as well as at least 9 credits) |                                                          |      |          |
|--------------------------------------------------------------------------------|----------------------------------------------------------|------|----------|
| T-INFO-111405                                                                  | Seminar: Commercial and Corporate Law in the IT Industry | 3 CP | Nolte    |
| T-INFO-101288                                                                  | Corporate Compliance                                     | 3 CP | Herzig   |
| T-INFO-102036                                                                  | Computer Contract Law                                    | 3 CP | Menk     |
| T-INFO-111436                                                                  | Employment Law                                           | 3 CP | Hoff     |
| T-INFO-111437                                                                  | Tax Law                                                  | 3 CP | Dietrich |

**Assessment**

see partial achievements

**Prerequisites**

None

**Competence Goal**

The student

- has gained in-depth knowledge of German company law, commercial law and civil law;
- is able to analyze, evaluate and solve complex legal and economic relations and problems;
- is well grounded in individual labour law, collective labour law and commercial constitutional law, evaluates and critically assesses clauses in labour contracts;
- recognizes the significance of the parties to collective labour agreements within the economic system and has differentiated knowledge of labour disputes law and the law governing the supply of temporary workers and of social law;
- possesses detailed knowledge of national earnings and corporate tax law and is able to deal with provisions of tax law in a scientific manner and assesses the effect of these provisions on corporate decision-making.

**Content**

The module covers a range of special topics in corporate law, knowledge of which is essential in order to make sensible business decisions. Building on the knowledge previously acquired in private law, students gain practical insights into how contracts are drafted, as well as even more detailed knowledge of civil law and German commercial and company law. In addition, they will acquire solid knowledge of labor and tax law.

**Workload**

The total workload for this module is approximately 270 hours (9 credits). The allocation is based on the credits of the courses of the module. The workload for courses with 3 credits is about 90 hours. The total number of hours per course results from the effort required to attend the lectures as well as the examination times and the time required to achieve the learning objectives of the module for an average student for an average performance.



## 5.205 Module: Probability and Computing [M-INFO-107168]

**Coordinators:** TT-Prof. Dr. Thomas Bläsius  
Prof. Dr. Peter Sanders

**Organisation:** KIT Department of Informatics

**Part of:** Informatics

**Credits**  
5 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                           |      |                            |
|---------------|---------------------------|------|----------------------------|
| T-INFO-114196 | Probability and Computing | 5 CP | Bläsius, Katzmann, Sanders |

### Assessment

See partial achievements (Teilleistung)

### Prerequisites

See partial achievements (Teilleistung)

### Competence Goal

The students

- understand when and why randomisation is useful or necessary for solving an algorithmic problem,
- can explain central design methods and analysis tools of randomised algorithms,
- can design and explain simple randomised algorithms and data structures for solving a problem,
- can decide which tools are suitable for the analysis of given randomised algorithms and data structures and apply them.

### Content

Randomised algorithms and data structures make their approach dependent on random experiments. While the design of deterministic algorithms is often driven by a pessimistic view of worst-case behaviour, randomised algorithms rely on approaches that occasionally fail but usually perform much better.

The runtime of such algorithms as well as the solution quality (in the case of optimisation problems) and sometimes also the correctness (in the case of computational problems) are then subject to chance. A formal analysis therefore focusses on expected values and probabilities of success. We will look at classical examples as well as current research topics from the field of hashing and graph theory. Specific design methods (such as probability amplification) and advanced analysis tools of probability theory (such as coupling, Poissonisation and concentration bounds) will be applied. It will often turn out that randomised approaches are more efficient or simpler than all (or at least all known) deterministic approaches.

We will also briefly consider on the theoretical side how randomised complexity classes relate to known classes such as P and NP, and on the practical side we will clarify how randomised algorithms can be implemented on common (essentially deterministic) computers with pseudorandomness.

### Workload

Lecture with exercise with 3 SWS, 5 LP  
approx. 45h attendance of the lecture and exercise  
approx. 30h preparation and follow-up work  
approx. 45 hours working on the exercise sheets  
approx. 30h exam preparation

### Recommendations

Basic knowledge of algorithms and data structures (e.g. from the lectures Algorithms 1 + 2) as well as basic knowledge of probability theory (e.g. from the lecture Introduction to Stochastics) are helpful.



## 5.206 Module: Project Lab Applied Machine Learning [M-WIWI-106491]

**Coordinators:** Prof. Dr.-Ing. Johann Marius Zöllner  
**Organisation:** KIT Department of Business and Economics  
**Part of:** Informatics

| Credits | Grading | Recurrence | Duration | Language | Level | Version |
|---------|---------|------------|----------|----------|-------|---------|
| 5 CP    | graded  | Each term  | 1 term   | German   | 4     | 1       |

### Election Regulations

Elections in this module must be complete. Election is only possible until the lower bounds are reached.

| Compulsory Elective Courses (Election: ) |                                                              |      |         |
|------------------------------------------|--------------------------------------------------------------|------|---------|
| T-WIWI-109985                            | <a href="#">Project Lab Cognitive Automobiles and Robots</a> | 5 CP | Zöllner |
| T-WIWI-109983                            | <a href="#">Project Lab Machine Learning</a>                 | 5 CP | Zöllner |

### Assessment

The module examination takes the form of an examination on the selected project lab. The control of success is described for each project lab.

### Competence Goal

Students

- Are able to solve real-world scientific problems using modern machine learning approaches.
- Are able to specify, adapt, and implement learning-based models to problems.
- Know advantages of learning-based algorithms over traditional solution strategies.

### Content

The module is to be regarded as a practice-oriented supplement to theoretical lectures on machine learning.

In the practical course, groups of two to four students each are given scientific tasks in the field of autonomous driving or robotics to be solved using modern ML-based methods. The tasks are of applied nature and mostly additionally require an integrating of the learned methods into existing systems provided by the chair and scientific partners. Due to the application reference, additional conditions are imposed on the learned procedures.

Students analyze the task, research the current state of the art, specify, implement and evaluate their own learning-based methods and present their results in a lecture and final report.

### Additional Information

The main difference of the internships within the module differ by the rotation in which they are held.

- Project Lab Cognitive Automobile every winter semester.
- Project Lab Machine Learning every summer semester.

### Workload

The workload of 5 credit points consists of attendance time at the experimental site for the 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 carried out will be prepared.

### Recommendations

Theoretical knowledge about machine learning methods is necessary. This can be acquired e.g. by lectures "Machine Learning 1: Basic Methods", or "Machine Learning 2: Advanced Methods". Also lectures of other research groups like "Machine Learning - Basics and Algorithms", "Deep Learning for Computer Vision 1/2" or "Deep Learning and Neural Networks" lay good theoretical foundations for the project lab.

First experiences with deep learning frameworks in Python like PyTorch/Jax/Tensorflow are an advantage.

## M

**5.207 Module: Project Lab: Image Analysis and Fusion [M-INFO-102383]**

**Coordinators:** Prof. Dr.-Ing. Jürgen Beyerer  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each summer term

**Duration**  
1 term

**Language**  
German

**Level**  
4

**Version**  
1

| Mandatory     |                                                        |      |         |
|---------------|--------------------------------------------------------|------|---------|
| T-INFO-104746 | <a href="#">Project Lab: Image Analysis and Fusion</a> | 6 CP | Beyerer |



**M****5.208 Module: Public Economic and Technology Law [M-INFO-106754]**

**Coordinators:** TT-Prof. Dr. Frederike Zufall  
**Organisation:** KIT Department of Informatics  
**Part of:** Law

**Credits**  
9 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
2 terms

**Language**  
German/English

**Level**  
4

**Version**  
2

| Public Economic and Technology Law (Election: at least 1 item as well as at least 9 credits) |                                |      |             |
|----------------------------------------------------------------------------------------------|--------------------------------|------|-------------|
| T-INFO-101309                                                                                | Telecommunications Law         | 3 CP |             |
| T-INFO-101312                                                                                | European and International Law | 3 CP | Brühann     |
| T-INFO-111404                                                                                | Seminar: IT- Security Law      | 3 CP | Schallbruch |
| T-INFO-113381                                                                                | Public International Law       | 3 CP | Zufall      |
| T-INFO-113887                                                                                | EU Data Protection Law         | 3 CP | Gil Gasiola |

**Assessment**

see partial achievement

**Prerequisites**

see partial achievement

**Competence Goal**

Students

- have in-depth knowledge and understanding of selected legal areas of public commercial and technology law,
- understand the international and European dimensions of the legal system
- can make connections between technical and legal issues, classify them legally and evaluate them.

**Content**

The module covers a range of special topics in public commercial and technology law. In addition to the areas of telecommunications law and IT security law, this also includes an in-depth examination of the European and international legal framework. Current legal aspects of the platform economy, the digital single market and the regulation of artificial intelligence are addressed.

**Workload**

The total workload for this module is approx. 270 hours (9 credits). The distribution is based on the credit points of the courses in the module. The workload for courses with 3 credits is approx. 90 hours. The total number of work hours per course results from the time required to attend the lectures, the examination times and the time required to achieve the learning objectives of the module for an average student for an average performance.

**Recommendations**

see partial achievement

**M****5.209 Module: Reinforcement Learning [M-INFO-105623]**

**Coordinators:** TT-Prof. Dr. Rudolf Lioutikov  
Prof. Dr. Gerhard Neumann

**Organisation:** KIT Department of Informatics

**Part of:** [Informatics](#)

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
2

| Mandatory     |                                        |      |                    |
|---------------|----------------------------------------|------|--------------------|
| T-INFO-111255 | <a href="#">Reinforcement Learning</a> | 6 CP | Lioutikov, Neumann |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

- Students are able to understand the RL problem and challenges.
- Students can differentiate between different RL algorithm and understand their underlying theory
- Students will know the mathematical tools necessary to understand RL algorithms
- Students can implement RL algorithms for various tasks
- Students understand current research questions in RL

**Content**

Reinforcement Learning (RL) is a sub-field of machine learning in which an artificial agent has to interact with its environment and learn how to improve its behaviour by trial and error. For doing so, the agent is provided with an evaluative feedback signal, called reward, that he perceives for each action performed in its environment. RL is one of the hardest machine learning problems, as, in contrast to standard supervised learning, we do not know the targets (i.e. the optimal actions) for our inputs (i.e. the state of the environment) and we also need to consider the long-term effects of the agent's actions on the state of the environment. Due to recent successes, RL has gained a lot of popularity with applications in robotics, automation, health care, trading and finance, natural language processing, autonomous driving and computer games. This lecture will introduce the concepts and theory of RL and review current state of the art methods with a particular focus on RL applications in robotics. An exemplary list of topics is given below:

- Primer in Machine Learning and Deep Learning
- Supervised Learning of Behaviour
- Introduction in Reinforcement Learning
- Dynamic Programming
- Value Based Methods
- Policy Optimization and Trust Regions
- Episodic Reinforcement Learning and Skill Learning
- Bayesian Optimization
- Variational Inference, Max-Entropy RL and Versatility
- Model-based Reinforcement Learning
- Offline Reinforcement Learning
- Inverse Reinforcement Learning
- Hierarchical Reinforcement Learning
- Exploration and Artificial Curiosity
- Meta Reinforcement Learning

**Workload**

Approximately 180 hours, divided into:

- 45 hours of lecture attendance
- 15 hours of exercise attendance
- 90 hours of post-processing and working on exercise sheets
- 30 hours of exam preparation.

**Recommendations**

- It is recommended that students are familiar with the content of the "Foundations of Artificial Intelligence" lecture.
- Good Python knowledge is recommended.
- Good mathematical background knowledge is recommended.

**M****5.210 Module: Reliable Computing I [M-INFO-100850]****Coordinators:** Prof. Dr. Mehdi Baradaran Tahoori**Organisation:** KIT Department of Informatics**Part of:** Informatics**Credits**  
3 CP**Grading**  
graded**Recurrence**  
Irregular**Duration**  
1 term**Language**  
English**Level**  
4**Version**  
1

| Mandatory     |                      |      |         |
|---------------|----------------------|------|---------|
| T-INFO-101387 | Reliable Computing I | 3 CP | Tahoori |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

The objective of this course is to become familiar with general and state of the art techniques used in design and analysis of fault-tolerant digital systems.

**Content**

The objective of this course is to become familiar with general and state of the art techniques used in design and analysis of fault-tolerant digital systems. The students will study and investigate existing fault-tolerant systems. Both Hardware and software methods will be studied and new research topics will be investigated.

This course overviews reliable (fault-tolerant) computing and the design and evaluation of dependable systems, and provides a base for research in reliable systems. Models and methods are used in the analysis and design of fault-tolerant and highly reliable computer systems will be taught in this course. Topics include faults and their manifestations, fault/error modeling, reliability, availability and maintainability analysis, system evaluation, performance-reliability trade-offs, system level fault diagnosis, hardware and software redundancy techniques, and fault-tolerant system design methods.

**Workload**

2 SWS:  $(2 \text{ SWS} + 1,5 \times 2 \text{ SWS}) \times 15 + 15 \text{ h preparation for the exam} = 90 \text{ h} = 3 \text{ ECTS}$

**M****5.211 Module: Research Focus Class: Blockchain & Cryptocurrencies [M-INFO-106654]**

**Coordinators:** Prof. Dr. Hannes Hartenstein  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

| Credits | Grading | Recurrence | Duration | Language | Level | Version |
|---------|---------|------------|----------|----------|-------|---------|
| 6 CP    | graded  | Irregular  | 1 term   | English  | 4     | 1       |

| Mandatory     |                                                                                   |      |             |
|---------------|-----------------------------------------------------------------------------------|------|-------------|
| T-INFO-113400 | <a href="#">Research Focus Class: Blockchain &amp; Cryptocurrencies</a>           | 3 CP | Hartenstein |
| T-INFO-113401 | <a href="#">Research Focus Class: Blockchain &amp; Cryptocurrencies - Seminar</a> | 3 CP | Hartenstein |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

- Students are familiar with current issues in the field of blockchain and cryptocurrencies and can identify specific research questions.
- Students have the necessary basic knowledge to identify, discuss and scientifically address current issues in the subject area.
- Students are able to independently develop a research topic and find and process related literature.
- Students are familiar with research methods in the field of decentralized systems and have gained initial experience in a specific research topic.
- Students can write a paper according to scientific standards.
- Students can present and discuss a research topic in a colloquium.

**Content**

Blockchains such as Ethereum are decentralized systems that are currently receiving a lot of attention both in practice and in research. These systems can not only be used to carry out payment transactions in a decentralized manner, but also to programmatically record and enforce processes between mutually distrustful parties in so-called smart contracts. In particular, security and fairness properties as well as scalability in terms of transaction throughput play a key role.

This course begins with a lecture in which the basics of blockchains and Ethereum in particular are taught and current problems are introduced. After an introduction to the structure and functionality of Ethereum, advanced aspects that are necessary to address current research questions will be covered. The basics of scientific methodology in dealing with decentralized systems are also covered. The basic knowledge imparted in the lecture will be applied and consolidated in the seminar - the second part of the course - through the students' own research work.

The seminar offers the opportunity to work on a self-chosen topic in the field of blockchains and cryptocurrencies, which is facilitated by the previous lecture and direct consultation. The students' task is to find and process literature on the chosen topic and to work on the chosen topic. The results are documented in a paper according to scientific standards and presented in a colloquium.

**Additional Information**

Places are limited. Information about the registration process is given in the first lecture. Registration is usually carried out via CampusPlus or Wiwi-Portal. A listing in one of them indicates that the module is offered in the current term.

**Workload**

6 ECTS = 180 hours

- Lecture attendance and discussion (20 hours)
- Lecture preparation and follow-up (20 hours)
- Literature research (20 hours)
- Implementation of self-chosen project (60 hours)
- Writing a scientific report (60 hours)

**Recommendations**

Knowledge from 'Decentralized Systems: Fundamentals, Modeling, and Applications' [M-INFO-105334] and skills from 'Scientific Methods to Design and Analyze Secure Decentralized Systems' [M-INFO-105780] are of advantage.

**M****5.212 Module: Research Practical Course: Artificial Intelligence & Security [M-INFO-106866]****Coordinators:** Prof. Dr. Christian Wressnegger**Organisation:** KIT Department of Informatics**Part of:** [Informatics](#)**Credits**  
6 CP**Grading**  
graded**Recurrence**  
Each term**Duration**  
1 term**Language**  
English**Level**  
3**Version**  
1

| Mandatory     |                                                                                   |      |             |
|---------------|-----------------------------------------------------------------------------------|------|-------------|
| T-INFO-113759 | <a href="#">Research Practical Course: Artificial Intelligence &amp; Security</a> | 6 CP | Wressnegger |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Qualifikationsziele: Students understand how to interpret results from state-of-the-art research and are able to actively contribute to timely research.

**Lernziele:**

- ← Students know and understand concepts of recent research at the intersection of artificial intelligence and computer security.
- ← Students are able independently research topics and methods in this field of research.
- ← Students understand limits of current approach in computer security research.

**Content**

In this practical course, the students work on a project at the intersection of artificial intelligence, machine learning, and computer security. They come in contact with and participate in timely and state-of-the-art research in this exciting field. In this scope, the students read up on a sub-field, design and implement a learning-based system, and conduct evaluations on real-world data.

Topics include but are not limited to adversarial machine learning, explainability of machine learning in computer security, learning-based attack detection, and vulnerability discovery.

**Workload**

- 140h Project work
- 20h Final report
- 15h Preparation of final presentation
- 5h attendance time (final event)

**M****5.213 Module: Research Practical Course: Explainable Artificial Intelligence [M-INFO-106495]**

**Coordinators:** TT-Prof. Dr. Rudolf Lioutikov  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics Seminars](#)

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                                                |      |           |
|---------------|--------------------------------------------------------------------------------|------|-----------|
| T-INFO-113114 | <a href="#">Research Practical Course: Explainable Artificial Intelligence</a> | 6 CP | Lioutikov |

**Assessment**

See partial achievements (Teilleistung).

**Prerequisites**

See partial achievements (Teilleistung).

**Competence Goal**

Students learn to understand and question complex scientific topics and to reproduce and verify published results. to reproduce and review published results. Students gain in-depth knowledge of interactive learning and experience with the use of novel learning methods.

**Content**

Each student will select a topic in the field of Explainable Artificial Intelligence and study and analyze it in the context of Robot Learning. The organizers will suggest topics but the students are welcome suggest relevant topics. The students will then implement and evaluate several algorithms corresponding to the chosen topic. The experimental evaluation will be documented in a report and presented to their peers.

It is highly recommended to take this research project in combination with the "Explainable Artificial Intelligence" Seminar, where the students get the chance to acquire the required background on the literature.

**Additional Information**

It is only possible to resign within two weeks after assignment of the topic.

**Workload**

Workload = 180h = 6 ECTS

- Attendance time: 15h
- Project work: 135h
- Write scientific report + prepare presentation: 30h

**Recommendations**

We recommend taking this Praktikum after attending the "Explainable Artificial Intelligence" lecture in the summer semester.

We highly recommend to take this research project in combination with the "Explainable Artificial Intelligence" seminar.

- Experience in Machine Learning is recommended, e.g. through prior coursework.
  - The Computer Science Department offers several great lectures e.g., "Maschinelles Lernen - Grundlagen und Algorithmen" and "Deep Learning"
- A good mathematical background will be beneficial
- Python experience is recommended
- We might use the PyTorch deep learning library In the exercises. Some prior knowledge in this is helpful but not necessary.

## M

**5.214 Module: Research Practical Course: Interactive Learning [M-INFO-106300]**

**Coordinators:** TT-Prof. Dr. Rudolf Lioutikov  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each summer term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
2

| Mandatory     |                                                 |      |           |
|---------------|-------------------------------------------------|------|-----------|
| T-INFO-112772 | Research Practical Course: Interactive Learning | 6 CP | Lioutikov |

**Assessment**

See Partial achievements (Teilleistung).

**Prerequisites**

See Partial achievements (Teilleistung).

**Competence Goal**

Students learn to understand and scrutinise complex scientific topics and to reproduce and check published results. and to reproduce and verify published results. Students gain in-depth knowledge in the field of interactive learning and experience with the use of novel learning methods.

**Content**

Each student will select a topic in the field of Interactive Learning and/or Explainable Artificial Intelligence. The organizers will suggest topics but the students are welcome suggest relevant topics. The students will then implement and evaluate several algorithms corresponding to the chosen topic. The experimental evaluation will be documented in a report and presented to their peers.

It is highly recommended to take this research project in combination with the "Interactive Learning" Seminar, where the students get the chance to acquire the required background on the literature.

**Workload**

Workload = 180h = 6 ECTS

- Attendance time: 15h

- Project work: 135h

- Writing scientific report + preparing presentation: 30h

**Recommendations**

We highly recommend to take this research project in combination with the "Interactive Learning" seminar.

It is highly recommended to attend the "Explainable Artificial Intelligence" lecture in parallel or prior to this project.

- Experience in Machine Learning is recommended, e.g. through prior coursework.
  - The Computer Science Department offers several great lectures e.g., "Maschinelles Lernen - Grundlagen und Algorithmen" and "Deep Learning"
- A good mathematical background will be beneficial
- Python experience is recommended
- We might use the PyTorch deep learning library In the exercises. Some prior knowledge in this is helpful but not necessary.



**M****5.215 Module: Research Project (Project, 1st Semester) [M-INFO-105037]**

**Coordinators:** Prof. Dr. Bernhard Beckert  
 Prof. Dr.-Ing. Michael Beigl  
 Prof. Dr. Ralf Reussner

**Organisation:** KIT Department of Informatics

**Part of:** Informatics

**Credits**  
10 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
2 terms

**Language**  
German

**Level**  
4

**Version**  
2

| Mandatory     |                                                             |      |         |
|---------------|-------------------------------------------------------------|------|---------|
| T-INFO-110218 | Research Project (Project, 1st Semester) - Oral Exam        | 3 CP | Beckert |
| T-INFO-110219 | Research Project (Project, 1st Semester) - Presentation     | 3 CP | Beckert |
| T-INFO-110220 | Research Project (Project, 1st Semester) - Project Proposal | 4 CP | Beckert |

**M****5.216 Module: Research Project (Project, 2nd Semester) [M-INFO-105038]**

**Coordinators:** Prof. Dr. Bernhard Beckert  
 Prof. Dr.-Ing. Michael Beigl  
 Prof. Dr. Ralf Reussner

**Organisation:** KIT Department of Informatics

**Part of:** Informatics

**Credits**  
10 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
2 terms

**Language**  
German

**Level**  
4

**Version**  
1

| Mandatory     |                                                                              |      |         |
|---------------|------------------------------------------------------------------------------|------|---------|
| T-INFO-110221 | <a href="#">Research Project (Project, 2nd Semester) - Oral Exam</a>         | 3 CP | Beckert |
| T-INFO-110222 | <a href="#">Research Project (Project, 2nd Semester) - Presentation</a>      | 3 CP | Beckert |
| T-INFO-110223 | <a href="#">Research Project (Project, 2nd Semester) - Scientific Report</a> | 4 CP | Beckert |

M

5.217 Module: Research Project Autonomous Learning Robots [M-INFO-105378]

**Coordinators:** Prof. Dr. Gerhard Neumann  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

|                        |                          |                                       |                           |                            |                   |                     |
|------------------------|--------------------------|---------------------------------------|---------------------------|----------------------------|-------------------|---------------------|
| <b>Credits</b><br>6 CP | <b>Grading</b><br>graded | <b>Recurrence</b><br>Each summer term | <b>Duration</b><br>1 term | <b>Language</b><br>English | <b>Level</b><br>4 | <b>Version</b><br>1 |
|------------------------|--------------------------|---------------------------------------|---------------------------|----------------------------|-------------------|---------------------|

|                  |                                                             |      |         |
|------------------|-------------------------------------------------------------|------|---------|
| <b>Mandatory</b> |                                                             |      |         |
| T-INFO-110861    | <a href="#">Research Project Autonomous Learning Robots</a> | 6 CP | Neumann |

**M****5.218 Module: Research Project Deep Learning for Robotics [M-INFO-107174]**

**Coordinators:** Prof. Dr. Gerhard Neumann  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                             |      |         |
|---------------|-------------------------------------------------------------|------|---------|
| T-INFO-114203 | <a href="#">Research Project Deep Learning for Robotics</a> | 6 CP | Neumann |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students learn to understand and scrutinise complex scientific topics and to reproduce and verify published results. Students gain in-depth knowledge in the field of learning with robots and experience with the use of novel learning methods.

**Content**

Each student has to choose one of the offered topics from the area of deep learning / robot learning / deep reinforcement learning / deep imitation learning. The students need to implement one or several algorithms and evaluate them against available baselines on standard benchmark tasks as well as on (custom-made) physically realistic simulations and/or a real robot platform. The experiments have to be documented in a report. Students will work in teams of 2. It is recommended to take this course together with the seminar "Deep learning for robotics" where the students will acquire the required background on the literature.

**Workload**

Workload: 180h

Attendance time: 15h

Project work: 135h

Writing a report + preparing a presentation: 30h

**Recommendations**

- Experience in Machine Learning is recommended.
- Python experience is recommended
- We will use the PyTorch deep learning library. Some prior knowledge in this is helpful but not necessary.

**M****5.219 Module: Research Project: Generative AI for Autonomous Agents [M-INFO-107163]**

**Coordinators:** Prof. Dr. Gerhard Neumann  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

| Credits | Grading | Recurrence       | Duration | Language | Level | Version |
|---------|---------|------------------|----------|----------|-------|---------|
| 6 CP    | graded  | Each summer term | 1 term   | English  | 4     | 1       |

| Mandatory     |                                                                       |      |         |
|---------------|-----------------------------------------------------------------------|------|---------|
| T-INFO-114189 | <a href="#">Research Project: Generative AI for Autonomous Agents</a> | 6 CP | Neumann |

**Assessment**

See partial achievements (Teilleistung)

**Competence Goal**

Students will learn to understand, question, and reproduce complex scientific topics and published results. They will gain in-depth knowledge in the field of learning for decision making and experience with the application of novel learning methods.

**Content**

This practical research course explores advanced machine learning methods and generative AI such as diffusion models to empower autonomous agents with intelligent decision-making capabilities. Students will delve into:

- Generative Models for Decision Making
- Reinforcement Learning (RL)
- Imitation Learning
- Multi-Agent Systems
- Uncertainty Quantification
- Learning Prediction Models of Physical Processes
- Time-Series Modeling
- Discovery and Inference of Latent Variables

Each student will choose one of the offered topics, implement one or several algorithms, and evaluate them against available baselines using standard benchmark tasks. The course emphasizes hands-on experimentation, requiring students to document their findings in a detailed report. Students will work in teams of two, closely collaborating with their supervisor with the aim of achieving publishable results. This course provides students with their first experience in running a research project in machine learning, including algorithm design, evaluation, benchmarking, deploying algorithms on HPC hardware, and paper writing.

**Workload**

Workload: 180h

Attendance time: 15h

Project work: 135h

Writing a report + preparing a presentation: 30h

**Recommendations**

- Experience in Machine Learning is recommended.
- Python experience is recommended
- We will use the PyTorch deep learning library. Some prior knowledge in this is helpful but not necessary.

## M

**5.220 Module: Research Project: Machine Learning for Autonomous Agents and Decision Making [M-INFO-106871]**

**Coordinators:** Prof. Dr. Gerhard Neumann  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                                                              |      |         |
|---------------|----------------------------------------------------------------------------------------------|------|---------|
| T-INFO-113765 | <a href="#">Research Project: Machine Learning for Autonomous Agents and Decision Making</a> | 6 CP | Neumann |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students will learn to understand, question, and reproduce complex scientific topics and published results. They will gain in-depth knowledge in the field of learning for decision making and experience with the application of novel learning methods.

**Content**

This practical research course explores advanced machine learning methods to empower autonomous agents with intelligent decision-making capabilities. Students will delve into:

- Generative Models for Decision Making
- Reinforcement Learning (RL)
- Imitation Learning
- Multi-Agent Systems
- Uncertainty Quantification
- Learning Prediction Models of Physical Processes
- Time-Series Modeling
- Discovery and Inference of Latent Variables

Each student will choose one of the offered topics, implement one or several algorithms, and evaluate them against available baselines using standard benchmark tasks. The course emphasizes hands-on experimentation, requiring students to document their findings in a detailed report. Students will work in teams of two, closely collaborating with their supervisor with the aim of achieving publishable results. This course provides students with their first experience in running a research project in machine learning, including algorithm design, evaluation, benchmarking, deploying algorithms on HPC hardware, and paper writing.

**Workload**

Workload: 180h

Attendance time: 15h

Project work: 135h

Writing a report + preparing a presentation: 30h

**Recommendations**

- Experience in Machine Learning is recommended.
- Python experience is recommended
- We will use the PyTorch deep learning library. Some prior knowledge in this is helpful but not necessary.

**M****5.221 Module: Research Seminar in Selected Topics in Statistical Learning and Data Science [M-INFO-106813]**

**Coordinators:** Prof. Dr. Nadja Klein  
**Organisation:** KIT Department of Informatics  
**Part of:** [Seminars](#)

| Credits | Grading | Recurrence | Duration | Language | Level | Version |
|---------|---------|------------|----------|----------|-------|---------|
| 3 CP    | graded  | Irregular  | 1 term   | English  | 4     | 1       |

| Mandatory     |                                                                                              |      |       |
|---------------|----------------------------------------------------------------------------------------------|------|-------|
| T-INFO-113674 | <a href="#">Research Seminar in Selected Topics in Statistical Learning and Data Science</a> | 3 CP | Klein |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

- **Report Writing Support:** Master students will receive guidance in developing and writing their reports, including assistance with literature review, research design, data analysis, and result interpretation.
- **Peer Feedback and Collaboration:** The seminar fosters collaboration and peer learning, with participants offering constructive criticism to improve research projects.

**Content**

The Research Seminar provides a platform for advanced Master students, to explore and delve into topics aligned with recent advances in statistical learning and data science.

It is designed for Master students in Computer Science, Mathematics, Econometrics, Techno-Mathematics, Business Informatics, or similar programs seeking to enhance their expertise in the fields of Bayesian statistics, uncertainty quantification, statistical learning and methods for big data.

The seminar aims to foster a collaborative and intellectually stimulating environment where participants can refine their research skills, exchange ideas, and receive feedback on their work.

**Workload**

90h

**Recommendations**

Certified knowledge in Bayesian methods, uncertainty quantification and statistical learning or related methods for big data

**M****5.222 Module: Robotics - Practical Course [M-INFO-107155]**

**Coordinators:** Prof. Dr.-Ing. Tamim Asfour  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each summer term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                            |      |        |
|---------------|--------------------------------------------|------|--------|
| T-INFO-114172 | <a href="#">Practical Course: Robotics</a> | 6 CP | Asfour |

**Assessment**

See partial Achievements (Teilleistung)

**Prerequisites**

See partial Achievements (Teilleistung)

**Competence Goal**

The student knows concrete solutions for different problems in robotics. He/she uses methods of inverse kinematics, grasp and motion planning, and visual perception. The student can implement solutions in the programming languages C++ and Python with the help of suitable software frameworks.

**Content**

The practical course is offered as an accompanying course to the lectures Robotics I-III. Every week, a small team of students will work on solving a given robotics problem. The list of topics includes robot modeling and simulation, inverse kinematics, robot programming via state charts, collision-free motion planning, grasp planning, robot vision and robot learning.

**Workload**

Practical course with 4 SWS, 6 LP  
 6 LP corresponds to 180 hours, including  
 2 hours introductory event  
 18 hours initial familiarization with the software framework  
 120 hours group work  
 40 hours attendance time

**Recommendations**

Attending the lectures Robotics I – Introduction to Robotics, Robotics II: Humanoid Robotics, Robotics III - Sensors and Perception in Robotics and Mechano-Informatics and Robotics is recommended.



**M****5.223 Module: Robotics I - Introduction to Robotics [M-INFO-107162]**

**Coordinators:** Prof. Dr.-Ing. Tamim Asfour  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                       |      |        |
|---------------|---------------------------------------|------|--------|
| T-INFO-114190 | Robotics I - Introduction to Robotics | 6 CP | Asfour |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

The students are able to apply the presented concepts to simple and realistic tasks from robotics. This includes mastering and deriving the mathematical concepts relevant for robot modeling. Furthermore, the students master the kinematic and dynamic modeling of robot systems, as well as the modeling and design of simple controllers. The students know the algorithmic basics of motion and grasp planning and can apply these algorithms to problems in robotics. They know algorithms from the field of image processing and are able to apply them to problems in robotics. They are able to model and solve tasks as a symbolic planning problem. The students have knowledge about intuitive programming procedures for robots and know procedures for programming and learning by demonstration.

**Content**

The lecture provides an overview of the fundamentals of robotics using the examples of industrial robots, service robots and autonomous humanoid robots. An insight into all relevant topics is given. This includes methods and algorithms for robot modeling, control and motion planning, image processing and robot programming. First, mathematical basics and methods for kinematic and dynamic robot modeling, trajectory planning and control as well as algorithms for collision-free motion planning and grasp planning are covered. Subsequently, basics of image processing, intuitive robot programming especially by human demonstration and symbolic planning are presented.

In the exercise, the theoretical contents of the lecture are further illustrated with examples. Students deepen their knowledge of the methods and algorithms by independently working on problems and discussing them in the exercise. In particular, students can gain practical programming experience with tools and software libraries commonly used in robotics.

**Workload**

Lecture with 3 SWS + 1 SWS Tutorial, 6 LP  
 6 LP corresponds to 180 hours, including  
 $15 \cdot 3 = 45$  hours attendance time (lecture)  
 $15 \cdot 1 = 15$  hours attendance time (tutorial)  
 $15 \cdot 6 = 90$  hours self-study and exercise sheets  
 30 hours preparation for the exam

## M

**5.224 Module: Robotics II - Humanoid Robotics [M-INFO-107123]**

**Coordinators:** Prof. Dr.-Ing. Tamim Asfour  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Each summer term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                 |      |        |
|---------------|---------------------------------|------|--------|
| T-INFO-114152 | Robotics II - Humanoid Robotics | 3 CP | Asfour |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students can explain the challenges and goals of humanoid robotics research, particularly regarding the implementation of complex sensorimotor and cognitive abilities in humanoid robots. They are familiar with the history of the field and understand how biomechanical models of the human body inform humanoid robot design.

Students have comprehensive knowledge of human and robotic grasping and manipulation. They can analyze human grasping and manipulation strategies, understand taxonomies, and evaluate different computational approaches for grasping and manipulation. They understand the challenges in transferring concepts from human studies to humanoid robots.

Students understand fundamentals of learning from human demonstration and imitation learning. They can explain the learning from demonstration cycle and methods for learning generalized task representation, especially task constraints from demonstrations, and how learned behaviors are reproduced on robots.

Students can describe cognitive and AI-based architectures for humanoid robots, including approaches to address the signal-to-symbol gap and human-inspired memory architectures that enable intelligent robot behavior.

**Content**

This lecture addresses the implementation of complex sensorimotor and cognitive abilities in humanoid robots, with humans serving as inspiration. The lecture begins by addressing the motivation for humanoid robotics. The history of humanoid robotics and biomechanical models of the human body that inform robot design are covered, along with some mechatronic principles underlying humanoid robot systems.

The first main topic comprehensively addresses grasping and manipulation. After covering fundamentals, the lecture discusses neuroscientific insights and concepts like grasp phases and grasping synergies to reduce control complexity. Taxonomies are presented as structured frameworks for understanding the space of possible constraints in grasping and manipulation. The lecture addresses computational approaches for grasping known, familiar, and unknown objects, covering both classical methods and modern learning-based approaches using deep learning and vision-language-action models.

The second main topic covers learning from demonstration and imitation learning. After introducing the topic, fundamentals are presented including the learning from demonstration cycle. The lecture emphasizes learning task models on both symbolic/semantic and subsymbolic/sensorimotor levels. While methods for capturing human demonstrations are briefly covered, the focus is on semantic segmentation of human demonstrations and learning of task constraints that capture the task and allow generalization. Movement primitives are presented as efficient representations that allow robots to generalize learned behaviors to new situations.

The lecture concludes with cognitive and AI-based architectures for humanoid robots, discussing state-of-the-art approaches, methods to address the signal-to-symbol gap, and human-inspired memory architectures that enable intelligent robot behavior.

**Workload**

Lecture with 2 SWS, 3 ECTS.

3 ECTS corresponds to approx. 90 hours, thereof:

approx. 15 \* 2h = 30h attendance time

approx. 15 \* 2h = 30h self-study prior/after the lecture

approx. 30h preparation for the exam and exam itself

**Recommendations**

Having visited the lecture on Robotics I – Introduction to Robotics is recommended

## M

**5.225 Module: Robotics III - Sensors and Perception in Robotics [M-INFO-107130]**

**Coordinators:** Prof. Dr.-Ing. Tamim Asfour  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

| Credits | Grading | Recurrence       | Duration | Language | Level | Version |
|---------|---------|------------------|----------|----------|-------|---------|
| 3 CP    | graded  | Each summer term | 1 term   | English  | 4     | 1       |

| Mandatory     |                                                   |      |        |
|---------------|---------------------------------------------------|------|--------|
| T-INFO-114155 | Robotics III - Sensors and Perception in Robotics | 3 CP | Asfour |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students can explain the main sensor principles used in robotics and distinguish between proprioceptive sensors (encoders, force/torque sensors, IMUs) and exteroceptive sensors (proximity, range, visual, and tactile sensors). They understand and can characterize sensor properties such as resolution, range, accuracy, and bandwidth, and can explain the principles of analog-to-digital conversion. Students are able to propose, analyze, and justify suitable sensor concepts for specific robotic tasks, taking into account trade-offs between different sensor modalities.

Students can apply fundamental perception methods for robotic applications. This includes robot vision techniques such as feature detection and matching, object detection and recognition, and semantic segmentation, including deep learning-based approaches. They can describe and analyze perception methods for manipulation tasks, including object pose estimation, grasp detection, active vision strategies, and haptic exploration. In addition, students can explain point cloud processing methods for registration and surface reconstruction, as well as principles of simultaneous localization and mapping (SLAM).

**Content**

This lecture complements the lecture "Robotics I" and provides a comprehensive overview of sensors and perception methods in robotics. It is divided into two main parts.

The first part introduces fundamental concepts of perception in robotics, including the distinction between sensation and perception within the perception-cognition-action loop. It covers sensor fundamentals, such as sensor characteristics (resolution, range, accuracy, bandwidth), analog-to-digital conversion, and common sensor classification schemes. Proprioceptive sensors for measuring the robot's internal state are discussed, including encoders (optical, magnetic, absolute, and incremental), force/torque sensors, and inertial measurement units (IMUs). The lecture then covers exteroceptive sensors, including proximity sensors, range sensors (LiDAR, time-of-flight cameras, ultrasonic sensors), visual sensors (monocular, stereo, RGB-D cameras), and tactile sensing technologies (capacitive, resistive, and optical).

The second part focuses on processing and interpreting sensor data. Topics in robot vision include image representation, feature detection and matching, object detection and recognition, semantic segmentation, and corresponding deep learning approaches. Point cloud processing is covered with emphasis on data structures, registration, surface reconstruction, and semantic segmentation. The lecture also addresses perception for manipulation, covering object pose estimation, grasp detection, visual servoing, active vision, and haptic exploration. It concludes with the simultaneous localization and mapping (SLAM) problem, including EKF SLAM, Graph SLAM, and FastSLAM.

**Workload**

Lecture with 2 SWS, 3 ECTS.

3 ECTS corresponds to approx. 90 hours, thereof:

approx. 15 \* 2h = 30h attendance time

approx. 15 \* 2h = 30h self-study prior/after the lecture

approx. 30h preparation for the exam and exam itself

**Recommendations**

Having visited the lectures on Robotics I – Introduction to Robotics is recommended.

**M****5.226 Module: Robotics Institute Germany - Lecture Series [M-INFO-107598]**

**Coordinators:** Prof. Dr.-Ing. Tamim Asfour  
 TT-Prof. Dr. Barbara Bruno  
 Prof. Dr. Jan Niehues

**Organisation:** KIT Department of Informatics

**Part of:** [Informatics](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                             |      |                        |
|---------------|-------------------------------------------------------------|------|------------------------|
| T-INFO-114895 | <a href="#">Robotics Institute Germany - Lecture Series</a> | 3 CP | Asfour, Bruno, Niehues |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students can discuss the foundations of various open research directions related to AI-powered robotics, as well as their open challenges, relevant findings/breakthroughs and state-of-the-art approaches.

**Content**

The course is structured as an inter-institutional lecture series, concurrently offered by various German institutions affiliated with the Robotics Institute Germany (RIG). In the lecture series students are offered an overview of significant open research directions related to AI-powered robotics by leading figures in the field. The lecturers are affiliated with various RIG partner institutions and students from various RIG partner institutions attend the lectures remotely. The lectures cover topics such as cognitive robotics, robot learning, robot perception, manipulation, natural interaction and communication with robots, human-robot interaction, soft robotics and responsible robotics. The exposure to top researchers in the field from different German institutions and the possibility of exchanges with students from other German universities are unique opportunities offered by this lecture series.

**Workload**

Lecture series with 2 SWS, 3 LP. 3 LP corresponds to approx. 90 hours, of which: approx. 22.5 hrs. of compulsory attendance  
 approx. 45 hours of literature research approx. 22.5 hrs. exam preparation

**Recommendations**

Knowledge of the content of module Robotics I - Introduction to Robotics is helpful.

## M

**5.227 Module: Safe Human-Robot-Collaboration [M-INFO-104877]**

**Coordinators:** Prof. Dr.-Ing. Tamim Asfour  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
German

**Level**  
4

**Version**  
1

**Mandatory**

|               |                                                |      |       |
|---------------|------------------------------------------------|------|-------|
| T-INFO-109911 | <a href="#">Safe Human-Robot-Collaboration</a> | 3 CP | Kurth |
|---------------|------------------------------------------------|------|-------|

**Competence Goal**

You will get familiar with the various forms of human-robot collaboration (HRC) and their respective advantages. You will understand the requirements of the Machinery Directive and the relevant standards for the safety of HRC applications. Participants will be able to identify risks and to develop a safety concept for HRC systems.

Course objectives:

- Successful participants are familiar with all relevant aspects of human-robot collaboration, from the planning to the implementation of an HRC application as well as the requirements for safety.
- Successful participants understand the process of risk assessment, the importance of functional safety and predictable misuse.
- Successful participants will understand the different safety functions of robots and their use to reduce the risk to an acceptable residual risk and know to use complementary safety light curtains and laser scanners.
- The participants will know what has to be considered in designing a HRC system and can create a safety concept for this system and check it for completeness.

**Content**

- Introduction and fundamentals of Human-Robot Collaboration (HRC)
  - Different forms of HRC and differentiation to full automation
  - Practical examples from series applications
    - Advantages of HRC compared to full automation with robots
  - Definition of safety
    - Machinery Directive / Standards
    - Declaration of incorporation / CE conformity
    - Safety Levels
    - Safety requirements in robotics
  - Potential hazards in human-robot collaboration
    - bump and squeeze
    - Foreseeable misuse
    - Error in the application
  - "Safe (?) Robots"
    - Requirements for collaborative operation according to ISO 10218-1
    - Overview of robots and their security concepts
    - Safely supervised robots
    - Gray technology / yellow technology in the robot controller
    - Safety functions based on position values and on force / torque values
  - Safe HRC-Applications
    - Risk assessment
    - HRC cell layout
    - Design of HRC end effectors, peripherals
    - Use of safety features
    - Examples of industrial HRC-solutions
  - From planning to the realization of HRC systems
    - HRC compliant engineering
    - Detailing of the HRC concept in the design phase
    - Programming and validation
    - Measurements demonstrating compliance with biomechanical limits
  - Biomechanical limits
    - TS 15022
    - transient and quasi-static contact
    - body atlas with limits
  - Safe sensor technology for safeguards
    - Basics
    - Laser scanners
    - Light curtains
    - Tactile sensors
    - Safe vision systems
    - Planning and design of safeguards
- Reaction time from the triggering event to the robot reaction
- Necessary safety distances for effectiveness of safeguards
- Safety in mobile robotics



## 5.228 Module: Sampling Methods for Machine Learning [M-INFO-107090]

**Coordinators:** Prof. Dr.-Ing. Uwe Hanebeck  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each summer term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                              |      |          |
|---------------|--------------------------------------------------------------|------|----------|
| T-INFO-114133 | <a href="#">Sampling Methods for Machine Learning</a>        | 6 CP | Hanebeck |
| T-INFO-114134 | <a href="#">Sampling Methods for Machine Learning - Pass</a> | 0 CP | Hanebeck |

### Assessment

See partial achievements (Teilleistung)

### Prerequisites

See partial achievements (Teilleistung)

### Competence Goal

Students will understand and be able to implement various sampling techniques, from basic random number generation to advanced methods like normalizing flows. They will develop the ability to evaluate sampling quality, optimize procedures, and select appropriate methods for specific machine learning tasks. Graduates will be capable of independently developing sampling solutions for complex problems and critically assessing different approaches. Their comprehensive understanding will enable them to engage with current developments in the field and apply their knowledge effectively in both research and practical applications. This will be supported via a digital exercise.

### Content

Sample-based inference is the de-facto standard for solving otherwise infeasible problems in machine learning, estimation, and control under (unavoidable) uncertainties. Thus, it is an important foundation for further studies. This lecture gives a thorough overview of state-of-the-art sampling methods and discusses current developments from the research frontier.

The first part shows how to efficiently sample large numbers of random samples from given densities starting with the special cases of uniform and Gaussian distributions. For sampling from arbitrary densities, important techniques such as inverse transform sampling, Knothe-Rosenblatt maps, Markov chain Monte Carlo, normalizing flows, and Langevin equations are introduced.

The second part is concerned with deterministic or low-discrepancy sampling, where the goal is to find a set of representative samples of a given density. These are usually obtained by optimization, which, in contrast to random samples, leads to good coverage, high homogeneity, and reproducible results. To analyze and synthesize such samples, various statistical tests and discrepancy measures are presented. This includes scalar tests such as the Cramér-von Mises test, Kolmogorov-Smirnov test, and multivariate generalizations based on Localized Cumulative Distributions and Stein discrepancy.

Finally, advanced topics such as importance sampling and sampling from the posterior density in a Bayesian update are discussed. Typical applications of sample-based inference include Bayesian neural networks, information fusion, and reinforcement learning.

### Workload

Per week:  
 2 SWS Presence  
 2h Follow-up  
 6h Digital exercise with programming tasks  
 2h Exam preparation  
 = 12h/week und 180h/semester

### Recommendations

Knowledge of a higher programming language with sophisticated libraries for scientific-numerical computing (e.g. Julia, Matlab, Python) is advantageous.



**M****5.229 Module: Scientific Methods to Design and Analyze Secure Decentralized Systems [M-INFO-105780]**

**Coordinators:** Prof. Dr. Hannes Hartenstein  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
5 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                                       |      |             |
|---------------|-----------------------------------------------------------------------|------|-------------|
| T-INFO-111568 | Scientific Methods to Design and Analyze Secure Decentralized Systems | 5 CP | Hartenstein |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

1. Philosophy of Science: The student understands epistemological principles like the scientific and mathematical process, within the context of networked and decentralized systems. The student knows about the current limits of scientific research, especially in regards to the security of a given decentralized system.
2. Empirical Methods: Observation / Monitoring: The student is able to construct setups to monitor system properties related to performance or security. The student knows how to observe a decentralized system like an overlay network without interference, i.e., without impact on the behavior to measure as well as the overall system functionality.
3. Combined Empirical / Formal Methods: The student has a fundamental understanding of Discrete Event Simulations, as well as stochastic modelling and random number generation. The student is able to conduct a simulation study consisting of observation, modelling, simulation, validation, and result analysis.
4. Formal Methods: The student knows how to apply formal methods like formal verification / model checking and model comparison / simulation-based proofs to decentralized systems. The student understands tradeoffs between empirical and formal methods, and can choose suitable methods for given research tasks.
5. Applications in Research: The student understands how the methods of this lecture are applied to practical examples, and knows how to apply the methods on problems of a researcher's everyday life.

**Content**

Decentralized Systems (like peer-to-peer- or blockchain-based systems) are systems controlled by multiple parties who make their own independent decisions to reach a common goal. However, not knowing which parties are trustworthy and which are betrayers requires a radically different way of thinking. Based on the lecture "Decentralized Systems: Fundamentals, Modeling, and Applications", in this lecture, we cover the necessary scientific methods to analyze existing and to create new decentralized systems. We treat both, selected empirical and formal methods and their tradeoffs, as well as the overarching philosophy of science behind the research process. Together with its practical parts, this lecture provides the foundational scientific toolbox to work on the decentralized systems of the future.

**Workload**

1. Attendance time (Course, exercise.): 3 SWS: 15 x 3h = 45h
  2. Self-study (e.g. independent review of course material, work on homework assignments)  
Weekly preparation and follow-up of the lecture/exercise: 15 x 3 SWS x 1,5h = 67,5hh
  3. Preparation for the exam: 37,5h
- $\Sigma = 150h = 5$  ECTS

**Recommendations**

Prior knowledge on the abstract concepts as well as concrete use cases of decentralized systems is strongly recommended. The "Decentralized Systems: Fundamentals, Modeling, and Applications" lecture covers all necessary aspects, but equivalent lectures and / or self-study can also be sufficient.

**M****5.230 Module: Selected Aspects in Real-time Systems [M-INFO-107431]**

**Coordinators:** Prof. Dr.-Ing. Thomas Längle  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
German

**Level**  
3

**Version**  
2

| Mandatory     |                                                       |      |        |
|---------------|-------------------------------------------------------|------|--------|
| T-INFO-114599 | <a href="#">Selected Aspects in Real-time Systems</a> | 3 CP | Längle |

## M

**5.231 Module: Seminar Decentralized Systems and Network Services [M-INFO-103048]****Coordinators:** Prof. Dr. Hannes Hartenstein**Organisation:** KIT Department of Informatics**Part of:** [Seminars](#)**Credits**  
3 CP**Grading**  
graded**Recurrence**  
Irregular**Duration**  
1 term**Language**  
German**Level**  
4**Version**  
1

| Mandatory     |                                                                    |      |             |
|---------------|--------------------------------------------------------------------|------|-------------|
| T-INFO-106064 | <a href="#">Seminar Decentralized Systems and Network Services</a> | 3 CP | Hartenstein |



## 5.232 Module: Seminar Dependable Computing [M-INFO-102662]

**Coordinators:** Prof. Dr. Mehdi Baradaran Tahoori

**Organisation:** KIT Department of Informatics

**Part of:** [Seminars](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                              |      |         |
|---------------|----------------------------------------------|------|---------|
| T-INFO-105577 | <a href="#">Seminar Dependable Computing</a> | 3 CP | Tahoori |

### Assessment

See partial achievements (Teilleistung)

### Prerequisites

See partial achievements (Teilleistung)

### Competence Goal

The objective of this seminar is to become familiar with general and state of the art techniques used in design and analysis of fault-tolerant digital systems.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

### Content

Reliability plays a major role in design of contemporary and next generation electronics. In many safety-critical application domains, reliability is considered as the main design criteria. With nanoscale technologies, the reliability of individual devices is decreasing, therefore, reliable computing must be considered in the design flow in order to ensure correctness of computing.

The objective of this seminar is to become familiar with general and state of the art techniques used in design and analysis of fault-tolerant digital systems. This seminar overviews reliable (fault-tolerant) computing and the design and evaluation of dependable systems, and provides a base for research in reliable systems.

The topics include study and investigation of existing and classical fault-tolerant systems as well as current trend in the research of reliable computing. Since reliability spans from hardware to software, and from device-level to system-level, various topics can be envisioned in the scope of this seminar and the prospective students can choose specific topic from a wide range of areas based on their interests and background.

### Workload

4 SWS / 3CP = 90h/week

### Recommendations

Knowledge of "Fault Tolerant Computing" and Computer Architecture is helpful.

M

5.233 Module: Seminar Hot Topics in Networking [M-INFO-100746]

Coordinators:

Prof. Dr. Martina Zitterbart

Organisation:

KIT Department of Informatics

Part of:

Seminars

|         |         |            |          |          |       |         |
|---------|---------|------------|----------|----------|-------|---------|
| Credits | Grading | Recurrence | Duration | Language | Level | Version |
| 3 CP    | graded  | Each term  | 1 term   | English  | 4     | 1       |

|               |                                  |      |            |
|---------------|----------------------------------|------|------------|
| Mandatory     |                                  |      |            |
| T-INFO-101283 | Seminar Hot Topics in Networking | 3 CP | Zitterbart |

## M

**5.234 Module: Seminar Image Analysis and Fusion [M-INFO-102375]**

**Coordinators:** Prof. Dr.-Ing. Jürgen Beyerer  
**Organisation:** KIT Department of Informatics  
**Part of:** [Seminars](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Each summer term

**Duration**  
1 term

**Language**  
German

**Level**  
4

**Version**  
1

| Mandatory     |                                                   |      |         |
|---------------|---------------------------------------------------|------|---------|
| T-INFO-104743 | <a href="#">Seminar Image Analysis and Fusion</a> | 3 CP | Beyerer |



## 5.235 Module: Seminar in Privacy [M-INFO-107242]

**Coordinators:** Prof. Dr. Thorsten Strufe  
**Organisation:** KIT Department of Informatics  
**Part of:** [Seminars](#)

**Credits**  
4 CP

**Grading**  
graded

**Recurrence**  
Each summer term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                    |      |        |
|---------------|------------------------------------|------|--------|
| T-INFO-114268 | <a href="#">Seminar in Privacy</a> | 4 CP | Strufe |

### Assessment

See partial achievements (Teilleistung)

### Prerequisites

See partial achievements (Teilleistung)

### Competence Goal

The seminar deals with current topics from the research field of technical data protection.

These include, for example:

- Attacks on private information in behavioral data
- Anonymous communication
- Publication of anonymized usage data (semantic/syntactic privacy)
- Understanding and supporting the use of online media
- Security in networks

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

### Content

The student is able to

- carry out a literature search based on a given topic, identify and evaluate the relevant literature;
- independently compile research results from IT security and technical data protection;
- analyze and discuss scientific studies and place them in their context;
- carry out their own classifications and evaluations of scientific studies, report on them in writing and present the results in a short scientific presentation.

### Workload

Workload attendance time in the seminar: 10h

Research and preparation of a paper: 75h

Reviewing and commenting on the preliminary papers of fellow students: 5h

Preparing the presentation: 30h

### Recommendations

Fundamentals of IT security, computer networks and distributed systems are required

**M****5.236 Module: Seminar Information Systems [M-WIWI-104815]**

**Coordinators:** Studiendekan der KIT-Fakultät für Informatik  
Studiendekan des KIT-Studienganges

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

**Part of:** [Seminars](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
1 term

**Language**  
German

**Level**  
1

**Version**  
1

| Mandatory     |                                                         |      |                                                                                     |
|---------------|---------------------------------------------------------|------|-------------------------------------------------------------------------------------|
| T-WIWI-109827 | <a href="#">Seminar in Information Systems (Master)</a> | 3 CP | Studiendekan der KIT-Fakultät für Informatik,<br>Studiendekan des KIT-Studienganges |

**Assessment**

The assessment is done by a seminar with at least 3 CP.

The assessment of the seminar (following §4(2), 3 ER) is described at the course description.

**Prerequisites**

None.

**Competence Goal**

Students:

- Can independently engage with a current, research-oriented question according to scientific criteria.
- Are able to conduct research, analyze, abstract, and critically evaluate information.
- Can draw their own conclusions from loosely structured information by integrating their interdisciplinary knowledge and selectively further develop current research findings.
- Are capable of validating their obtained results and presenting them logically and systematically in written and oral form, adhering to scientific working methods (structure, specialized terminology, referencing). In doing so, they can argue professionally and defend their findings in discussions with experts.
- Are familiar with the DFG Code "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines when producing their scientific work.

**Content**

The module consists of a seminar, that is related to the research field of economic sciences. A complete list of available seminars is published in the internet.

In addition to the seminar, the module emphasizes the importance of adhering to high standards of research ethics. As part of this commitment, students are required to familiarize themselves with the **DFG Code "Guidelines for Safeguarding Good Research Practice."** This training is offered through the [online course "Good Scientific Practice"](#) provided by the KIT Library, which can be completed through self-study at the student's convenience.



**Additional Information**

The seminar titles listed in the module handbook are to be understood as placeholders. The seminars currently offered for each semester are announced in the course catalog and on the institutes' websites. As a rule, the current seminar topics for each semester are announced at the end of the previous semester. When planning the seminar module, please note that registration for some seminars is required by the end of the previous semester. The WIWI-seminars for a semester and the available seminar places are published in the WiWi-Portal at <https://portal.wiwi.kit.edu> at approximately the same time as the course catalog for that semester.

**Allocation of places in the seminar module:**

A number of individual seminars are offered for the seminar module each semester and in all subjects. While it can happen that the demand for individual seminars - as well as for individual seminar topics within a seminar - exceeds the available places, there are always enough seminar places and topics to cover the entire demand. Applications are therefore not usually made for just "one" seminar, but for several in parallel.

Students with a high level of academic progress (measured by the number of credit points) who are likely to have difficulty finding a seminar place can contact the Examinations Office with a note of urgency (ideally before the start of the upcoming seminar allocation round). They will find support there in order to obtain a suitable seminar place quickly.

Selection criteria for the allocation of places and topics in individual seminars are announced on the respective event website. As a rule, places are allocated via the WIWI portal at <https://portal.wiwi.kit.edu/>. The thematic allocation is based on preferences and suitability for the topics. Among other things, professional and practical experience in the subject area and, if applicable, foreign language skills play a role.

The Informatics seminars offered by the Institute AIFB can be taken in module M-INFO-102822 "Seminar Informatics" (T-WIWI-103480 "Seminar Informatics B (Master)").

**Workload**

The total workload for this module is approximately 90 hours.

**M****5.237 Module: Seminar Laboratory: Machine Learning and Intelligent Systems [M-INFO-105959]****Coordinators:** Prof. Dr.-Ing. Uwe Hanebeck**Organisation:** KIT Department of Informatics**Part of:** [Informatics](#)**Credits**  
3 CP**Grading**  
graded**Recurrence**  
Each summer term**Duration**  
1 term**Language**  
German**Level**  
4**Version**  
1

| Mandatory     |                                                                              |      |                  |
|---------------|------------------------------------------------------------------------------|------|------------------|
| T-INFO-112105 | <a href="#">Seminar Laboratory: Machine Learning and Intelligent Systems</a> | 3 CP | Fennel, Hanebeck |

**M****5.238 Module: Seminar Module Applied Informatics [M-WIWI-107692]**

**Coordinators:** Professorenschaft des Instituts AIFB  
**Organisation:** KIT Department of Informatics  
 KIT Department of Business and Economics  
**Part of:** [Seminars](#)

| Credits | Grading | Recurrence | Duration | Language       | Level | Version |
|---------|---------|------------|----------|----------------|-------|---------|
| 3 CP    | graded  | Each term  | 1 term   | German/English | 3     | 1       |

| Mandatory     |                                                   |      |                                      |
|---------------|---------------------------------------------------|------|--------------------------------------|
| T-WIWI-103479 | <a href="#">Seminar in Informatics A (Master)</a> | 3 CP | Professorenschaft des Instituts AIFB |

**Assessment**

The module examination is carried out by providing evidence of a seminar worth 3 credit points as a different type of examination (in accordance with §4(2), 3 SPO). The assessment of success is described in the corresponding course of this module.

**Prerequisites**

None

**Competence Goal**

The student

- deals with a defined problem in the field of applied informatics,
- analyzes and discusses problems within the framework of the courses and in the final seminar papers,
- discusses, presents and defends subject-specific arguments within a given task,
- organizes the preparation of the final seminar papers largely independently.
- Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and actively apply these guidelines in the preparation of their scientific work.

The skills acquired in the seminar module serve in particular as preparation for the Master's thesis. Accompanied by the relevant examiners, students practise independent academic work when writing and presenting their final seminar papers.

**Content**

The module consists of a seminar that deals scientifically with topics of applied informatics.

The DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" is taught as part of the [online course "Good Scientific Practice"](#) of the KIT library, which can be completed in self-study.

**Workload**

The total workload for this seminar is approximately 90 hours. This is composed of the following:

**1. Attendance Time (approx. 30 hours):**

- Regular participation in seminar sessions (presentations, discussions, peer-review sessions).
- Introductory session and, if applicable, supplementary workshop units.

**2. Self-Study (approx. 60 hours):**

- **Literature research and induction (approx. 20 hours):** Searching for relevant specialist literature and exploring the specific topic area.
- **Preparation of the seminar performance (approx. 30 hours):** Writing the seminar paper or preparing the presentation materials.
- **Presentation preparation (approx. 10 hours):** Didactic preparation of the topic and practicing the presentation.

**Teaching and Learning Methods**

Seminar

**M****5.239 Module: Seminar Module Economic Sciences [M-WIWI-102736]**

**Coordinators:** Studiendekan des KIT-Studienganges  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [Seminars](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
1 term

**Language**  
German

**Level**  
1

**Version**  
1

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

|               |                                                               |      |                                                             |
|---------------|---------------------------------------------------------------|------|-------------------------------------------------------------|
| T-WIWI-103474 | <a href="#">Seminar in Business Administration A (Master)</a> | 3 CP | Professorenschaft des Fachbereichs Betriebswirtschaftslehre |
| T-WIWI-103478 | <a href="#">Seminar in Economics A (Master)</a>               | 3 CP | Professorenschaft des Fachbereichs Volkswirtschaftslehre    |
| T-WIWI-103481 | <a href="#">Seminar in Operations Research A (Master)</a>     | 3 CP | Nickel, Rebennack, Stein                                    |
| T-WIWI-103483 | <a href="#">Seminar in Statistics A (Master)</a>              | 3 CP | Grothe, Schienle                                            |

**Assessment**

The assessment is done by a seminar with at least 3 CP.

The assessment of the seminar (following §4(2), 3 ER) is described at the course description.

**Prerequisites**

None.

**Competence Goal**

Students:

- Can independently engage with a current, research-oriented question according to scientific criteria.
- Are able to conduct research, analyze, abstract, and critically evaluate information.
- Can draw their own conclusions from loosely structured information by integrating their interdisciplinary knowledge and selectively further develop current research findings.
- Are capable of validating their obtained results and presenting them logically and systematically in written and oral form, adhering to scientific working methods (structure, specialized terminology, referencing). In doing so, they can argue professionally and defend their findings in discussions with experts.
- Are familiar with the DFG Code "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines when producing their scientific work.

**Content**

The module consists of a seminar, that is related to the research field of economic sciences. A complete list of available seminars is published in the internet.

The teaching of the DFG Code "Guidelines for Safeguarding Good Research Practice" takes place within the [online course "Good Scientific Practice"](#) of the KIT Library, which can be completed in self-study.

**Additional Information**

The seminar titles listed in the module handbook are to be understood as placeholders. The seminars currently offered for each semester are announced in the course catalog and on the institutes' websites. As a rule, the current seminar topics for each semester are announced at the end of the previous semester. When planning the seminar module, please note that registration for some seminars is required by the end of the previous semester. The WIWI-seminars for a semester and the available seminar places are published in the WiWi-Portal at <https://portal.wiwi.kit.edu> at approximately the same time as the course catalog for that semester.

**Allocation of places in the seminar module:**

A number of individual seminars are offered for the seminar module each semester and in all subjects. While it can happen that the demand for individual seminars - as well as for individual seminar topics within a seminar - exceeds the available places, there are always enough seminar places and topics to cover the entire demand. Applications are therefore not usually made for just "one" seminar, but for several in parallel.

Selection criteria for the allocation of places and topics in individual seminars are announced on the respective event website. As a rule, places are allocated via the WIWI portal at <https://portal.wiwi.kit.edu/>. The thematic allocation is based on preferences and suitability for the topics. Among other things, professional and practical experience in the subject area and, if applicable, foreign language skills play a role.

The Informatics seminars offered by the Institute AIFB can be taken in module M-INFO-102822 "Seminar Informatics" (T-WIWI-103480 "Seminar Informatics B (Master)").

**Workload**

The total workload for this module is approximately 90 hours.

**M****5.240 Module: Seminar Module Law Master [M-INFO-107671]**

**Coordinators:** Dr. Yvonne Matz  
**Organisation:** KIT Department of Informatics  
**Part of:** [Seminars](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
1 term

**Language**  
German

**Level**  
1

**Version**  
1

| Mandatory     |                                                 |      |                                          |
|---------------|-------------------------------------------------|------|------------------------------------------|
| T-INFO-115025 | <a href="#">Seminar: Legal Studies Master I</a> | 3 CP | Professorenschaft des Fachbereichs Recht |

**Competence Goal**

The student

- deals with a defined problem in the field of law,
- analyzes and discusses problems within the framework of the courses and in the final seminar papers,
- discusses, presents and defends subject-specific arguments within a given task,
- organizes the preparation of the final seminar papers largely independently.

The skills acquired in the seminar module serve in particular as preparation for the Bachelor's thesis. Accompanied by the relevant examiners, the student practises independent scientific work when writing the final seminar papers and presenting them.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines when writing their scientific work.

**Content**

The module consists of a seminar that is thematically related to law. A list of approved courses will be published on the Internet.

**M****5.241 Module: Seminar: Designing and Conducting Experimental Studies [M-INFO-103078]**

**Coordinators:** Prof. Dr.-Ing. Michael Beigl  
**Organisation:** KIT Department of Informatics  
**Part of:** [Seminars](#)

**Credits**  
4 CP

**Grading**  
graded

**Recurrence**  
Irregular

**Duration**  
1 term

**Language**  
German

**Level**  
4

**Version**  
1

| Mandatory     |                                                                        |      |       |
|---------------|------------------------------------------------------------------------|------|-------|
| T-INFO-106112 | <a href="#">Seminar: Designing and Conducting Experimental Studies</a> | 4 CP | Beigl |

**M****5.242 Module: Seminar: Advanced Algorithms in Computer Graphics [M-INFO-102729]****Coordinators:** Prof. Dr.-Ing. Carsten Dachsbacher**Organisation:** KIT Department of Informatics**Part of:** [Seminars](#)**Credits**  
3 CP**Grading**  
graded**Recurrence**  
Each winter term**Duration**  
1 term**Language**  
German**Level**  
4**Version**  
1

| Mandatory     |                                                                   |      |             |
|---------------|-------------------------------------------------------------------|------|-------------|
| T-INFO-105664 | <a href="#">Seminar: Advanced Algorithms in Computer Graphics</a> | 3 CP | Dachsbacher |





## 5.243 Module: Seminar: Advanced Topics in Natural Language Processing [M-INFO-107353]

**Coordinators:** Prof. Dr. Jan Niehues  
**Organisation:** KIT Department of Informatics  
**Part of:** [Seminars](#)

| Credits | Grading | Recurrence | Duration | Language | Level | Version |
|---------|---------|------------|----------|----------|-------|---------|
| 3 CP    | graded  | Each term  | 1 term   | English  | 4     | 1       |

| Mandatory     |                                                                         |      |         |
|---------------|-------------------------------------------------------------------------|------|---------|
| T-INFO-114433 | <a href="#">Seminar: Advanced Topics in Natural Language Processing</a> | 3 CP | Niehues |

### Assessment

See partial achievements (Teilleistung)

### Prerequisites

See partial achievements (Teilleistung)

### Competence Goal

Students learn to familiarise themselves independently with topics based on scientific literature and prepare them for presentations.

From the other presentations, students gain in-depth knowledge in sub-areas of machine translation and learn to critically analyse the work presented.

### Content

Machine translation now makes it possible to automatically translate both written texts and spoken language into another language. In statistical approaches to machine translation, methods from machine learning are primarily used to train statistical models for the translation process.

In the seminar, current research results on various aspects of the systems will be discussed. Selected publications from the fields will be presented by the participants. Possible topics include improvement of word order and grammar of the target language, adaptation to topic or genre, treatment of spoken language phenomena, error correction, ...

Students are familiar with the DFG Code of Good Scientific Practice and successfully apply these guidelines when writing their scientific work.

### Workload

90h

### Recommendations

Previous knowledge from the lecture "Machine Translation" is an advantage.

## M

**5.244 Module: Seminar: Advanced Topics on SAT Solving [M-INFO-107209]**

**Coordinators:** Prof. Dr. Peter Sanders  
**Organisation:** KIT Department of Informatics  
**Part of:** [Seminars](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

**Mandatory**

|               |                                                         |      |               |
|---------------|---------------------------------------------------------|------|---------------|
| T-INFO-114231 | <a href="#">Seminar: Advanced Topics on SAT Solving</a> | 3 CP | Iser, Sanders |
|---------------|---------------------------------------------------------|------|---------------|

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

**Content**

With selected high-influence papers from the field of SAT solving, we take a close look at how SAT solvers evolved in the past decade and learn about the major cornerstones of modern and efficient large scale SAT solving systems.

**Workload**

Attendance time (3-4 dates): 4.5 - 6h  
 Reading, summarising and relating (2-3 papers): 30 - 40h  
 Preparation of the presentation: 16 - 24h  
 Total 90h

**Recommendations**

Knowledge of the basics from "SAT Solving in Practice" is helpful.

M

5.245 Module: Seminar: AI Systems Engineering [M-INFO-106356]

**Coordinators:** Prof. Dr.-Ing. Michael Beigl  
**Organisation:** KIT Department of Informatics  
**Part of:** [Seminars](#)

|                        |                          |                                |                           |                                   |                   |                     |
|------------------------|--------------------------|--------------------------------|---------------------------|-----------------------------------|-------------------|---------------------|
| <b>Credits</b><br>4 CP | <b>Grading</b><br>graded | <b>Recurrence</b><br>Irregular | <b>Duration</b><br>1 term | <b>Language</b><br>German/English | <b>Level</b><br>4 | <b>Version</b><br>1 |
|------------------------|--------------------------|--------------------------------|---------------------------|-----------------------------------|-------------------|---------------------|

|                  |                                                 |      |       |
|------------------|-------------------------------------------------|------|-------|
| <b>Mandatory</b> |                                                 |      |       |
| T-INFO-112881    | <a href="#">Seminar: AI Systems Engineering</a> | 4 CP | Beigl |



## 5.246 Module: Seminar: Algorithm Engineering [M-INFO-106086]

**Coordinators:** Prof. Dr. Peter Sanders  
**Organisation:** KIT Department of Informatics  
**Part of:** [Seminars](#)

| Credits | Grading | Recurrence | Duration | Language | Level | Version |
|---------|---------|------------|----------|----------|-------|---------|
| 4 CP    | graded  | Irregular  | 1 term   | English  | 4     | 1       |

| Mandatory     |                                                |      |         |
|---------------|------------------------------------------------|------|---------|
| T-INFO-112312 | <a href="#">Seminar: Algorithm Engineering</a> | 4 CP | Sanders |

### Assessment

See partial achievements (Teilleistung)

### Prerequisites

See partial achievements (Teilleistung)

### Competence Goal

Students can

- carry out a literature search based on a given topic, identify, locate, evaluate and finally analyse the relevant literature.
- prepare presentations in a scientific context. To this end, students master techniques that enable them to prepare and present the content to be presented to the audience.
- prepare their written seminar paper (as required later for further academic work) in accordance with the requirements and quality standards of academic writing, taking into account the format requirements specified by academic publishers for the publication of documents.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

### Content

This seminar covers various topics from the field of algorithm engineering. The focus can be on scalability, parallelism, efficiency or theoretical guarantees of algorithms. Example topics may include graph algorithms, sorting algorithms, string algorithms, SAT solvers, data structures or other algorithms. The exact focus of the seminar for the current semester will be announced in advance on the institute website by the chair of Prof. Sanders.

Participants in the seminar carry out their own literature research, present their results to their fellow students and prepare a paper.

The exact formalities will be announced at a kick-off event at the beginning of the semester, which will also be announced on the institute's website.

### Workload

4 LP corresponds to approx. 120 working hours, of which

- 10h seminar attendance
- 45h Literature research, assessment and evaluation of relevant literature
- 25h preparation of own presentation
- 25h Preparation of the written paper
- 15h preparation and follow-up work

### Recommendations

Knowledge of algorithms is an advantage. Exemplary lectures are Algorithms I, Algorithms II, Algorithm Engineering and Parallel Algorithms.



## 5.247 Module: Seminar: Applications and Extensions of Timed Systems [M-INFO-106512]

**Coordinators:** Jun.-Prof. Dr. Maike Schwammberger

**Organisation:** KIT Department of Informatics

**Part of:** Seminars

| Credits | Grading | Recurrence | Duration | Language | Level | Version |
|---------|---------|------------|----------|----------|-------|---------|
| 4 CP    | graded  | Irregular  | 1 term   | English  | 4     | 1       |

| Mandatory     |                                                       |      |               |
|---------------|-------------------------------------------------------|------|---------------|
| T-INFO-113132 | Seminar: Applications and Extensions of Timed Systems | 4 CP | Schwammberger |

### Assessment

See partial achievements (Teilleistung)

### Prerequisites

See partial achievements (Teilleistung)

### Competence Goal

The students can understand, model and analyse time-critical systems. Further on, they can apply the learned topics to real-world problems. They can independently work on a given topic in a team of two students and present the topic adequately within a paper and in front of an audience. The students can also critically discuss the works of the other students in plenum discussions.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

### Content

Many of the (embedded) software systems we are confronted with in everyday life have time-critical functionalities. For example, in the event of an accident, an airbag should be activated within a specific, very short, period of time. As another example: we expect fast response times from our smartphones so that we can use them conveniently and purposefully.

When modeling software systems, "time" is therefore a decisive factor. In this seminar, various mechanisms to formalise and analyse so-called real-time systems are discussed. The lecture also focuses on applications of timed systems. For instance, the following topics are dealt with:

- Timed Games
- Applications of Timed Automata (e.g. UPPAAL in Space)
- Synthesising Strategies using UPPAAL Stratego
- Duration Calculus (e.g. Satisfiability, Calculus)
- Interval Temporal Logic vs Duration Calculus

The module will consist of an introductory lecture part, where some basic topics around timed systems are introduced. For the second half of the module, the students will prepare papers and topic talks each in teams of two students. Additionally, a conference-style peer-review process for the papers is planned amongst the students. It is also expected that the students actively discuss their topics with their fellow students.

### Workload

4 ECTS correspond to 120 working hours, of which

approx. 10 hours attendance of an introductory lecture incl. preparation and wrap-up

approx. 60 hours independent examination of a given topic + writing a paper

approx. 30 hours preparation of a lecture

approx. 20 hours block seminar, incl. preparation and follow-up (e.g. review)

### Recommendations

Knowledge in areas of theoretical computer science and modeling of (embedded) software systems is helpful (e.g. CTL, finite automata, first order logic). It is also helpful, but not at all necessary, to have knowledge of the topics of the summer term lecture „Timed Systems“. Necessary topics from that lecture will also be introduced in the beginning of the winter term, if necessary.

**M****5.248 Module: Seminar: Artificial Intelligence for Energy Systems [M-INFO-106490]**

**Coordinators:** TT-Prof. Dr. Benjamin Schäfer  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics Seminars](#)

**Credits**  
4 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                                     |      |         |
|---------------|---------------------------------------------------------------------|------|---------|
| T-INFO-113110 | <a href="#">Seminar: Artificial Intelligence for Energy Systems</a> | 4 CP | Schäfer |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

- Students obtained a foundational knowledge of AI in energy systems as an active research field and can name some ongoing challenges
- Students are able to independently conduct a literature review on a given topic.
- Students are able to present their knowledge in a written and structured report
- Students are able to orally present results and discuss topics of the seminar in the broader context of the field

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

**Content**

Artificial Intelligence (AI) is a key technology in many areas of society and research. Energy systems with the ongoing energy transition ("Energiewende") make it a fascinating field for deploying AI methods. AI and machine learning algorithms can play a crucial role in improving energy efficiency, optimizing power generation and distribution or enhancing system stability while facilitating additional renewable energy integration. This seminar will explore fundamental AI algorithms and their applications in energy systems. Examples may include forecasting of energy demand or renewable generation, explainability of algorithms as well as optimization via AI.

**Workload**

20h attendance time (kick-off and talks by other students)  
 20h literature review  
 40h writing of own contribution  
 10h per-review for other students  
 30h preparation of the final presentation  
 120h=4ECTS

**Recommendations**

Previous participation in "Energieinformatik 1" and/or "Energieinformatik 2" is beneficiary but not mandatory.

## M

**5.249 Module: Seminar: Computer Science TECO [M-INFO-105328]**

**Coordinators:** Prof. Dr.-Ing. Michael Beigl  
**Organisation:** KIT Department of Informatics  
**Part of:** [Seminars](#)

| Credits | Grading | Recurrence | Duration | Language       | Level | Version |
|---------|---------|------------|----------|----------------|-------|---------|
| 3 CP    | graded  | Irregular  | 1 term   | German/English | 4     | 1       |

| Mandatory     |                                                |      |       |
|---------------|------------------------------------------------|------|-------|
| T-INFO-110808 | <a href="#">Seminar: Computer Science TECO</a> | 3 CP | Beigl |

**Workload**

The total workload for this course unit is approx. 90 hours (3.0 credits).

Presence time: Kickoff, presentation and discussion and meeting with supervisors :  
 10 h 00 min

Literature research, study planning, implementation, analysis and documentation :  
 76 h 00 min

Preparation of the presentation :  
 4 h 00 min

SUM : 90 h 00 min

**M****5.250 Module: Seminar: Continuous Software Engineering [M-INFO-105309]**

**Coordinators:** Prof. Dr.-Ing. Anne Koziolk  
**Organisation:** KIT Department of Informatics  
**Part of:** [Seminars](#)

**Credits**  
4 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
2

| Mandatory     |                                                          |      |         |
|---------------|----------------------------------------------------------|------|---------|
| T-INFO-110794 | <a href="#">Seminar: Continuous Software Engineering</a> | 4 CP | Koziolk |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students can

- carry out a literature search based on a given topic, identify, locate, evaluate and finally analyze the relevant literature.
- prepare their seminar paper (and later their Bachelor's/Master's thesis) with a minimum of training, taking into account the format requirements specified by all publishers for the publication of documents.
- Preparing presentations in a scientific context. To this end, techniques are introduced that make it possible to prepare and present the content to be presented in an auditorium-appropriate manner.

present the results of their research in written form, as is generally the case in scientific publications.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and apply these guidelines successfully in the preparation of their scientific work.

**Content**

Modern software engineering takes place in short cycles that enable rapid feedback Technologies such as build servers and containerization enable fast, frequent and automatic deployment of software in productive operation and rapid feedback into development (DevOps).

The term "Continuous Software Engineering" summarizes the interlocking of the various activities.

The seminar will examine various current challenges in the field of continuous software engineering, including the engineering of applications with machine learning components.

**Workload**

25 working hours for the literature research

55 working hours for the preparation of the thesis and peer reviews

20 working hours for the preparation of the final presentation

20 working hours for the final block event and meeting with the supervisor.

This results in a total of 120 working hours





## 5.251 Module: Seminar: Critical Topics in AI [M-INFO-106958]

**Coordinators:** Prof. Dr. Pascal Friederich  
**Organisation:** KIT Department of Informatics  
**Part of:** [Seminars](#)

| Credits | Grading | Recurrence       | Duration | Language | Level | Version |
|---------|---------|------------------|----------|----------|-------|---------|
| 3 CP    | graded  | Each summer term | 1 term   | English  | 4     | 1       |

| Mandatory     |                                                |      |            |
|---------------|------------------------------------------------|------|------------|
| T-INFO-113915 | <a href="#">Seminar: Critical Topics in AI</a> | 3 CP | Friederich |

### Assessment

See partial achievements (Teilleistung)

### Prerequisites

See partial achievements (Teilleistung)

### Competence Goal

Qualification objectives:

- Students are able to work independently on literature about a topic of current research and to critically evaluate it, to find and understand relevant publications, and to classify and process their content accordingly in order to be able to present the chosen topic area in the form of a presentation and a written paper.

Learning Objectives 

- Overview of positive as well as negative impact of AI technology
- Overview of scientific and related ethical issues in current AI research

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

### Content

This seminar covers the technical as well as ethical aspects of critical issues in AI. Topics covered include bias in machine learning methods, ethically and socially critical applications of AI, and the impact of AI on society. The exact topics will be determined in each semester.

Students will work independently on an advanced topic and critically engage with it, presenting and discussing their findings in a lecture and summarizing them in a seminar paper.

### Workload

Total 90 h, of which:

- Introductory courses: 4 h
- Literature research: 30 h
- Writing the report (10-15 pages) and preparing the presentation (30+15 minutes): 50 h
- Presentation of the results: 6 h

### Recommendations

Interest in social topics and research questions is required

**M****5.252 Module: Seminar: Cryptanalysis [M-INFO-105337]**

**Coordinators:** Prof. Dr. Jörn Müller-Quade  
**Organisation:** KIT Department of Informatics  
**Part of:** [Seminars](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Each summer term

**Duration**  
1 term

**Language**  
German/English

**Level**  
4

**Version**  
1

| Mandatory     |                                        |      |              |
|---------------|----------------------------------------|------|--------------|
| T-INFO-110823 | <a href="#">Seminar: Cryptanalysis</a> | 3 CP | Müller-Quade |



## 5.253 Module: Seminar: Deep Learning for Robotics [M-INFO-107175]

**Coordinators:** Prof. Dr. Gerhard Neumann  
**Organisation:** KIT Department of Informatics  
**Part of:** [Seminars](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                     |      |         |
|---------------|-----------------------------------------------------|------|---------|
| T-INFO-114204 | <a href="#">Seminar: Deep Learning for Robotics</a> | 3 CP | Neumann |

### Assessment

See partial achievements (Teilleistung)

### Prerequisites

See partial achievements (Teilleistung)

### Competence Goal

Students are able to independently understand a complex research topic, present the content in a concise and understandable way and prepare a scientific report summarizing the topic. 

Students are able to independently understand a complex research topic, present the content in a concise and understandable way and prepare a scientific report summarizing the topic. Students get a deeper understanding of state-of-the art learning algorithms and get to know current research challenges.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

### Content

Each student has to choose one of the offered topics from the area of deep learning / robot learning / deep reinforcement learning / deep imitation learning. Each topic consists of several research papers for which the students have to prepare a presentation as well as a report in form of a scientific research paper. It is recommended to take the seminar together with the "Research Project Deep Learning for Robotics", where the presented algorithms will be implemented and evaluated. Students will work in teams of 2.

### Workload

Workload = 90 h = 3 ECTS

Attendance time: 15h

Self-study: 45h

Writing a scientific report: 20h

Prepare presentation: 10h

### Recommendations

Attendance of the lecture "Machine Learning - Fundamentals and Algorithms" is recommended.

**M****5.254 Module: Seminar: Digital Accessibility and Assistive Technologies [M-INFO-105884]****Coordinators:** Prof. Dr.-Ing. Rainer Stiefelhagen**Organisation:** KIT Department of Informatics**Part of:** [Seminars](#)

| Credits | Grading | Recurrence       | Duration | Language       | Level | Version |
|---------|---------|------------------|----------|----------------|-------|---------|
| 3 CP    | graded  | Each winter term | 1 term   | German/English | 4     | 1       |

| Mandatory     |                                                                           |      |              |
|---------------|---------------------------------------------------------------------------|------|--------------|
| T-INFO-111832 | <a href="#">Seminar: Digital Accessibility and Assistive Technologies</a> | 3 CP | Stiefelhagen |

**Content**

Digital accessibility is a topic that affects us all. Accessing information digitally, from childhood to old age. Assistive technologies, such as smartphones, tablets, smartwatches, wearables in general have become a part of our everyday life. Exactly these things should be operable and usable by all people. Regardless of any barriers.

But what are the details behind this? What are the rights and foundations for this? What all has to be done to be "barrier-free"?

This can all be best illustrated by the example of "visual impairment".

According to the World Health Organization, there are approximately 285 million people with visual impairments worldwide, including approximately 39 million people who are blind. The partial or complete loss of vision significantly restricts blind and visually impaired people in their working and social lives. It is difficult for blind and visually impaired people to orient themselves and move around in public spaces without assistance. The reasons for this are problems in perceiving obstacles and landmarks as well as the resulting fear of accidents and orientation difficulties. Other problems in everyday life are: reading texts, recognizing banknotes, food, clothes or finding objects in the household.

For support, blind and visually impaired people can already rely on a number of technical aids. For example, digitized texts can be made accessible through speech output or Braille output devices. There are also various devices made specifically for the blind. The most important aid for improving mobility is by far the cane for the blind. In recent years, some electronic aids for obstacle detection or orientation support have also been developed, but these offer only very limited functionality at a relatively high price and are therefore rather rarely in use.

The seminar is intended to provide insight into topics of IT-based assistive technologies (AT) and, on the other hand, to prepare participants for writing conference articles on the topic. The selection of topics may span a wider range. Such as:

- Legal principles
- Existing assistive technology tools for different application areas
- AT for information access
- New steps of accessible software development
- New basics and techniques for accessible web design (websites and web applications)
- Accessible documents today and tomorrow
- Use of machine vision methods
- Feedback systems and their basics
- Insights into current research topics around the topic of digital accessibility

For the latest information, visit <http://cvhci.anthropomatik.kit.edu/>

## M

**5.255 Module: Seminar: Embedded Systems I [M-INFO-107231]**

**Coordinators:** Prof. Dr.-Ing. Jörg Henkel  
**Organisation:** KIT Department of Informatics  
**Part of:** [Seminars](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
2

| Mandatory     |                                             |      |        |
|---------------|---------------------------------------------|------|--------|
| T-INFO-114255 | <a href="#">Seminar: Embedded Systems I</a> | 3 CP | Henkel |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students learn the basics of scientific work in the form of literature research, writing a scientific paper and giving a presentation to a specialist audience.

Learning objectives:

Students learn to read conference papers, articles in specialist journals and standard literature. Furthermore, they interpret these texts in order to give an overview of the topic in their own words in a paper. Finally, they also present an overview of the topic to other computer scientists. In doing so, they are trained in scientific writing in the form of expression, text structure and reduction to the essentials.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines when writing their scientific work.

**Content**

This module bundles the seminars at the Chair of Embedded Systems:

Internet of Things

Machine Learning

Embedded Security and Architectures

For current information, please check the course catalog and the Chair of Embedded Systems homepage at <https://ces.itec.kit.edu>.

**Workload**

90 h



## 5.256 Module: Seminar: Embedded Systems II [M-INFO-107232]

**Coordinators:** Prof. Dr.-Ing. Jörg Henkel  
**Organisation:** KIT Department of Informatics  
**Part of:** [Seminars](#)

| Credits | Grading | Recurrence | Duration | Language | Level | Version |
|---------|---------|------------|----------|----------|-------|---------|
| 3 CP    | graded  | Each term  | 1 term   | English  | 4     | 1       |

| Mandatory     |                                              |      |        |
|---------------|----------------------------------------------|------|--------|
| T-INFO-114256 | <a href="#">Seminar: Embedded Systems II</a> | 3 CP | Henkel |

### Assessment

See partial achievements (Teilleistung)

### Prerequisites

See partial achievements (Teilleistung)

### Competence Goal

**Qualification objective:** Students learn the basics of scientific work in the form of literature research, writing a scientific paper and giving a presentation to a specialist audience.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines when writing their scientific work.

**Learning objectives:** Students learn how to read conference papers, articles in specialist journals and standard literature. Furthermore, they interpret these texts in order to give an overview of the topic in their own words in a paper. Finally, they also present an overview of the topic to other computer scientists. In doing so, they are trained in scientific writing in the form of expression, text structure and reduction to the essentials.

### Content

This module bundles the seminars at the Chair of Embedded Systems:

Internet of Things (IoT) for Healthcare

Internet of Things (IoT) in Embedded Systems

Approximate Computing

Thermal-aware Embedded Systems

Dependability in Internet of Things (IoT)

Performance Optimization for Multicore Chips

Power Efficient Reliability

Distributed Decision Making

Low Power Design for Embedded Systems

Reconfigurable Embedded Systems

Mixed Criticality Systems

Security in Internet of Things (IoT)

For current information, please refer to the course catalog and the Chair of Embedded Systems homepage at <http://ces.itec.kit.edu>.

### Additional Information

This is identical to the module 'Seminars: Embedded Systems I' and enables participation in a second seminar at the CES Chair.

### Workload

90 h



## 5.257 Module: Seminar: Energy Informatics [M-INFO-103153]

**Coordinators:** Prof. Dr. Veit Hagenmeyer  
**Organisation:** KIT Department of Informatics  
**Part of:** [Seminars](#)

| Credits | Grading | Recurrence | Duration | Language       | Level | Version |
|---------|---------|------------|----------|----------------|-------|---------|
| 4 CP    | graded  | Irregular  | 1 term   | German/English | 4     | 1       |

| Mandatory     |                                             |      |            |
|---------------|---------------------------------------------|------|------------|
| T-INFO-106270 | <a href="#">Seminar: Energy Informatics</a> | 4 CP | Hagenmeyer |

### Assessment

See Partial Achievements (Teilleistung).

### Prerequisites

See Partial Achievements (Teilleistung).

### Competence Goal

The student has an in-depth insight into the subject areas of energy informatics and has basic knowledge in the areas of modeling, simulation and algorithms in energy networks. Based on a given topic, he/she can identify, locate, evaluate and finally analyze relevant literature with the help of a literature search. He/she is able to classify the topic in the subject area and put it into an overall context.

He/she is able to write a seminar paper (and later the Bachelor's/Master's thesis) with a minimum of training, taking into account the format requirements specified by all publishers for the publication of documents. In addition, he/she knows how to elaborate the given topic in the form of a scientific presentation and knows techniques for preparing and presenting the content to be presented in a manner suitable for an audience. Thus, he/she has the knowledge to present scientific results of the research in written form as it is the case in scientific publications.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and apply these guidelines successfully in the preparation of their scientific work.

### Content

Energy informatics is a young field of research that includes various areas outside of computer science, such as economics, electrical engineering and law. As a result of the energy transition, more and more electricity is being fed into the grid from renewable sources. However, the trend towards decentralized and volatile power generation is already leading to bottlenecks in power grids, as these are not designed for a bidirectional scenario. With the help of energy informatics and the associated networking of the various competencies, intelligent control of the grid infrastructure - of electricity consumers, generators, storage systems and grid components - should contribute to an environmentally friendly, sustainable, efficient and reliable energy supply.

For this reason, the seminar "Seminar: Energy Informatics" will examine different algorithms, simulations and modeling with regard to their advantages and disadvantages in the various areas of grid infrastructure.

As a rule, the prerequisite for passing the module is the preparation of a written paper of max. 15 pages and an oral presentation of at least 30 minutes.

### Workload

4 LP corresponds to approx. 120 hours

- approx. 21 hours attendance of the seminar,
- approx. 45 hours analyzing and working on the topic,
- approx. 27 hours preparing and writing the presentation, and
- approx. 27 hours writing the paper.

## M

**5.258 Module: Seminar: Exoskeletons & Motion Capture [M-INFO-106927]**

**Coordinators:** Prof. Dr. Katja Mombaur  
**Organisation:** KIT Department of Informatics  
**Part of:** [Seminars](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                            |      |         |
|---------------|------------------------------------------------------------|------|---------|
| T-INFO-113892 | <a href="#">Seminar: Exoskeletons &amp; Motion Capture</a> | 3 CP | Mombaur |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

- The students know the state of the art of exoskeletons and assistive robots and current medical applications.
- Students are familiar with the most important methods and devices for measuring human movements with and without robotic mobility assistance systems
- Students are able to independently research, understand, critically evaluate and summarize scientific literature on a given topic (usually in English).
- Students will be able to prepare and deliver a scientific presentation, taking into account the level of knowledge of the other seminar participants, and to answer detailed questions on the topic
- Students will be able to ask questions about scientific presentations of other students and make active contributions to scientific discussions
- Students will be able to use Latex to create a scientific text (in English) incorporating the sources they have read.

**Content**

This seminar provides an insight into the current state of research and the practical use of exoskeletons in medicine and their potential to improve the quality of life of people with and without physical disabilities. It also gives an overview of different motion capture technologies, which play an important role in exoskeleton research but have many other applications. The proseminar is offered by the research group Optimization and Biomechanics for Human-Centred Robotics at the IAR.

Exoskeletons are used to improve mobility and are worn by people directly on the body to support or completely replace their muscle strength. One class of exoskeletons assists people with mobility impairments to walk, stand and perform other physical activities so that they can regain their independence and participate in the activities of daily living. Other types of exoskeletons are used by healthy people to prevent injuries in difficult working conditions.

The applications of motion capture include many disciplines in which human behavior and movements are of interest, such as sports science, biomechanics, medicine, psychology, etc., but they also play an important role in the creation of animated films and computer games. In robotics, and especially in the development of exoskeletons, they are important for analyzing human-robot interaction and improving robot design and control. Various motion capture technologies exist for recording movement kinematics, ground reaction forces and muscle activity.

The proseminar presentation topics cover the spectrum of different exoskeleton types and motion capture technologies.

Schedule of the proseminar:

In an event in the first week of the semester, the topic of the seminar and the individual lecture topics are presented in detail and distributed to the students according to their preferences. In a second session in week 3, an introduction to academic literature research, writing and presentations will take place. Afterwards, the students carry out a literature search under supervision and prepare a presentation and a corresponding paper. As the scientific literature is mostly in English, the paper should also be written in English. Presentations can be held in either English or German and take place in one or more block courses during the last third of the semester.

**Additional Information**

Limited number of participants



**Workload**

Estimated effort for this module is 90 hours:

20h – In person events (kickoff meeting, individual preparatory meetings, seminar block)

20h – Literature research

20h – Preparation of presentation

30h – Paper writing

**Recommendations**

Knowledge in Robotics (e.g. from the class Robotics 1 and follow-ups) is helpful



## 5.259 Module: Seminar: Explainable Artificial Intelligence [M-INFO-106497]

**Organisation:** KIT Department of Informatics

**Part of:** [Seminars](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                              |      |           |
|---------------|--------------------------------------------------------------|------|-----------|
| T-INFO-113115 | <a href="#">Seminar: Explainable Artificial Intelligence</a> | 3 CP | Lioutikov |

### Assessment

See partial achievements (Teilleistung).

### Prerequisites

See partial achievements (Teilleistung).

### Competence Goal

Students are able to independently understand a complex research topic, present the content in a concise and understandable way and prepare a scientific report summarizing the topic.

Students are able to independently understand a complex research topic, present the content in a concise and understandable way and prepare a scientific report summarizing the topic. Students get a deeper understanding of state-of-the-art learning algorithms and get to know current research challenges.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

### Content

Each student will select several related papers in the field of Explainable Artificial Intelligence and study and analyze it in the context of Robot Learning. The organizers will suggest several papers but the students will be encouraged to identify and research additional relevant papers during the semester. The students will then prepare a presentation and a basic scientific research paper.

It is highly recommended to take this seminar in combination with the "Explainable Robot Intelligence" Research Project (Forschungspraktikum), where the students get the chance to deepen their understanding, implement and evaluate their presented work.

### Additional Information

It is only possible to resign within two weeks after assignment of the topic.

### Workload

Workload = 90 h = 3 ECTS

- Attendance time: 15h
- Self-study: 45h
- Writing a scientific report: 20h
- Preparing a presentation: 10h

### Recommendations

We recommend taking this research project after attending the "Explainable Artificial Intelligence" lecture in the summer semester.

We highly recommend to take this seminar in combination with the "Explainable Artificial Intelligence" research project (Forschungspraktikum).

- Experience in Machine Learning is recommended, e.g. through prior coursework.
  - The Computer Science Department offers several great lectures e.g., "Maschinelles Lernen - Grundlagen und Algorithmen" and "Deep Learning"
- A good mathematical background will be beneficial
- Python experience is recommended
- We will use the PyTorch deep learning library. Some prior knowledge in this is helpful but not necessary.

**M****5.260 Module: Seminar: Exploring Robotics - Insights from Science Fiction, Research and Society [M-INFO-106651]**

**Coordinators:** TT-Prof. Dr. Barbara Bruno  
**Organisation:** KIT Department of Informatics  
**Part of:** [Seminars](#)

| Credits | Grading | Recurrence       | Duration | Language | Level | Version |
|---------|---------|------------------|----------|----------|-------|---------|
| 3 CP    | graded  | Each summer term | 1 term   | English  | 4     | 1       |

| Mandatory     |                                                                                                   |      |       |
|---------------|---------------------------------------------------------------------------------------------------|------|-------|
| T-INFO-113398 | <a href="#">Seminar: Exploring Robotics - Insights from Science Fiction, Research and Society</a> | 3 CP | Bruno |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

The students gain experience with literature research on a current research topic. They explore, understand and compare different approaches to a selected scientific problem. The students are able to write a summary of their literature research in the form of a scientific publication in English and give a scientific talk on it.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

**Content**

The students choose a topic from the field of robotics (e.g. remote control, behavior-based robotics, human-robot interaction, the "uncanny valley," natural language understanding, machine learning) and conduct a research on it that, building on literature findings, also includes and addresses the perspectives of society and the general media (as given by science fiction books, movies and games, as well as media and news outlets) and technology assessment (including social/societal expectations and needs, ethical implications, and risks/benefits analyses).

Students work under the guidance of a scientific supervisor. At the end of the semester, they present the results and write an elaboration in English in the form of a scientific publication.

**Workload**

Seminar with 2 SWS, 3 LP.

3 LP corresponds to approx. 90 hours, of which

approx. 45 hours of literature research

approx. 25 hrs. elaboration

approx. 10 hrs. preparation of presentation

approx. 10 hrs. compulsory attendance

**Recommendations**

Knowledge of the content of modules Robotics I - Introduction to Robotics, Robotics II: Humanoid Robotics, Robotics III - Sensors and Perception in Robotics is helpful.

**M****5.261 Module: Seminar: Failing Forward: Robotics, Critical Reading and the Making of Good Research [M-INFO-107436]**

**Coordinators:** TT-Prof. Dr. Barbara Bruno  
**Organisation:** KIT Department of Informatics  
**Part of:** [Seminars](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                                                                      |      |       |
|---------------|------------------------------------------------------------------------------------------------------|------|-------|
| T-INFO-114604 | <a href="#">Seminar: Failing Forward: Robotics, Critical Reading and the Making of Good Research</a> | 3 CP | Bruno |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

The students refine their critical reading skills and gain experience with literature research on a current research topic. They can identify and propose good research practices. The students are able to present their findings and reflections in the form of a scientific publication in English and give a scientific talk on it.

**Content**

The students choose a topic from the field of human-robot interaction (e.g. about robots in public spaces, or robots and diversity, or companion robots for older adults). They then conduct a literature research under the guidance of a scientific supervisor, aimed at identifying what makes good research and good research reporting on the chosen topic. At the end of the semester, they present the results and write an elaboration in English in the form of a short scientific position paper.

**Workload**

Seminar with 2 SWS, 3 LP.

3 LP corresponds to approx. 90 hours, of which

approx. 45 hours of literature research

approx. 25 hrs. elaboration

approx. 10 hrs. preparation of presentation

approx. 10 hrs. compulsory attendance

**Recommendations**

Knowledge of the content of modules Robotics I - Introduction to Robotics, Robotics II: Humanoid Robotics, Robotics III - Sensors and Perception in Robotics is helpful.

**M****5.262 Module: Seminar: From Big Data to Data Science: Advanced Methods of Information Fusion [M-INFO-102305]****Coordinators:** Prof. Dr.-Ing. Uwe Hanebeck**Organisation:** KIT Department of Informatics**Part of:** [Seminars](#)**Credits**  
3 CP**Grading**  
graded**Recurrence**  
Each term**Duration**  
1 term**Language**  
German/English**Level**  
4**Version**  
1

| Mandatory     |                                                                                                |      |          |
|---------------|------------------------------------------------------------------------------------------------|------|----------|
| T-INFO-101270 | <a href="#">Seminar: From Big Data to Data Science: Advanced Methods of Information Fusion</a> | 3 CP | Hanebeck |

## M

**5.263 Module: Seminar: Graph Algorithms [M-INFO-102550]****Coordinators:** Dr. rer. nat. Torsten Ueckerdt**Organisation:** KIT Department of Informatics**Part of:** [Seminars](#)**Credits**  
4 CP**Grading**  
graded**Recurrence**  
Irregular**Duration**  
1 term**Language**  
German**Level**  
4**Version**  
1

| Mandatory     |                                           |      |          |
|---------------|-------------------------------------------|------|----------|
| T-INFO-105128 | <a href="#">Seminar: Graph Algorithms</a> | 4 CP | Ueckerdt |

**M****5.264 Module: Seminar: Hot Topics in Artificial Intelligence & Security 1 [M-INFO-106868]****Coordinators:** Prof. Dr. Christian Wressnegger**Organisation:** KIT Department of Informatics**Part of:** [Seminars](#)**Credits**  
4 CP**Grading**  
graded**Recurrence**  
Each winter term**Duration**  
1 term**Language**  
English**Level**  
4**Version**  
1

| Mandatory     |                                                                                 |      |             |
|---------------|---------------------------------------------------------------------------------|------|-------------|
| T-INFO-113761 | <a href="#">Seminar: Hot Topics in Artificial Intelligence &amp; Security 1</a> | 4 CP | Wressnegger |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students know basic concepts artificial intelligence and machine learning in computer security, and are able to understand/interpret results from state-of-the-art research.

- Students know and understand basic concepts of combining artificial intelligence and computer security.
- Students are able independently research topics and methods.
- Students understand limits of current methods and applications

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work

**Content**

This seminar is concerned with the combination of artificial intelligence, machine learning and computer security in practice. Many tasks in the security landscape are based on manual labor, such as searching for vulnerabilities or analyzing malware. Here, machine learning can be used to establish a higher degree of automation, providing more "intelligent" security solutions (AI for Security). However, also these learning-based systems can be attacked and need to be secured (Security of AI).

This module is part of a seminar series to intensifies the contents of the AISEC lecture. It can be attended individually and in no particular order. The module puts focus on timely topics from recent research and teaches students to work up results from state-of-the-art research. To this end, the they will read up on a sub-field, prepare a seminar report, and present their work at the end of the term to their colleagues.

**Workload**

- 30h Literature research
- 60h Elaboration of the seminar paper
- 20h Preparation of final presentation
- 10h attendance time

**Recommendations**

The basics of IT security and artificial intelligence are a prerequisite.

**M****5.265 Module: Seminar: Hot Topics in Artificial Intelligence & Security 2 [M-INFO-106869]****Coordinators:** Prof. Dr. Christian Wressnegger**Organisation:** KIT Department of Informatics**Part of:** [Seminars](#)**Credits**  
4 CP**Grading**  
graded**Recurrence**  
Each summer term**Duration**  
1 term**Language**  
English**Level**  
4**Version**  
1

| Mandatory     |                                                                                 |      |             |
|---------------|---------------------------------------------------------------------------------|------|-------------|
| T-INFO-113762 | <a href="#">Seminar: Hot Topics in Artificial Intelligence &amp; Security 2</a> | 4 CP | Wressnegger |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students know basic concepts artificial intelligence and machine learning in computer security, and are able to understand/interpret results from state-of-the-art research.

- Students know and understand basic concepts of combining artificial intelligence and computer security.
- Students are able independently research topics and methods.
- Students understand limits of current methods and applications

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work

**Content**

This seminar is concerned with the combination of artificial intelligence, machine learning and computer security in practice. Many tasks in the security landscape are based on manual labor, such as searching for vulnerabilities or analyzing malware. Here, machine learning can be used to establish a higher degree of automation, providing more "intelligent" security solutions (AI for Security). However, also these learning-based systems can be attacked and need to be secured (Security of AI).

This module is part of a seminar series to intensifies the contents of the AISEC lecture. It can be attended individually and in no particular order. The module puts focus on timely topics from recent research and teaches students to work up results from state-of-the-art research. To this end, the they will read up on a sub-field, prepare a seminar report, and present their work at the end of the term to their colleagues.

**Workload**

- 30h Literature research
- 60h Elaboration of the seminar paper
- 20h Preparation of final presentation
- 10h attendance time

**Recommendations**

The basics of IT security and artificial intelligence are a prerequisite.



## M

**5.266 Module: Seminar: Hot Topics in Bioinformatics [M-INFO-100750]****Coordinators:** Prof. Dr. Alexandros Stamatakis**Organisation:** KIT Department of Informatics**Part of:** [Seminars](#)**Credits**  
3 CP**Grading**  
graded**Recurrence**  
Each summer term**Duration**  
1 term**Language**  
English**Level**  
4**Version**  
1

| Mandatory     |                                                       |      |            |
|---------------|-------------------------------------------------------|------|------------|
| T-INFO-101287 | <a href="#">Seminar: Hot Topics in Bioinformatics</a> | 3 CP | Stamatakis |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Participants will be able to understand, critically evaluate and compare current scientific publications in the field of sequence-based bioinformatics. They are able to present, understand, and critically assess the algorithms and models from current publications orally and in writing at a level that corresponds to the quality of scientific publications and conference presentations. They are able to suggest possible extensions to existing work and assess if the results are reproducible.

**Content**

The field of Bioinformatics is by now established as an independent application area of computer science. One of the main objectives of classical bioinformatics is to generate biological knowledge (usually from molecular data, e.g., DNA data sets) using appropriate models and algorithms. The so-called molecular data flood, which is being driven by increasingly faster and cheaper methods for extracting DNA, presents bioinformatics with new challenges regarding data storage and processing. These challenges range from discrete algorithms on strings and trees to parallel processing of data and large numerical simulations on supercomputers. The aim of the module is to provide an insight into the many facets of current bioinformatics research.

**Workload**

10 hours of topic selection + 10 hours of attending the seminar lectures + 30 hours of reading and understanding the paper(s) + 10 hours of lecture preparation + 30 hours for writing the report = 90 hours = 3 ECTS



## 5.267 Module: Seminar: Hot Topics in Explainable Artificial Intelligence (XAI) [M-INFO-106392]

**Coordinators:** Prof. Dr. Christian Wressnegger

**Organisation:** KIT Department of Informatics

**Part of:** [Seminars](#)

| Credits | Grading | Recurrence       | Duration | Language | Level | Version |
|---------|---------|------------------|----------|----------|-------|---------|
| 4 CP    | graded  | Each summer term | 1 term   | English  | 4     | 1       |

| Mandatory     |                                                                                  |      |             |
|---------------|----------------------------------------------------------------------------------|------|-------------|
| T-INFO-112917 | <a href="#">Seminar: Hot Topics in Explainable Artificial Intelligence (XAI)</a> | 4 CP | Wressnegger |

### Assessment

See partial achievements (Teilleistung)

### Prerequisites

See partial achievements (Teilleistung)

### Competence Goal

Students know concepts of explainable machine learning and are able to understand/interpret results from state-of-the-art research.

- Students know and understand concepts of methods for explaining machine learning algorithms.
- Students are able independently research topics and methods in the field of explainable machine learning.
- Students understand limits of current approaches for explaining machine learning.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

### Content

This seminar is concerned with explainable machine learning in computer security. Learning-based systems often are difficult to interpret, and their decisions are opaque to practitioners. This lack of transparency is a considerable problem in computer security, as black-box learning systems are hard to audit and protect from attacks.

The module introduces students to the emerging field of explainable machine learning and teaches them to work up results from recent research. To this end, the students will read up on a sub-field, prepare a seminar report, and present their work at the end of the term to their colleagues.

Topics cover different aspects of the explainability of machine learning methods for the application in computer security in particular.

### Workload

- 24h literature research
- 48h Elaboration of the seminar paper
- 24h Review of preliminary work by fellow students
- 16h preparation of final presentation
- 8h attendance time

In total 120h

**M****5.268 Module: Seminar: Information Systems [M-INFO-107686]**

**Coordinators:** Prof. Dr.-Ing. Klemens Böhm  
**Organisation:** KIT Department of Informatics  
**Part of:** [Seminars](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

**Mandatory**

|               |                                              |      |      |
|---------------|----------------------------------------------|------|------|
| T-INFO-115055 | <a href="#">Seminar: Information Systems</a> | 3 CP | Böhm |
|---------------|----------------------------------------------|------|------|

**Assessment**

See Partial Achievements (Teilleistung).

**Prerequisites**

See Partial Achievements (Teilleistung).

**Competence Goal**

- Students receive an initial introduction to scientific work in a specific specialist area in the field of information systems.
- Working on the seminar paper also prepares students for writing their Master's thesis.
- By attending the seminars, students are taught not only techniques of scientific work but also key qualifications.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines when writing their scientific work.

**Content**

The Chair of Information Management Systems offers at least one seminar per semester on a selected information systems topic (every seminar at the "Chair of Information Management Systems" that is not a proseminar counts as an "Information Systems Seminar").

These are usually current research topics, for example from the fields of databases, data mining or workflow management.

Details are announced each semester (notices and homepage of the Chair of Information Management Systems).

**Workload**

- General introduction 2h
- Introduction to presentations 2h
- Reading and understanding articles and publications 6x4,5h=27h
- Creating a paper 6x4,5h=27h
- Creating a presentation 6x4,5h=27h
- Lectures 10x0.5h=5h

Total = 90h (3 ECTS)

**Recommendations**

Lectures of the Chair of Information Management Systems that match the topic of the seminar are strongly recommended.

## M

**5.269 Module: Seminar: Interactive Learning [M-INFO-106301]**

**Coordinators:** TT-Prof. Dr. Rudolf Lioutikov  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)  
[Seminars](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Each summer term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
2

| Mandatory     |                                               |      |           |
|---------------|-----------------------------------------------|------|-----------|
| T-INFO-112773 | <a href="#">Seminar: Interactive Learning</a> | 3 CP | Lioutikov |

**Assessment**

See Partial Achievements (Teilleistung).

**Prerequisites**

See Partial Achievements (Teilleistung).

**Competence Goal**

**Qualifikationsziel:** Students are able to independently understand a complex research topic, present the content in a concise and understandable way and prepare a scientific report summarizing the topic.

**Lernziele:** Students are able to independently understand a complex research topic, present the content in a concise and understandable way and prepare a scientific report summarizing the topic. Students get a deeper understanding of state-of-the art learning algorithms and get to know current research challenges.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

**Content**

Each student will select several related papers in the field of Interactive Learning. The organizers will suggest several papers but the students will be encouraged to identify and research additional relevant papers during the semester. The students will then prepare a presentation and a basic scientific research paper.

It is highly recommended to take this seminar in combination with the "Interactive Learning" Research Project (Forschungspraktikum), where the students get the chance to deepen their understanding, implement and evaluate their presented work.

**Workload**

Workload = 90 h = 3 ECTS

- Attendance time: 15hr
- Self-study: 45h
- Writing a scientific report: 20h
- Prepare presentation: 10h

**Recommendations**

We highly recommend to take this seminar in combination with the "Interactive Learning" research project (Forschungspraktikum).

It is highly recommended to attend the "Explainable Artificial Intelligence" lecture in parallel or prior to this seminar.

- Experience in Machine Learning is recommended, e.g. through prior coursework.
  - The Computer Science Department offers several great lectures e.g., "Maschinelles Lernen - Grundlagen und Algorithmen" and "Deep Learning"
- A good mathematical background will be beneficial
- Python experience is recommended
- We might use the PyTorch deep learning library in the exercises. Some prior knowledge in this is helpful but not necessary.



## 5.270 Module: Seminar: Interpretability and Causality in Machine Learning [M-INFO-107217]

**Coordinators:** Jun.-Prof. Dr. Jan Stühmer  
**Organisation:** KIT Department of Informatics  
**Part of:** [Seminars](#)

| Credits | Grading | Recurrence       | Duration | Language | Level | Version |
|---------|---------|------------------|----------|----------|-------|---------|
| 3 CP    | graded  | Each summer term | 1 term   | English  | 4     | 1       |

| Mandatory     |                                                                             |      |         |
|---------------|-----------------------------------------------------------------------------|------|---------|
| T-INFO-114237 | <a href="#">Seminar: Interpretability and Causality in Machine Learning</a> | 3 CP | Stühmer |

### Assessment

See partial achievements (Teilleistung)

### Prerequisites

See partial achievements (Teilleistung)

### Competence Goal

Qualification target:

Students acquire the foundations of scientific literature research, writing of a scientific report, and presenting their results in front of an audience.

Learning objectives:

Students independently acquire an understanding of their research topic from scientific literature such as conference papers, journal papers and textbooks.

They are able to independently present the content in a concise and understandable way in a written report and in a presentation in front of an audience.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

### Content

Topic of this Masterseminar are machine learning approaches and deep learning methods for learning of interpretable representations. These methods enable to reconstruct underlying principles from data, for example the reconstruction of generative factors of a dataset.

Starting from these methods for interpretable representations, we will discuss further methods for causal discovery, that enable the inference of causal dependencies in data.

Methods and algorithms covered include for example variational inference, contrastive learning, as well as statistical methods for factor analysis.

There will be a kick-off meeting at the beginning of the semester and 2-3 block seminars towards the end of the term.

Dates for both will still be determined.

The Masterseminar will be held in English language.

### Workload

90h

### Recommendations

Attendance of the lecture "Machine Learning - Fundamentals and Algorithms" is recommended.



## 5.271 Module: Seminar: Learning Causality - a Challenge for Human and Artificial Intelligence [M-INFO-107033]

**Coordinators:** Dr. Dominik Janzing  
Prof. Dr. Gerhard Neumann

**Organisation:** KIT Department of Informatics

**Part of:** [Seminars](#)

| Credits | Grading | Recurrence       | Duration | Language | Level | Version |
|---------|---------|------------------|----------|----------|-------|---------|
| 3 CP    | graded  | Each summer term | 1 term   | German   | 4     | 1       |

| Mandatory     |                                                                                                 |      |         |
|---------------|-------------------------------------------------------------------------------------------------|------|---------|
| T-INFO-114102 | <a href="#">Seminar: Learning Causality - a Challenge for Human and Artificial Intelligence</a> | 3 CP | Janzing |

### Assessment

See partial achievements (Teilleistung)

### Prerequisites

See partial achievements (Teilleistung)

### Competence Goal

The student

- understands the problem of causal inferences based on statistical data analysis.
- understands the existing approaches to machine learning of causal structures and can evaluate them critically.
- discusses, presents and defends subject-specific arguments within a given task;
- organizes the preparation of a seminar paper largely independently.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

### Content

Although traditional statistical methods can show statistical correlations between observed variables, they make no statement about the underlying causal relationship. However, the question of cause and effect is often the central question, both in purely academic scientific research and in industrial applications. It is only in the last 2-3 decades that scientists in the fields of machine learning, statistics, philosophy and physics have begun to realize that statistical data do contain information about causality, even if it is still not easy to extract this information. The seminar provides an insight into the latest research results in causal data analysis.

### Workload

Workload = 90 h = 3 ECTS

Attendance time: 15h

Self-study: 45h

Writing a scientific report: 20h

Preparing a presentation: 10h

### Recommendations

The seminar is aimed at students of computer science, but also other subjects if they have a good mathematical background and interest (e.g. mathematics, physics, psychology).

Basic concepts of probability theory are assumed



## 5.272 Module: Seminar: Machine Learning in Climate and Environmental Sciences [M-INFO-106719]

**Coordinators:** TT-Prof. Dr. Peer Nowack  
**Organisation:** KIT Department of Informatics  
**Part of:** [Seminars](#)

| Credits | Grading | Recurrence | Duration | Language | Level | Version |
|---------|---------|------------|----------|----------|-------|---------|
| 3 CP    | graded  | Irregular  | 1 term   | English  | 4     | 1       |

| Mandatory     |                                                                                 |      |        |
|---------------|---------------------------------------------------------------------------------|------|--------|
| T-INFO-113519 | <a href="#">Seminar: Machine Learning in Climate and Environmental Sciences</a> | 3 CP | Nowack |

### Assessment

See partial achievements (Teilleistung)

### Prerequisites

See partial achievements (Teilleistung)

### Competence Goal

The students will learn to:

- independently discuss current research topics on machine learning in climate and environmental sciences.
- summarize published research in a structured way and explain it in their own words, in group discussions and in the form of a presentation.
- contrast modern problem-solving approaches and methods and propose suitable solutions for a variety of subject-relevant issues.
- Optional: students are invited to develop their own research ideas on the basis of what they have learned and to refine them in discussion with their supervisors. Such ideas could be pursued as a project internship, in the "Practical Research course" or in the form of a master's thesis.

### Content

Machine learning (ML) methods are already ubiquitous in many areas of society and research. This is especially true for climate and environmental sciences, where ML algorithms help e.g. to improve predictions of climate change and weather, or to optimize energy supply systems. In this session, we will discuss cutting-edge publications on ML applications in climate and environmental sciences, as well as the underlying theory behind the classes of algorithms. While organizers will suggest initial papers, students will be encouraged to seek out additional relevant literature throughout the semester.

The seminar will cover both the in-depth study of the climate/environmental sciences topic as well as of the specific machine learning method(s) employed in the literature. It will include two short and one longer final presentation from each student. The first presentation will focus solely on the chosen climate or environmental event or phenomenon, while the second presentation will cover the machine learning methods employed in studying it. Next to suggested reading by the module organizers, students will be encouraged to seek out additional relevant literature throughout the semester.

Towards the end, students will compile their findings into the final presentation accompanied by a scientific report, presenting the results in the form of a lecture.

### Workload

Total 90 h, consisting of:

Seminar attendance and personal meetings with the supervisors: 10 h

Literature research: 30 h

Writing the seminar paper and preparing the final presentation: 50 h

### Recommendations

- An interest in climate and environmental sciences topics is a prerequisite.

M

5.273 Module: Seminar: Neural Networks and Artificial Intelligence [M-INFO-102412]

Coordinators: Prof. Dr. Jan Niehues

Organisation: KIT Department of Informatics

Part of: [Seminars](#)

| Credits | Grading | Recurrence       | Duration | Language | Level | Version |
|---------|---------|------------------|----------|----------|-------|---------|
| 3 CP    | graded  | Each winter term | 1 term   | English  | 4     | 1       |

| Mandatory     |                                                                      |      |         |
|---------------|----------------------------------------------------------------------|------|---------|
| T-INFO-104777 | <a href="#">Seminar: Neural Networks and Artificial Intelligence</a> | 3 CP | Niehues |





## 5.274 Module: Seminar: Post-Quantum Cryptography [M-INFO-105585]

**Coordinators:** Prof. Dr. Jörn Müller-Quade  
**Organisation:** KIT Department of Informatics  
**Part of:** [Seminars](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Irregular

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                    |      |              |
|---------------|----------------------------------------------------|------|--------------|
| T-INFO-111200 | <a href="#">Seminar: Post-Quantum Cryptography</a> | 3 CP | Müller-Quade |

### Assessment

See partial achievements (Teilleistung)

### Prerequisites

See partial achievements (Teilleistung)

### Competence Goal

The student

- can describe the mathematical foundations of different quantum-hard problems
- knows basic post-quantum cryptosystems
- analyzes and discusses specific problems within the scope of his seminar paper
- presents technical arguments and is able to defend them within the scope of a certain assignment
- manages and prepares his seminar paper and his presentation largely independent

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

### Content

The Seminar deals with the foundations of post-quantum cryptography and quantum hard problems.

First, the mathematical basics describing several quantum-hard problems are introduced in introductory lectures. Subsequently, different post-quantum cryptosystems and common cryptographic notions will be introduced. Furthermore the seminar covers related topics, such as provability in the event of quantum adversaries.

### Workload

Attendance time in seminar: 15 h

Writing the paper: 30 h

Designing and preparing the presentation: 45 h

### Recommendations

Basic knowledge of IT-Security and cryptography are recommended.



## 5.275 Module: Seminar: Practical Graph Algorithms [M-INFO-107264]

**Coordinators:** Prof. Dr. Henning Meyerhenke

**Organisation:** KIT Department of Informatics

**Part of:** [Seminars](#)

**Credits**  
4 CP

**Grading**  
graded

**Recurrence**  
Irregular

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                     |      |            |
|---------------|-----------------------------------------------------|------|------------|
| T-INFO-114297 | <a href="#">Seminar: Practical Graph Algorithms</a> | 4 CP | Meyerhenke |

### Assessment

See partial achievements (Teilleistung)

### Prerequisites

See partial achievements (Teilleistung)

### Competence Goal

Students are able to:

- perform a literature review on the basis of a given topic/scientific paper, to read and understand relevant scientific works in algorithm engineering for graph problem and to identify the scientific context.
- present a scientific paper and its context. This includes competency in tools and techniques for making the content accessible for a target audience.
- create a written report of their topic in accordance to usual quality standards for scientific writing
- critically assess the work of other participants and make constructive suggestions for improvement.
- Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

### Content

This seminar covers various topics from the field of practical graph algorithms such as small subgraph detection, graph robustness, centrality computations, and related ones. The exact focus of the seminar for the current semester will be announced in advance on the website of Prof. Meyerhenke's chair. Participants in the seminar carry out their own literature research, present their results to their fellow students and prepare a paper.

The seminar will be held in several blocks, partially online, partially on-site. The exact formalities will be announced at an online kick-off event at the beginning of the semester, which will also be announced on the course website mentioned above.

### Workload

4 LP corresponds to approx. 120 working hours, of which

- 15h seminar attendance
- 35h Literature research, assessment and evaluation of relevant literature
- 35h preparation of own presentation
- 35h preparation of the scientific report

### Recommendations

Knowledge of algorithms, in particular graph algorithms, is a clear advantage. Exemplary lectures are Algorithms I and Algorithms II.

## M

**5.276 Module: Seminar: Privacy and Security [M-INFO-107216]**

**Coordinators:** Prof. Dr. Thorsten Strufe  
**Organisation:** KIT Department of Informatics  
**Part of:** [Seminars](#)

**Credits**  
4 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                               |      |        |
|---------------|-----------------------------------------------|------|--------|
| T-INFO-114236 | <a href="#">Seminar: Privacy and Security</a> | 4 CP | Strufe |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

The student is able to

- conduct a literature search based on a given topic, identify and evaluate the relevant literature;
- independently compile research results from IT security and technical data protection;
- analyze and discuss scientific studies and place them in their context;
- conduct their own classifications and evaluations of scientific studies, report on them in writing and present the results in a short scientific presentation.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

**Content**

The seminar deals with current topics from the research field of data protection and security.

These include, for example:

- Privacy attacks on communication
- Network security
- Anonymized online services
- Evaluation of the anonymity of online services
- Anonymized publication of data (differential privacy, k-anonymity)
- Transparency/awareness-enhancing systems
- Behavioral analysis of media use
- Biometric authentication

**Workload**

Seminar attendance time: 10h

Researching and writing a paper: 75h

Reviewing and commenting on the preliminary papers of fellow students: 5h

Preparing the presentation: 30h

**Recommendations**

Fundamentals of IT security, computer networks and distributed systems are required



## 5.277 Module: Seminar: Proofs from THE BOOK [M-INFO-103306]

**Coordinators:** Prof. Dr. Peter Sanders  
**Organisation:** KIT Department of Informatics  
**Part of:** [Seminars](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Irregular

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                               |      |         |
|---------------|-----------------------------------------------|------|---------|
| T-INFO-106604 | <a href="#">Seminar: Proofs from THE BOOK</a> | 3 CP | Sanders |

### Assessment

See partial achievements (Teilleistung)

### Prerequisites

See partial achievements (Teilleistung)

### Competence Goal

The students learn to follow and understand complex mathematical proofs on their own. They learn to represent these proofs in an appealing manner and present the proofs to the other participants using a blackboard.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

### Content

According to the Hungarian mathematician Paul Erdős, God is keeping a book – the BOOK – under wraps that contains the most elegant mathematical proofs. Erdős' loftiest goal was to find such proofs from the BOOK.

After Erdős' death in 1996, Martin Aigner and Günter Ziegler published the book "Proofs from THE BOOK" in 1998. The book has also been published in German with the title "Das BUCH der Beweise". In Aigner and Ziegler's collection, there are some 40 of the most elegant proofs which are handled as candidates for BOOK-proofs.

In this seminar, the participants will present and discuss proofs from "Proofs from THE BOOK" and other well known and well studied proofs in the area of mathematics and informatics.

### Workload

Seminar with 2 SWS, 3 LP

3 LP correspond to about 90h of work, split into

about 20h attendance

about 60h preparation for seminar

about 10h follow-up

### Recommendations

The German version "Das Buch der Beweise" is available online at the KIT library within the KIT network. The English version "Proofs from THE BOOK" is available as a physical copy at the KIT library. We recommend having a look inside either version before registering for this seminar.



## 5.278 Module: Seminar: Quantum Information Theory [M-INFO-105408]

**Coordinators:** Prof. Dr. Jörn Müller-Quade  
**Organisation:** KIT Department of Informatics  
**Part of:** [Seminars](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Irregular

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                     |      |              |
|---------------|-----------------------------------------------------|------|--------------|
| T-INFO-110904 | <a href="#">Seminar: Quantum Information Theory</a> | 3 CP | Müller-Quade |

### Assessment

See partial achievements (Teilleistung)

### Prerequisites

See partial achievements (Teilleistung)

### Competence Goal

The student...

- understands the basics of Quantum Information Theory.
- understands formalizing quantum states via state vectors and is able to autonomously use the state vector formalism to design and analyze quantum algorithms.
- knows and understands the quantum gates introduced in the seminar.
- knows the visual quantum circuit tool "Quirk" and is able to autonomously apply it to design and analyze quantum algorithms.
- knows and understands the quantum problems and algorithms discussed in the seminar and is able to explain them and relate them to one another.
- knows and understands the impact quantum algorithms have on classic cryptography.
- knows and understands the basics of and presented protocols for quantum key distribution.
- is able to autonomously apply the techniques presented in the seminar, e.g. to prove correctness of simple quantum algorithms.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

### Content

- Basics of Quantum Information Theory
- Formalism for dealing with quantum systems
- "Quirk"
- Important quantum problems and algorithms
- Quantum key distribution
- Quantum walks

### Workload

Seminar attendance time: 18h  
 Preparation and follow-up work: 12h  
 Preparation of a presentation: 30h  
 Preparation of a written examination: 30h

### Recommendations

Students should be familiar with the contents of the module "Linear Algebra 1 and 2", as well as the basics of IT security.

## M

**5.279 Module: Seminar: Recent Highlights in Algorithms [M-INFO-107172]**

**Coordinators:** TT-Prof. Dr. Thomas Bläsius  
Prof. Dr. Peter Sanders

**Organisation:** KIT Department of Informatics

**Part of:** [Seminars](#)

**Credits**  
4 CP

**Grading**  
graded

**Recurrence**  
Irregular

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                          |      |                            |
|---------------|----------------------------------------------------------|------|----------------------------|
| T-INFO-114201 | <a href="#">Seminar: Recent Highlights in Algorithms</a> | 4 CP | Bläsius, Sanders, Ueckerdt |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students can,

- carry out a literature search based on a given topic, identify, locate, evaluate and finally analyse the relevant literature.
  - prepare presentations in a scientific context. To this end, students master techniques that enable them to prepare and present the content to be presented in a manner suitable for an audience.
  - prepare their written seminar paper (as required later for further academic work) in accordance with the requirements and quality standards of academic writing, taking into account the format requirements specified by academic publishers for the publication of documents.
  - critically assess the work of other participants and make constructive suggestions for improvement.
- Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

**Content**

The seminars offered as part of this seminar module deal with current topics in algorithm technology and explore them in depth. As a rule, the prerequisite for passing the module is the preparation of a written paper of max. 15 pages and an oral presentation of at least 45 minutes.

**Workload**

Seminar with 2SWS, 4LP

4 LP corresponds to approx. 120 working hours, of which

approx. 10h seminar attendance

approx. 40 hours of literature research, assessment and evaluation of relevant literature

approx. 30h preparation of own presentation

approx. 30 hours writing the paper

approx. 10h Reading two papers and formulating constructive criticism and suggestions for improvement in writing

**M****5.280 Module: Seminar: Research Trends in Human-Computer Interaction [M-INFO-106594]****Coordinators:** Prof. Dr. Kathrin Gerling**Organisation:** KIT Department of Informatics**Part of:** [Seminars](#)**Credits**  
3 CP**Grading**  
graded**Recurrence**  
Each term**Duration**  
1 term**Language**  
German/English**Level**  
4**Version**  
2

| Mandatory     |                                                                        |      |         |
|---------------|------------------------------------------------------------------------|------|---------|
| T-INFO-113284 | <a href="#">Seminar: Research Trends in Human-Computer Interaction</a> | 3 CP | Gerling |

M

5.281 Module: Seminar: Robot Reinforcement Learning [M-INFO-105379]

Coordinators:

Prof. Dr. Gerhard Neumann

Organisation:

KIT Department of Informatics

Part of:

Seminars

|         |         |            |          |          |       |         |
|---------|---------|------------|----------|----------|-------|---------|
| Credits | Grading | Recurrence | Duration | Language | Level | Version |
| 3 CP    | graded  | Irregular  | 1 term   | German   | 4     | 1       |

|               |                                       |      |         |
|---------------|---------------------------------------|------|---------|
| Mandatory     |                                       |      |         |
| T-INFO-110862 | Seminar: Robot Reinforcement Learning | 3 CP | Neumann |





## 5.282 Module: Seminar: Secure Multiparty Computation [M-INFO-105761]

**Coordinators:** Prof. Dr. Jörn Müller-Quade  
**Organisation:** KIT Department of Informatics  
**Part of:** [Seminars](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Irregular

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                        |      |              |
|---------------|--------------------------------------------------------|------|--------------|
| T-INFO-111501 | <a href="#">Seminar: Secure Multiparty Computation</a> | 3 CP | Müller-Quade |

### Assessment

See partial achievements (Teilleistung)

### Prerequisites

See partial achievements (Teilleistung)

### Competence Goal

Students learn to familiarize themselves thoroughly with scientific papers, to present them to other students and to deal with questions on their topic in a subsequent discussion round.

Students will be able to differentiate between different protocols for secure multiparty computation and weigh up their advantages and weaknesses.

Students will be able to present academic publications from the research field of secure multiparty computation in a suitable manner, place them in the historical context of the research field and critically examine the results and findings presented.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and apply these guidelines successfully in the preparation of their academic work.

### Content

In the setting of secure multiparty computation, two or more parties with private inputs wish to compute some joint function of their inputs. The security requirements of such a computation are privacy (meaning that the parties learn the output and nothing more), correctness (meaning that the output is correctly distributed), independence of inputs, and more. Due to its generality, secure computation is a central tool in cryptography.

In this seminar, we examine modern protocols for secure multiparty computation of arbitrary functions.

### Workload

Attendance time in seminar: 15 h

Meeting with supervisors: 5 h

Independent work in relation to the individual seminar topic: 70 h

### Recommendations

Knowledge of the content of the lecture Cryptographic Protocols is assumed.

**M****5.283 Module: Seminar: Selected Topics in Public-Key-Cryptography [M-INFO-105586]****Coordinators:** Prof. Dr. Jörn Müller-Quade**Organisation:** KIT Department of Informatics**Part of:** [Seminars](#)**Credits**  
3 CP**Grading**  
graded**Recurrence**  
Each winter term**Duration**  
1 term**Language**  
German/English**Level**  
4**Version**  
1

| Mandatory     |                                                                     |      |  |
|---------------|---------------------------------------------------------------------|------|--|
| T-INFO-111201 | <a href="#">Seminar: Selected Topics in Public-Key-Cryptography</a> | 3 CP |  |

M

5.284 Module: Seminar: Service-Oriented Architectures [M-INFO-102372]

Coordinators:

Prof. Dr. Sebastian Abeck

Organisation:

KIT Department of Informatics

Part of:

Seminars

| Credits | Grading | Recurrence | Duration | Language | Level | Version |
|---------|---------|------------|----------|----------|-------|---------|
| 3 CP    | graded  | Each term  | 1 term   | German   | 4     | 1       |

| Mandatory     |                                         |      |       |
|---------------|-----------------------------------------|------|-------|
| T-INFO-104740 | Seminar: Service-Oriented Architectures | 3 CP | Abeck |

**M****5.285 Module: Seminar: Software Architecture, Security and Privacy [M-INFO-107236]**

**Coordinators:** Prof. Dr. Ralf Reussner  
**Organisation:** KIT Department of Informatics  
**Part of:** [Seminars](#)

| Credits | Grading | Recurrence | Duration | Language | Level | Version |
|---------|---------|------------|----------|----------|-------|---------|
| 4 CP    | graded  | Irregular  | 1 term   | English  | 4     | 1       |

| Mandatory     |                                                                      |      |          |
|---------------|----------------------------------------------------------------------|------|----------|
| T-INFO-114260 | <a href="#">Seminar: Software Architecture, Security and Privacy</a> | 4 CP | Reussner |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students can,

- carry out a literature search based on a given topic, identify, locate, evaluate and finally analyze the relevant literature.
- prepare their seminar paper (and later their Bachelor's/Master's thesis) with a minimum of training, taking into account the format requirements specified by all publishers for the publication of documents.
- Preparing presentations in a scientific context. To this end, techniques are introduced that make it possible to prepare and present the content to be presented in an auditorium-appropriate manner.
- present the results of their research in written form, as is generally the case in scientific publications.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and apply these guidelines successfully in the preparation of their scientific work.

**Content**

Anyone who processes personal data automatically must effectively protect this data from unauthorized access in order to act in accordance with data protection laws, but also to prevent damage to reputation and trustworthiness should data protection violations become public. Protecting personal data from unauthorized access and complying with other data protection obligations is therefore actually one of the most important goals in software design and operation.

However, looking at data protection in isolation does not do justice to reality. If an attacker gains access to personal data, voluntary commitments and internal data protection regulations no longer apply. In case of doubt, the operator of the software is liable for severe fines. Effective security precautions are therefore indispensable as a mainstay for protecting personal data.

Security-critical vulnerabilities must be identified at an early stage, ideally before the vulnerability is introduced. Such quality assessments are performed by software architecture-based analyses. How security can be described and analyzed at the software architecture level is the subject of ongoing research, as is the question of whether - and how - security can be expressed in figures.

In this seminar, students deal with these questions and the state of research at the interface between data protection, security and software architecture. Possible topics are located in one or more of these areas.

**Workload**

25 working hours for literature research  
 55 working hours for writing the thesis and preparing peer reviews  
 20 working hours for preparing the final presentation  
 20 working hours for the final block event and meeting with the supervisor.  
 This results in a total of 120 working hours

**M****5.286 Module: Seminar: Software Quality Assurance and Software Test [M-INFO-105895]****Coordinators:** Prof. Dr.-Ing. Ina Schaefer**Organisation:** KIT Department of Informatics**Part of:** [Seminars](#)**Credits**  
4 CP**Grading**  
graded**Recurrence**  
Each summer term**Duration**  
1 term**Language**  
German/English**Level**  
4**Version**  
2

| Mandatory     |                                                                       |      |          |
|---------------|-----------------------------------------------------------------------|------|----------|
| T-INFO-111850 | <a href="#">Seminar: Software Quality Assurance and Software Test</a> | 4 CP | Schaefer |

## M

**5.287 Module: Seminar: Speech-to-Speech Translation [M-INFO-107179]**

**Coordinators:** Prof. Dr. Jan Niehues  
**Organisation:** KIT Department of Informatics  
**Part of:** [Seminars](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Each summer term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                       |      |         |
|---------------|-------------------------------------------------------|------|---------|
| T-INFO-114208 | <a href="#">Seminar: Speech-to-Speech Translation</a> | 3 CP | Niehues |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students learn to familiarise themselves independently with topics based on academic literature and prepare them for presentations.

From the other presentations, students gain in-depth knowledge in sub-areas of language-to-language translation

By evaluating the presentations of their fellow students, students improve their social skills.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

**Content**

Speech-to-speech translation is a popular application that combines automatic speech recognition and machine translation. However, a user-friendly combination requires more than just a linear connection of the individual techniques.

In this seminar, students work independently on individual topics from the fields of automatic speech recognition, machine translation and their combination into speech-to-speech translation systems using the literature provided and present the summarised findings to the other participants in the seminar in the form of a slide-based presentation.

**Workload**

90 h

## M

**5.288 Module: Seminar: Ubiquitous Systems [M-INFO-101880]**

**Coordinators:** Prof. Dr.-Ing. Michael Beigl  
**Organisation:** KIT Department of Informatics  
**Part of:** [Seminars](#)

**Credits**  
4 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
1 term

**Language**  
German

**Level**  
4

**Version**  
1

| Mandatory     |                                             |      |       |
|---------------|---------------------------------------------|------|-------|
| T-INFO-103578 | <a href="#">Seminar: Ubiquitous Systems</a> | 4 CP | Beigl |

**Workload**

The total workload for this course unit is approx. 120 hours (4.0 credits).

## Activity

## Workload

Attendance time: Kickoff, presentation and discussion and meeting with supervisors: 10 h

Literature research and writing the paper: 106 h

Preparing the presentation: 4 h

TOTAL: 120 h 00 min

**M****5.289 Module: Service Analytics [M-WIWI-101506]**

**Coordinators:** Prof. Dr. Gerhard Satzger  
Prof. Dr. Christof Weinhardt

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

**Part of:** [Economics and Management \(Business Administration\)](#)

Credits  
9 CPGrading  
gradedRecurrence  
Each termDuration  
2 termsLanguage  
EnglishLevel  
4Version  
11

| Compulsory Elective Courses (Election: 9 credits) |                                                                                                          |        |           |
|---------------------------------------------------|----------------------------------------------------------------------------------------------------------|--------|-----------|
| T-WIWI-108715                                     | <a href="#">Artificial Intelligence in Service Systems</a>                                               | 4,5 CP | Satzger   |
| T-WIWI-114209                                     | <a href="#">Artificial Intelligence in Service Systems II: Generative AI Applications &amp; Adoption</a> | 4,5 CP | Satzger   |
| T-WIWI-105777                                     | <a href="#">Business Intelligence Systems</a>                                                            | 4,5 CP | Mädche    |
| T-WIWI-112152                                     | <a href="#">Practical Seminar: Artificial Intelligence in Service Systems</a>                            | 4,5 CP | Satzger   |
| T-WIWI-113725                                     | <a href="#">Special Topics in Information Systems</a>                                                    | 4,5 CP | Weinhardt |

**Assessment**

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

- 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.

**Additional Information**

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](http://www.ksri.kit.edu/teaching).

**Workload**

Total workload for 9 credit points: approx. 270 hours.

Attendance time: 90 hours

Preparation and follow-up: 100 hours

Exam and exam preparation: 80 hours



**M****5.290 Module: Service Design Thinking [M-WIWI-101503]**

**Coordinators:** Prof. Dr. Gerhard Satzger  
Prof. Dr. Orestis Terzidis

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

**Part of:** [Economics and Management \(Business Administration\)](#)

**Credits**  
9 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
2 terms

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                         |      |                   |
|---------------|-----------------------------------------|------|-------------------|
| T-WIWI-102849 | <a href="#">Service Design Thinking</a> | 9 CP | Satzger, Terzidis |

**Assessment**

The assessment is carried out as a general exam (according to Section 4(2), 3 of the examination regulation). The overall grade of the module is the grade of the examination (according to Section 4(2), 3 of the examination regulation).

**Prerequisites**

None

**Competence Goal**

Students

- Gain a comprehensive understanding of the globally recognized innovation approach “Design Thinking” as introduced and promoted by the Stanford University
- Apply the learned approach in the context of a real innovation project provided by a partner organization
- Conceive new, creative solutions through extensive need finding of relevant service users  
Develop prototypes early and independently, test them and improve them iteratively to solve the challenge provided by the partner organization
- Communicate, present and network in interdisciplinary and international environments.

**Content**

Course phases (roughly 4 weeks each):

Design Space Exploration:

- Exploring the problem space by questioning the given innovation challenge from practice.
- Familiarization with the topic area of the respective challenge.
- Gathering first impressions of the requirements and needs of people related to the problem.

Critical Function Prototype:

- Building an intensive understanding of the needs of the target group of the respective challenge.
- Deriving critical functions from the customer's perspective that could help solve the overall problem.
- Building prototypes for the critical functions and testing them in real customer situations.

Dark Horse Prototype:

- Reversal of assumptions and experiences made so far. The goal is to develop radically new and unconventional ideas.
- Implementation of the ideas into simple prototypes and subsequent testing.

Funky Prototype:

- Integration of the individual successfully tested functions from the critical function and dark horse phase into solution concepts. These are also tested and further developed.

Functional Prototype:

- Selection of successful funky prototypes and development of these towards high-resolution prototypes. The final solution approach for the project is written down in detail and feedback is obtained.

Final Prototype:

- Implementing the final prototype and presenting it to the practical partner as well as the SUGAR Network.

**Additional Information**

Due to practical project work as a component of the program, access is limited. The module (as well as the module component) spans two semesters. It starts in September every year and runs until end of June in the subsequent year. Entering the program is only possible at its beginning - after prior application in May/June. For more information on the application process and the program itself are provided in the module component description and the program's website (<https://sdtkarlsruhe.de/>). Furthermore, the lecturers provide an information event for applicants every year in May. This module is part of the KSRI Teaching Program.

**Workload**

The workload for this module is approx. 2 days per week over a period of 9 months. The workload for this practical module is therefore comparatively high. The reason for this is that the participants work in international teams with students from other universities and partner organizations and solve real innovation challenges.

The workload of approx. 270 hours is spread over approx. 105 hours (3.5 CP) in the first semester and 165 hours (5.5 CP) in the second semester.

**Recommendations**

This course is held in English – proficiency in writing and communication is required.

Our past students recommend to take this course at the beginning of the masters program.

**M****5.291 Module: Service Economics and Management [M-WIWI-102754]**

**Coordinators:** Prof. Dr. Gerhard Satzger  
Prof. Dr. Christof Weinhardt

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

**Part of:** Economics and Management (Business Administration)

**Credits**  
9 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
2 terms

**Language**  
English

**Level**  
4

**Version**  
6

| Compulsory Elective Courses (Election: 9 credits) |                                                                       |        |           |
|---------------------------------------------------|-----------------------------------------------------------------------|--------|-----------|
| T-WIWI-112757                                     | Digital Services: Innovation & Business Models                        | 4,5 CP | Satzger   |
| T-WIWI-112823                                     | Platform & Market Engineering: Commerce, Media, and Digital Democracy | 4,5 CP | Weinhardt |

**Assessment**

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**

None

**Competence Goal**

Students

- understand the scientific basics of the management of digital services and corresponding systems
- gain a comprehensive insight in the importance and the most important features of information systems as an central component of the digitalization of business processes, products and services
- know the most relevant concepts and theories to shape the digital transformation process of service systems successfully
- understand the OR methods in the sector of service management and apply them adequately
- are able to use large amounts of available data systematically for the planning, operation and improvement of complex service offers and to design and control information systems
- are able to develop market-oriented coordination mechanisms and apply service systems.

**Content**

This module provides the foundation for the management of digital services and corresponding systems. The courses in this module cover the major concepts for a successful management of service systems and their digital transformation. Current examples from the research and practice enhance the relevance of the discussed topics.

**Additional Information**

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](http://www.ksri.kit.edu/teaching).

From summer semester 2023, the course Service Innovation will be offered with a revised course concept and content. The focus will be on the closer integration of the topics of service innovation and digitalization. Current foundational content (e.g., on service innovation challenges or human-centered innovation methods) will remain. New content will cover topics such as digital platforms and ecosystems, IoT and smart service innovation, and business models.

**Workload**

Total workload for 9 credit points: approx. 270 hours. The allocation is based on the credit points of the courses in the module.

**Recommendations**

None

**M****5.292 Module: Service Innovation, Design & Engineering [M-WIWI-102806]**

**Coordinators:** Prof. Dr. Alexander Mädche  
Prof. Dr. Gerhard Satzger

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

**Part of:** Economics and Management (Business Administration)

Credits  
9 CPGrading  
gradedRecurrence  
Each termDuration  
2 termsLanguage  
EnglishLevel  
4Version  
6

| Compulsory Elective Courses (Election: 9 credits) |                                                 |        |         |
|---------------------------------------------------|-------------------------------------------------|--------|---------|
| T-WIWI-112757                                     | Digital Services: Innovation & Business Models  | 4,5 CP | Satzger |
| T-WIWI-113460                                     | Engineering Interactive Systems: AI & Wearables | 4,5 CP | Mädche  |
| T-WIWI-114210                                     | (Gen)AI-based Automation in Organizations       | 4,5 CP | Mädche  |
| T-WIWI-113459                                     | Practical Seminar: Human-Centered Systems       | 4,5 CP | Mädche  |
| T-WIWI-110887                                     | Practical Seminar: Service Innovation           | 4,5 CP | Satzger |

**Assessment**

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****Dependencies between courses:**

The course Practical Seminar Service Innovation cannot be applied in combination with the course Practical Seminar Digital Service Design.

**Competence Goal**

Students

- know about the challenges, concepts, methods and tools of service innovation management and are able to use them successfully.
- have a profound comprehension of the development and design of innovative services and are able to apply suitable methods and tools on concrete and specific issues.
- are able to embed the concepts of innovation management, development and design of services into organisations
- are aware of the strategic importance of services, are able to present value creation in the context of services systems and to strategically exploit the possibilities of their digital transformation
- elaborate concrete and problem-solving solutions for practical tasks in teams.

**Content**

This module is designed to constitute the basis for the development of successful ICT supported innovations thus including the methods and tools for innovation management, for the design and the development of digital services and the implementation of new business models. Current examples from science and practice enhance the relevance of the topics addressed.

**Additional Information**

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](http://www.ksri.kit.edu/teaching).

From summer semester 2023, the course Service Innovation will be offered with a revised course concept and content. The focus will be on the closer integration of the topics of service innovation and digitalization. Current foundational content (e.g., on service innovation challenges or human-centered innovation methods) will remain. New content will cover topics such as digital platforms and ecosystems, IoT and smart service innovation, and business models.

**Workload**

Total workload for 9 credit points: approx. 270 hours. The allocation is based on the credit points of the courses in the module.

**Recommendations**

Attending the course Practical Seminar Service Innovation [2595477] is recommended in combination with the course Service Innovation [2595468].

Attending the course Practical Seminar Digital Service Design [new] is recommended in combination with the course Digital Service Design [new].



## 5.293 Module: Service Management [M-WIWI-101448]

**Coordinators:** Prof. Dr. Gerhard Satzger  
Prof. Dr. Christof Weinhardt

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

**Part of:** [Economics and Management \(Business Administration\)](#)

| Credits | Grading | Recurrence | Duration | Language | Level | Version |
|---------|---------|------------|----------|----------|-------|---------|
| 9 CP    | graded  | Each term  | 1 term   | English  | 4     | 12      |

| Compulsory Elective Courses (Election: 9 credits) |                                                                                                          |        |         |
|---------------------------------------------------|----------------------------------------------------------------------------------------------------------|--------|---------|
| T-WIWI-108715                                     | <a href="#">Artificial Intelligence in Service Systems</a>                                               | 4,5 CP | Satzger |
| T-WIWI-114209                                     | <a href="#">Artificial Intelligence in Service Systems II: Generative AI Applications &amp; Adoption</a> | 4,5 CP | Satzger |
| T-WIWI-112757                                     | <a href="#">Digital Services: Innovation &amp; Business Models</a>                                       | 4,5 CP | Satzger |

### Assessment

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

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

### Competence Goal

The students

- understand the basics of developing and managing IT-based services,
- understand and apply OR methods in service management,
- systematically use vast amounts of available data for planning, operation, personalization and improvement of complex service offerings, and
- understand and analyze innovation processes in corporations.

### Content

The module service management addresses the basics of developing and managing IT-based services. The lectures contained in this module teach the basics of developing and managing IT-based services and the application of OR methods in the field of service management. Moreover, students learn to systematically analyze vast amounts of data for planning, operation and improvement for complex service offerings. These tools enhance operational and strategic decision support and help to analyze and understand the overall innovation processes in corporations. Current examples from research and industry demonstrate the relevance of the topics discussed in this module.

### Additional Information

From summer semester 2023, the course Service Innovation will be offered with a revised course concept and content. The focus will be on the closer integration of the topics of service innovation and digitalization. Current foundational content (e.g., on service innovation challenges or human-centered innovation methods) will remain. New content will cover topics such as digital platforms and ecosystems, IoT and smart service innovation, and business models.

### Workload

Total workload for 9 credit points: approx. 270 hours. The allocation is based on the credit points of the courses in the module. 120-135 hours for the courses with 4.5 credits, 135-150 hours for the courses with 5 credits and 150-180 hours for the courses with 6 credits.

The total number of hours per course results from the time required to attend the lectures and exercises, as well as the examination times and the time required to achieve the learning objectives of the module for an average student for an average performance.

### Recommendations

None

**M****5.294 Module: Service Operations [M-WIWI-102805]**

**Coordinators:** Prof. Dr. Stefan Nickel  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [Economics and Management \(Operations Research\)](#)

**Credits**  
9 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
1 term

**Language**  
German/English

**Level**  
4

**Version**  
9

**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) |                                                                               |        |              |
|---------------------------------------------------------|-------------------------------------------------------------------------------|--------|--------------|
| T-WIWI-102718                                           | <a href="#">Discrete-Event Simulation in Production and Logistics</a>         | 4,5 CP | Spieckermann |
| T-WIWI-102884                                           | <a href="#">Operations Research in Health Care Management</a>                 | 4,5 CP | Nickel       |
| T-WIWI-102715                                           | <a href="#">Operations Research in Supply Chain Management</a>                | 4,5 CP | Nickel       |
| T-WIWI-102716                                           | <a href="#">Practical Seminar: Health Care Management (with Case Studies)</a> | 4,5 CP | Nickel       |
| Supplementary Courses (Election: at most 1 item)        |                                                                               |        |              |
| T-MACH-112213                                           | <a href="#">Applied material flow simulation</a>                              | 4,5 CP | Baumann      |
| T-WIWI-114109                                           | <a href="#">Service Operations and Cyber Security</a>                         | 4,5 CP | Mohr         |

**Assessment**

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

**Prerequisites**

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

**Competence Goal**

Students

- 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.

**Additional Information**

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](http://www.ksri.kit.edu/teaching).

**Workload**

Total workload for 9 credit points: approx. 270 hours. The allocation is based on the credit points of the courses in the module.

**Recommendations**

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



**M****5.295 Module: Simulation and Optimization in Robotics and Biomechanics [M-INFO-106504]**

**Coordinators:** Prof. Dr. Katja Mombaur  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
2

| Mandatory     |                                                                 |      |         |
|---------------|-----------------------------------------------------------------|------|---------|
| T-INFO-113123 | Simulation and Optimization in Robotics and Biomechanics        | 6 CP | Mombaur |
| T-INFO-114838 | Simulation and Optimization in Robotics and Biomechanics - Pass | 0 CP | Mombaur |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

The students

- can explain advanced principles of modeling, optimization and control of dynamic processes, in particular mechanical systems and can apply them
  - can model, classify and analyze complex motions in robotics or biomechanics, and investigate specific properties such as stability.
  - can apply nonlinear optimization and optimal control methods and can compare and evaluate different mathematical approaches.
  - know how to use software tools based on C++ and Lua for modeling, simulation, optimization and visualization of humanoid and robotic systems
- are capable of solving optimal control problems numerically and to evaluate the quality of the solution.

**Content**

The goal of this course is to give a practical introduction into simulation and optimization of motions in robotics and biomechanics. Simulation and optimization play an important role in generating and controlling motions in complex robotics systems and in predicting and analyzing motions of humans. Theory and methods will be covered, but the focus is on the use software tools for modeling, simulation, optimization and visualization of multibody systems. Topics covered include:

- Dynamic process modeling
- Transforming real world problems into mathematical models
- Modeling of complex robotics and biomechanics systems (e.g. humanoids), based on previous modeling knowledge
- Common template models for bipedal walking and running in robotics and biomechanics
- Simulation of mechanical / robotics systems (Integrators and Initial value problems)
- Boundary value problems
- Nonlinear optimization problems
- Optimal control problems
- Direct and indirect methods for optimal control problems, focus on direct methods, especially direct multiple shooting
- Stability of dynamical systems, stability in biomechanics and robotics

**Additional Information**

Limitation to 30 participants

**Workload**

Estimated effort for this module is 180 hours:

60h - Lecture and exercises (2+2 SWS)

80h - Independent work (repetition of lecture contents, preparation of assignments)

40h - Exam preparation



## 5.296 Module: Software Architecture and Quality [M-INFO-107237]

**Coordinators:** Prof. Dr. Ralf Reussner  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                   |      |          |
|---------------|-----------------------------------|------|----------|
| T-INFO-114261 | Software Architecture and Quality | 3 CP | Reussner |

### Assessment

See partial achievements (Teilleistung)

### Prerequisites

See partial achievements (Teilleistung)

### Competence Goal

Students can explain the role of components and explicit software architecture descriptions for engineering software development.

They can also explain the basic concepts of component-based software development.

Students are familiar with advanced concepts of view-based metamodeling and can apply these to the scenarios of the software development domain.

In addition, they can use procedures for the documentation, evaluation and reuse of software architectures, such as architecture patterns or architecture styles.

Furthermore, they can differentiate between and use different software development processes.

Students can design models for software quality characteristics such as performance.

The effects of architecture design decisions on software quality characteristics such as performance can also be analyzed.

### Content

In many software development projects, the software architecture is the main determining factor for software quality. Runtime properties such as performance or reliability, as well as maintainability, essentially depend on the architecture of a software system.

In the lecture, students learn about and apply modern approaches to software architecture modeling and analysis, which can be used to predict the quality characteristics of the system at design time. The lecture thus lays the scientific foundations for software design as an engineering discipline, as the methods learned enable an understanding of the effects of architectural design decisions on software quality. In particular, software qualities such as performance, reliability and maintainability are discussed.

In connection with software architecture, software components are also introduced as "software building blocks". In particular, techniques for the reuse of architectural knowledge such as patterns, styles and reference architectures and product lines are discussed.

The lecture deals with the Palladio component model as a description language for software components and architectures.

Using the Palladio component model, role models for the design and development of component-based software are presented in addition to quality prediction.

Its use is demonstrated using industry-related case studies and techniques for evaluating the quality of your software architecture are illustrated.

The lecture covers technologies such as MOF, OCL and architecture-centered, model-driven software development (AC-MDSD). Modern middleware from practice such as Java EE / EJB is also presented.

### Workload

(2 SWS + 1.5 x 2 SWS) x 15 + 15 h exam preparation = 90 h

**M****5.297 Module: Software Engineering II [M-INFO-107235]**

**Coordinators:** Prof. Dr.-Ing. Anne Koziolk  
 Prof. Dr. Raffaella Mirandola  
 Prof. Dr. Ralf Reussner

**Organisation:** KIT Department of Informatics

**Part of:** [Informatics](#)

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each summer term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                         |      |                                 |
|---------------|-----------------------------------------|------|---------------------------------|
| T-INFO-114259 | <a href="#">Software Engineering II</a> | 6 CP | Koziolk, Mirandola,<br>Reussner |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Software processes: Students understand evolutionary and incremental development and can describe the advantages over the sequential approach. They can describe the phases and disciplines of the unified process.

Requirements engineering: Students can describe the terms of requirements engineering and name activities in the requirements engineering process. They can classify and assess requirements according to the facets of type and representation. They can apply basic guidelines for specifying natural language requirements and describe prioritization procedures for requirements. Describe the purpose and elements of use case models. You can classify use cases according to their granularity and objectives. You can create use case diagrams and use cases. They can derive system sequence diagrams and operation contracts from use cases and can describe their role in the software development process.

Software architecture: Students can reproduce and explain the definition of software architecture and software components. They can explain the difference between software architecture and software architecture documentation. They can describe the advantages of explicit architecture and the factors influencing architecture decisions. You can assign design decisions and elements to the layers of an architecture. You will be able to describe what component models define. They can describe the components of the Palladio component model and discuss some of the design decisions made.

Enterprise Software Patterns: Students can characterize enterprise applications and decide for a described application which properties it fulfills. They know patterns for structuring domain logic, architectural patterns for data access and object-relational structure patterns. They can select a suitable pattern for a design problem and justify the selection based on the advantages and disadvantages of the patterns.

Software design: Students can assign the responsibilities resulting from system operations to classes or objects in object-oriented design using the GRASP patterns and thus design object-oriented software.

Software quality: Students know the principles for readable program code, can identify violations of these principles and develop proposals for solutions.

Model-driven software development: Students can describe the goals and the idealized division of labor of model-driven software development (MDSD) and reproduce and explain the definitions for model and metamodel. They can discuss the goals of modeling. You will be able to describe the model-driven architecture and express constraints in the Object Constraint Language. You can express simple transformation fragments of model-to-text transformations in a template language. You can weigh up the advantages and disadvantages of MDSD.

Embedded systems: Students will be able to explain the principle of a real-time system and why they are usually implemented as parallel processes. They can describe a rough design process for real-time systems. They can describe the role of a real-time operating system. They can distinguish between different classes of real-time systems.

Reliability: Students can describe the various dimensions of reliability and categorize a given requirement. They can illustrate that unit tests are not sufficient to evaluate software reliability and can describe how usage profile and realistic error data have an influence.

Domain-driven design (DDD): Students are familiar with the design metaphor of ubiquitous language, Closed Contexts, and Strategic Design. They can describe a domain using the DDD concepts, entity, value objects, services, and improve the resulting domain model using the patterns of aggregates, factories, and depots. They know the different types of interactions between Closed Contexts and can apply them.

Security (in the sense of security): Students can describe the basic ideas and challenges of security assessment. They can recognize common security problems and propose solutions.

**Content**

Requirements engineering, software development processes, software quality, software architectures, MDD, Enterprise Software Patterns software maintainability, software security, dependability, embedded software, middleware, domain-driven design

**Additional Information**

The Software Engineering II module is a basic module.

**Workload**

Preparation and follow-up time 1.5 h / 1 SWS

Total workload:

$(4 \text{ SWS} + 1.5 \times 4 \text{ SWS}) \times 15 + 30 \text{ h exam preparation} = 180 \text{ h} = 6 \text{ ECTS}$

## M

**5.298 Module: Software Lab Parallel Numerics [M-INFO-102998]**

**Coordinators:** Prof. Dr. Wolfgang Karl  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
1 term

**Language**  
German/English

**Level**  
4

**Version**  
2

| Mandatory     |                                                |      |      |
|---------------|------------------------------------------------|------|------|
| T-INFO-105988 | <a href="#">Software Lab Parallel Numerics</a> | 6 CP | Karl |

## M

**5.299 Module: Software Product Line Engineering [M-INFO-107212]**

**Coordinators:** Prof. Dr.-Ing. Ina Schaefer  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Each summer term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                   |      |          |
|---------------|-----------------------------------|------|----------|
| T-INFO-114234 | Software Product Line Engineering | 3 CP | Schaefer |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students understand the essential concepts (such as modularity, variation point, feature model, feature mapping, configuration, product generator, and product) and techniques (such as feature-oriented domain analysis, variant extraction, delta modelling, variant space analyses, product generation, testing of software product lines) of the development of software product lines, their relationships and their assignment to problem and solution spaces. They are able to understand and apply the different methods for designing software product lines, such as feature-orientated domain analysis or variant extraction. Students are familiar with various product generation strategies and know their advantages and disadvantages in practical use. Students are familiar with techniques for the maintenance of software product lines, such as variant space analysis, the generation of product samples and the testing of software product lines, and are able to apply these. In addition, students are familiar with current results and issues from the research field of software product lines and understand their significance, e.g. results from the field of language product lines.

Learning objectives: Students are able to independently design, implement and maintain a software product line. Students can apply feature-orientated domain analysis to a given domain and design a software product line based on a domain description and implement it in practice with tool support. Students can use variant extraction independently and with tool support to design a software product line from a series of product variants of a software system and implement it by refactoring. Students can select a suitable product generation strategy for a given domain and implement it with tool support. Students can analyse and improve the variant space of a given software product line. Students know different techniques to maintain a software product line and can analyse the variant space, generate product samples and develop tests for a given software product line.

**Content**

This module teaches students the procedures and techniques for the development and maintenance of multi-variant software systems using software product lines. The lecture will provide an overview of the basic goals, processes, concepts and techniques in the development and maintenance of software product lines. It is subdivided into the subject areas of the problem space and the solution space. In the first topic area, topics such as feature-oriented domain analysis, feature models and analyses of the variant space are dealt with, whereas in the second topic area, different techniques for product generation and testing of product lines are discussed and demonstrated in practice.

In addition, current results and questions from software product line research are presented and discussed.

**Workload**

(2 SWS + 1.5 x 2 SWS) x 15 + 15 h exam preparation = 90 h

**Recommendations**

Basic knowledge from the lectures Software Engineering II [T-INFO-101370] and Formal Systems [T-INFO-101336] is helpful.

**M****5.300 Module: Software Security Engineering [M-INFO-106344]**

**Coordinators:** Prof. Dr. Ralf Reussner  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Each summer term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                               |      |                   |
|---------------|-----------------------------------------------|------|-------------------|
| T-INFO-112862 | <a href="#">Software Security Engineering</a> | 3 CP | Gerking, Reussner |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Qualification target: Participants will be able to apply measures to detect or avoid vulnerabilities in different development phases.

Learning objectives:

- Participants acquire the ability to name criteria from security standards and evaluate their fulfillment.
- They master central security principles and their application to specific use cases.
- They can formalize security policies (based on security models) and recognize violations of policies.
- They are familiar with the handling and processing of security incidents.

**Content**

The course deals with the engineering of cyber security along the development cycle of software systems. This includes constructive and analytical development measures to achieve protection goals through systematic prevention and detection of vulnerabilities. The course familiarizes participants with the adoption and implementation of security measures in various development phases. Relevant fundamentals from the field of formal security models are introduced.

**Workload**

(2 SWS + 1.5 x 2 SWS) x 15 + 15 h exam preparation = 90 h

**Recommendations**

Knowledge of Software Engineering I and Software Engineering II is recommended.

## M

**5.301 Module: Software Test and Quality Management (SQM) [M-INFO-107239]**

**Coordinators:** Prof. Dr.-Ing. Ina Schaefer  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
5 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                           |      |          |
|---------------|-------------------------------------------|------|----------|
| T-INFO-114263 | Softwaretest and Quality Management (SQM) | 5 CP | Schaefer |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

After completing the module, participants will be familiar with the basic principles of software testing. They will be able to apply the general testing process and master the activities and techniques to support it. Participants will be able to specify test cases in all phases of the software life cycle. They know test procedures and methods with which they can prepare and carry out software tests efficiently. They are familiar with common methods of test management methods and test tools for automating test activities.

**Content**

1. Basics (introduction, definition of terms, principles of software testing, fundamental test process, psychology of testing)
2. Testing in the software life cycle (general V-model, component test, integration test, system test, acceptance test, testing of new product versions, overview of test types)
3. Static testing (structured group tests, static analyses, metrics)
4. Dynamic testing (black-box procedure, white-box procedure, experience-based test case determination)
5. Test management (test organisation and planning, economic aspects, test strategy, management of test work, error management, requirements for configuration management).
6. Testing tools (types, selection, introduction)
7. Modern test procedures (model-based testing, regression testing, testing of variant-rich systems)
8. Debugging

**Additional Information**

At the end of the course there is also the opportunity to be certified as an "ISTQB - Certified Tester - Foundation Level". A date and the modalities for the exam will be agreed on in the lecture.

**Workload**

150h





## 5.302 Module: Software-Evolution [M-INFO-100719]

**Coordinators:** Prof. Dr. Ralf Reussner  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                    |      |          |
|---------------|------------------------------------|------|----------|
| T-INFO-101256 | <a href="#">Software-Evolution</a> | 3 CP | Reussner |

### Assessment

See partial achievements (Teilleistung)

### Prerequisites

See partial achievements (Teilleistung)

### Competence Goal

Students learn about the particular challenges of long-lived software systems and the possibilities of influencing the future development of a software system through targeted software evolution. Students will learn which tools and concepts they can use in the context of software evolution and which factors have an impact on the software development process. In addition to the theoretical basics, students will gain insight into practical examples and suitable tools that simplify the handling of software evolution. A cross-section of implementation aspects, techniques, management and concepts will be conveyed to the participants of the lecture. Students are enabled to analyze, evaluate and improve software systems.

### Content

The lecture Software Evolution covers: Software development processes, special features of long-lived software systems, evolution scenarios for software systems, software architecture development, software refurbishment, implementation techniques, architecture patterns, traceability, software evaluation methods, maintainability analyses and tools to support software evolution.

### Workload

(2 SWS + 1.5 x 2 SWS) x 15 + 15 h exam preparation = 90 h

## M

**5.303 Module: Statistics and Econometrics II [M-WIWI-105414]**

**Coordinators:** Prof. Dr. Melanie Schienle  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [Economics and Management \(Economics\)](#)  
[Economics and Management \(Statistics\)](#)

**Credits**  
9 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
1 term

**Language**  
German/English

**Level**  
4

**Version**  
5

| Compulsory Elective Courses (Election: ) |                                                                       |        |          |
|------------------------------------------|-----------------------------------------------------------------------|--------|----------|
| T-WIWI-103063                            | <a href="#">Analysis of Multivariate Data</a>                         | 4,5 CP | Grothe   |
| T-WIWI-114622                            | <a href="#">Introduction to Econometrics</a>                          | 5 CP   | Schienle |
| T-WIWI-103064                            | <a href="#">Financial Econometrics</a>                                | 4,5 CP | Schienle |
| T-WIWI-110939                            | <a href="#">Financial Econometrics II</a>                             | 4,5 CP | Schienle |
| T-WIWI-112153                            | <a href="#">Microeconometrics</a>                                     | 4,5 CP | Krüger   |
| T-WIWI-103065                            | <a href="#">Statistical Modeling of Generalized Regression Models</a> | 4,5 CP | Heller   |

**Assessment**

The assessment is carried out as partial exams 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 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

- shows an advanced understanding of Econometric techniques and statistical model building.
- is able to develop advanced Econometric models for applied problems based on available data
- is able to apply techniques and models efficiently with statistical software, to interpret results and to judge on different approaches with appropriate statistical criteria.

**Content**

The courses provide foundations of advanced Econometric and statistical techniques for regression, time series and multivariate analysis.

**Workload**

The total workload for this module is approximately 270 hours.



## 5.304 Module: Stochastic Information Processing [M-INFO-100829]

**Coordinators:** Prof. Dr.-Ing. Uwe Hanebeck  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
German

**Level**  
4

**Version**  
1

| Mandatory     |                                   |      |          |
|---------------|-----------------------------------|------|----------|
| T-INFO-101366 | Stochastic Information Processing | 6 CP | Hanebeck |

### Assessment

See Partial Achievements (Teilleistung).

### Prerequisites

See Partial Achievements (Teilleistung).

### Competence Goal

Qualification objective: Students can describe a given nonlinear dynamic model probabilistically and set up the equations for Bayesian inference. If no analytical solution exists, they can estimate the strength of the nonlinearity and select and implement a suitable practical filter for real-time state estimation.

Learning objective: Students are familiar with dynamic state models and methods for recursively estimating the state. The advantages and disadvantages of the various practical filters can be assessed in a problem-oriented manner.

### Content

To deal with complex dynamic systems, as they occur for example in robotics, one typically requires both system models and the temporal evolution of the system states. For both system identification and state reconstruction, however, usually only noisy data are available.

For continuous state spaces, an exact calculation of the probability densities is only possible in a few special cases. In practice, general nonlinear systems are often traced back to these special cases by simplifying assumptions. One extreme is linearization with subsequent application of linear estimation theory. However, this often leads to unsatisfactory results and requires additional heuristic measures. At the other extreme are numerical approximation methods, which only evaluate the desired probability densities at discrete points in the state space. Although the basic principle of these methods is usually quite simple, their practical implementation is often difficult and, in particular for higher-dimensional systems, computationally demanding. 🤖

As a middle ground, analytical nonlinear estimation methods would therefore often be desirable. In this lecture the main difficulties in the development of such estimation methods are outlined and corresponding solution modules are presented. Based on these building blocks, some analytical estimation methods are discussed in detail as examples, which are very suitable for practical implementation and offer a good compromise between computing effort and performance. Useful applications of these estimation methods are also discussed. Both known methods and the results of current research are presented.

### Additional Information

As a theoretical foundation lecture, "Stochastic Information Systems" is an ideal introduction to the ISAS lectures. Conversely, prior knowledge of "Localization of Mobile Agents" (LMA) [course no. 24613] and "Information Processing in Sensor Networks" (IIS) [course no. 24102],

, may nevertheless be helpful depending on the type of learner - more concrete applications are highlighted there. In all of our lectures, the content is always derived and explained in detail from the beginning; it is therefore possible to start with SI, LMA or IIS.

### Workload

[1.5 h lecture + 1.5 h exercise (3 SWS)] x 15  
 + [4.5 h follow-up lecture + 3.5 h preparation exercise] x 15  
 + 15 h exam preparation  
 = 180 h  $\hat{=}$  6 ECTS

### Recommendations

Knowledge of the basics of probability theory is helpful.

## M

**5.305 Module: Stochastic Optimization [M-WIWI-103289]**

**Coordinators:** Prof. Dr. Steffen Rebennack  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [Economics and Management \(Operations Research\)](#)

Credits  
9 CPGrading  
gradedRecurrence  
Each termDuration  
1 termLanguage  
German/EnglishLevel  
4Version  
11

| Compulsory Elective Courses (Election: between 1 and 2 items) |                                                                |        |           |
|---------------------------------------------------------------|----------------------------------------------------------------|--------|-----------|
| T-WIWI-106546                                                 | <a href="#">Introduction to Stochastic Optimization</a>        | 4,5 CP | Rebennack |
| T-WIWI-106548                                                 | <a href="#">Advanced Stochastic Optimization</a>               | 4,5 CP | Rebennack |
| T-WIWI-106549                                                 | <a href="#">Large-scale Optimization</a>                       | 4,5 CP | Rebennack |
| Supplementary Courses (Election: at most 1 item)              |                                                                |        |           |
| T-WIWI-102723                                                 | <a href="#">Graph Theory and Advanced Location Models</a>      | 4,5 CP | Nickel    |
| T-WIWI-102719                                                 | <a href="#">Mixed Integer Programming I</a>                    | 4,5 CP | Stein     |
| T-WIWI-102720                                                 | <a href="#">Mixed Integer Programming II</a>                   | 4,5 CP | Stein     |
| T-WIWI-111247                                                 | <a href="#">Mathematics for High Dimensional Statistics</a>    | 4,5 CP | Grothe    |
| T-WIWI-111587                                                 | <a href="#">Multicriteria Optimization</a>                     | 4,5 CP | Stein     |
| T-WIWI-103124                                                 | <a href="#">Multivariate Statistical Methods</a>               | 4,5 CP | Grothe    |
| T-WIWI-102715                                                 | <a href="#">Operations Research in Supply Chain Management</a> | 4,5 CP | Nickel    |
| T-WIWI-106545                                                 | <a href="#">Optimization under Uncertainty</a>                 | 4,5 CP | Rebennack |
| T-WIWI-112109                                                 | <a href="#">Topics in Stochastic Optimization</a>              | 4,5 CP | Rebennack |

**Assessment**

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

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

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

**Prerequisites**

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

**Competence Goal**

The student

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

**Additional Information**

The courses are sometimes offered irregularly. The curriculum, planned for three years in advance, can be found on the Internet at <http://sop.ior.kit.edu/28.php>.

**Workload**

The total workload for this module is approximately 270 hours (9 credits). The allocation is made according to the credit points of the courses of the module. The total number of hours per course is determined by the amount of time spent attending the lectures and exercises, as well as the exam times and the time required to achieve the module's learning objectives for an average student for an average performance.

**Recommendations**

It is recommended to listen to the lecture "Introduction to Stochastic Optimization" before the lecture "Advanced Stochastic Optimization" is visited.

**M****5.306 Module: Student Innovation Lab (SIL) 1 [M-WIWI-105010]**

**Coordinators:** Prof. Dr.-Ing. Sören Hohmann  
Prof. Dr. Orestis Terzidis

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

**Part of:** [Economics and Management \(Business Administration\)](#)

**Credits**  
9 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
2 terms

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                               |      |          |
|---------------|-----------------------------------------------|------|----------|
| T-WIWI-102864 | <a href="#">Entrepreneurship</a>              | 3 CP | Terzidis |
| T-WIWI-110166 | <a href="#">SIL Entrepreneurship Project</a>  | 3 CP | Terzidis |
| T-WIWI-110287 | <a href="#">SIL Entrepreneurship Emphasis</a> | 3 CP | Terzidis |

**Assessment**

The assessment of this module comprises a written examination of 60 minutes on the lecture contents of the lecture "Entrepreneurship" as well as two seminars. All examinations are graded. In both seminars the following tasks have to be fulfilled:

- "SIL Entrepreneurship Project": Presentation of the Value Profile & submission of the Business Plan
- "SIL Entrepreneurship Emphasis": Submission of price calculation, market potential analysis, competition analysis, financial plan, risk analysis, decision basis for funding and legal form

In addition, both courses provide for smaller, ungraded tasks to monitor progress.

The grade consists of 60 % of the written examination, 20 % of the examination "SIL Entrepreneurship Project" and 20 % of the examination "SIL Entrepreneurship Advanced".

**Prerequisites**

The module can only be completed together with the module M-WIWI-105011 "Student Innovation Lab 2".

An application is required for participation in the modules Student Innovation Lab (SIL) 1 and Student Innovation Lab (SIL) 2. Information about the application can be found at <http://www.kit-student-innovation-lab.de/index.php/for-students/>.

**Competence Goal****Personal competence**

- Ability to reflect: Students can analyse certain elements of their actions in social interaction, critically assess them and develop alternative actions.
- Decision-making ability: Students can prepare a decision template in due time and provide the necessary factual arguments for alternative decisions and thus make timely decisions.
- Interdisciplinary cooperation: Students can recognise the limits of their domain competence and adjust to domains outside their subject area. The students are able to recognise missing (own) competences and to supplement them with complementary competences (of other persons in the team). Students can communicate their domain to others and develop a basic understanding of foreign domains.
- Value-based action: Students can use selected tools of psychology to recognize their own values. They can compare these values with other team members and critically reflect on whether their offers match these values.

**Social competence**

- Ability to cooperate: Students can analyse and assess their cooperation behaviour in the group.
- Communication skills: Students can present their information in a convincing, focused and target group-oriented way.
- Conflict ability: Students can recognise conflicts at an early stage, analyse conflict situations and name solution concepts.

**Innovation and Entrepreneurship Competence**

- Agile product development: Students can apply methods of agile product development such as Scrum.
- Methodical innovation finding: Students can perform user- or technology-centric innovation processes to develop sustainable value propositions for dedicated target groups (e.g. Design Thinking (DT), Technology Application Selection (TAS) process).
- Orientation on the management of new technology-based companies (NTBF): Students can name the central concepts of intellectual property and legal form. Students can name the most important tasks of entrepreneurial leadership. They can identify the relevant forms of business modelling and draw up a business plan. Students know the central approaches to building an organisation. Students will be able to identify the ownership structure of investments and how to develop a strategy. The students can name marketing concepts and create a business model.
- Create investment readiness: The students are able to create a rudimentary sales and cost planning. Furthermore, they are able to create a project plan for a company and derive an investment plan from it. The students can present the business plan to potential investors and develop investor empathy.
- Business model development competence: Students are able to use relevant tools for business modelling, e.g. the Business Model Canvas. Students can develop and evaluate alternative business models.
- Dealing with risks: Students can identify the basic risks in terms of desirability, technical feasibility and profitability. Students can use customer interaction methods to test desirability and willingness to pay. Students can draw up a rudimentary competitive analysis. Students can identify and identify risks and possible reactions.

**Systemic technical competence**

- Problem-solving competence: Students can analyse, assess and solve a technical problem in a structured way.
- Agile Methodology of System Development: Students can name the different system development processes and apply them appropriately.
- Validation in a volatile environment: Students can perform a technical and economic validation under volatile boundary conditions. For this purpose they can name the boundary conditions and interpret the results of the validation.
- Functional decomposition: Students are able to identify and interpret complex customer needs and derive functional requirements from them.
- Architecture development: The students are able to recognize correlations from the functional requirements and to derive a suitable system architecture.

**Content**

In a real laboratory, the module imparts professional, social and personal competences in entrepreneurship and in the respective technical domain. The aim is to prepare students in the best possible way for an entrepreneurial activity within or outside an established organisation. Our teaching is research-based and practice-oriented.

As an integral part, the lecture Entrepreneurship offers the theoretical basis and gives an overview of important theoretical concepts and empirical evidence. Current case studies and practical experiences of successful founders underline the theoretical and empirical contents. In order to operate a company on a long-term basis, important specialist knowledge is also of decisive importance. The content of the lecture therefore includes an introduction to Entrepreneurial Marketing and Leadership as well as the basics of Opportunity Recognition and Business Modeling. Customer-centric development methods, the lean start-up approach and methods for technology-oriented innovation are presented. Future founders must be able to develop and manage resources such as financial and human capital, infrastructure and intellectual property. Further aspects relate to the establishment of an organisation and the financing of one's own project.

The knowledge gained in the lecture Entrepreneurship will be applied in a practice-oriented seminar and in the labs. We use an action learning approach to complement the knowledge with skills and reflective attitudes. In five-member teams, the students experience their way from idea generation to the final investor pitch.

With regard to the labs, students have the following options:

- As an innovation platform, the Automation Innovation Lab offers flying robots for cooperative swarm solutions.
- The Industry 4.0 Innovation Lab enables innovations in the area of the next industrial revolution with mobile robot platforms.
- In the Internet of Things Innovation Lab, innovations in Assisted Living and Smart Housing are made possible by a comprehensive kit of mobile robots and sensors.
- The Computer Vision for Health Lab offers a selection of state-of-the-art imaging devices and powerful computing hardware for innovative image-based applications for medicine and healthcare.

The module also teaches methods of agile system development (Scrum) and the associated validation methods as well as methods of functional prototyping. Gate plans are applied within the module to determine project progress.

Methods for the reflection of individual & team work are treated and applied as well as group work specific knowledge about different roles of team members, solution of conflict situations and interdisciplinary teams are obtained.

**Workload**

Total effort for 9 credit points: approx. 270 hours. The distribution is based on the credit points of the courses of the module. The total number of hours per course results from the effort required to attend lectures and exercises, as well as the examination times and the time required to achieve the learning objectives of the module for an average student for an average performance.



**M****5.307 Module: Sustainable Information Systems [M-WIWI-107649]**

**Coordinators:** TT-Prof. Dr. Philipp Staudt  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [Economics and Management \(Business Administration\)](#)

**Credits**  
9 CP

**Grading**  
graded

**Recurrence**  
Each term

**Duration**  
2 terms

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                                 |        |        |
|---------------|-------------------------------------------------|--------|--------|
| T-WIWI-114994 | <a href="#">Digital Energy Systems</a>          | 4,5 CP | Staudt |
| T-WIWI-114995 | <a href="#">Sustainable Information Systems</a> | 4,5 CP | Staudt |

**Assessment**

The module examination consists of partial examinations of the selected courses, which together meet the required credit point requirement. Details of the examination can be found in the respective partial performance description. The total grade of the module is formed from the grades of the partial examinations weighted by credit points (cut off after the first decimal place).

**Prerequisites**

None

**Competence Goal**

The student

- knows methods for investigating the use of sustainable information systems or information systems for promoting sustainability.
- is aware of the uses of digital technology for sustainability.
- understands how digital technology is changing the energy market and the energy system.
- is able to generate insights into the use of information systems with the help of scientific methods.
- is familiar with the economic and behavioral science theories underlying the digitization of the energy system.
- can make decisions on the use of digital technology for sustainability purposes or in the energy sector.

**Content**

The module deals with the use of digital technology for sustainability purposes from a general and an energy system perspective. The courses focus on context-specific as well as methodological and theoretical content. While Methods in Sustainable Information Systems focuses on the general perspective on sustainability and methodological knowledge, Digital Energy Systems focuses on the energy system context and economic and behavioral theory fundamentals.

**Workload**

Total workload for 9 credit points: approx. 270 hours.

- Attendance time: 51 hours
- Preparation and follow-up: 153 hours
- Exam and exam preparation: 66 hours

The exact distribution is based on the credit points of the courses in the module.

**M****5.308 Module: Telematics [M-INFO-107243]**

**Coordinators:** Prof. Dr. Martina Zitterbart  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |            |      |            |
|---------------|------------|------|------------|
| T-INFO-114269 | Telematics | 6 CP | Zitterbart |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students

- master protocols, architectures, and methods and algorithms that are used on the Internet for routing and for establishing a reliable end-to-end connection, as well as various media allocation procedures in local networks.
- have an understanding of the systems and the problems that appear in a global, dynamic network as well as the mechanisms used to remedy them.
- are familiar with current developments such as SDN and data center networking.
- know methods to manage and administrate networks.

Students master the basic protocol mechanisms for establishing reliable end-to-end communication. Students have detailed knowledge of the mechanisms used in TCP for congestion and flow control and can discuss the issue of fairness with multiple parallel transport streams. Students can analytically determine the performance of transport protocols and know methods that fulfill special requirements of TCP, such as high data rates and short latencies. Students are familiar with current topics such as problems introduced by utilization of middle boxes in the Internet, the use of TCP in data centers and multipath TCP. Students can use transport protocols in practice.

Students know the functions of routers in the Internet and can reproduce and apply common routing algorithms. Students can reproduce the architecture of a router and know different approaches to buffer placement as well as their advantages and disadvantages.

Students understand the distinction of routing protocols into interior and exterior gateway protocols and have detailed knowledge of the functionality and properties of common protocols such as RIP, OSPF and BGP. The students are familiar with current topics such as SDN.

Students know the function of media allocation and can classify and analytically evaluate media allocation processes. Students have in-depth knowledge of Ethernet and are familiar with various Ethernet forms and their differences, especially current developments such as real-time Ethernet and data center Ethernet. Students can reproduce and apply the spanning tree protocol. Students can reproduce the technical characteristics of DSL. Students are familiar with the concept of label switching and can compare existing approaches such as MPLS.

**Content**

- Introduction
- End-to-end data transport
- Routing protocols and architectures
- Media allocation
- Bridges
- Data transmission
- Further selected examples
- Network management

**Workload**

Lecture with 3 SWS plus follow-up/exam preparation, 6 CP.

6 CP corresponds to approx. 180 working hours, of which

approx. 60 hours lecture attendance

approx. 60 hours preparation/follow-up work

approx. 60 hours exam preparation

## M

**5.309 Module: Testing Digital Systems I [M-INFO-100851]****Coordinators:** Prof. Dr. Mehdi Baradaran Tahoori**Organisation:** KIT Department of Informatics**Part of:** Informatics**Credits**  
3 CP**Grading**  
graded**Recurrence**  
Irregular**Duration**  
1 term**Language**  
English**Level**  
4**Version**  
1

| Mandatory     |                           |      |         |
|---------------|---------------------------|------|---------|
| T-INFO-101388 | Testing Digital Systems I | 3 CP | Tahoori |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

The course provides the basic techniques for testing digital circuits

**Content**

Testing of digital circuits plays a critical role during the design and manufacturing cycles. It also ensures the quality of parts shipped to the customers. Test generation and design for testability are integral parts of automated design flow of all electronics products. The objective of this course is to provide the foundations for developing test methods for digital systems and provides the techniques necessary to practice design for testability.

This course encompasses the theoretical and practical aspects of digital systems testing and the design of easily testable circuits. Topics include Introduction to Testing (testing definition, types of test, automatic test equipment, test economics, and quality models), Failures and Errors (definitions, failure modes, failure mechanisms, reliability defects), Faults (fault models, stuck-at faults, bridging faults, timing faults, transistor-level faults, functional-level faults, effectiveness of different fault models based on real data), Logic and Fault Simulation (fault equivalence and fault collapsing, true-value simulation, fault simulation algorithms, statistical methods), Test Generation for Combinational Circuits (algebraic methods, path-tracing (D-alg, PODEM, FAN), testability metrics, test file compression), Digital Design-For-Testability and Internal Scan Design (ad-hoc methods, scan architectures, scan-based test methodology).

**Workload**

2 SWS: (2 SWS + 1,5 x 2 SWS) x 15 + 15 h preparation for the exam = 90 h = 3 ECTS



## 5.310 Module: Testing Digital Systems II [M-INFO-102962]

**Coordinators:** Prof. Dr. Mehdi Baradaran Tahoori

**Organisation:** KIT Department of Informatics

**Part of:** Informatics

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Each summer term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                            |      |         |
|---------------|----------------------------|------|---------|
| T-INFO-105936 | Testing Digital Systems II | 3 CP | Tahoori |

### Assessment

See partial achievements (Teilleistung)

### Prerequisites

See partial achievements (Teilleistung)

### Competence Goal

The objective of this course is to provide more advanced topics on testing of digital systems and complement the foundation covered in Testing Digital Systems I.

### Content

Testing of digital circuits plays a critical role during the design and manufacturing cycles. It also ensures the quality of parts shipped to the customers. Test generation and design for testability are integral parts of automated design flow of all electronic products. The objective of this course is to provide more advanced topics on testing of digital systems and complement the foundation covered in Testing Digital Systems I.

Topics include Functional and Structural Testing (design verification vectors, exhaustive test, pseudo-exhaustive test, pseudo-random testing), Essentials of Test Generation for Sequential Circuits (state-machine initialization, time-frame expansion method), Built-in Self Test (test economics of BIST, test pattern generation, output response analysis, BIST architectures), Boundry Scan (Boundry scan architectures, BS test methodology), Delay Testing (path delay test, hazard-free, robust, and non-robust delay tests), transition faults, delay test schemes), Current-Based Testing (motivation, test vectors for IDDQ, variations of IDDQ), Memory Test (memory test algorithm, memory BIST, memory repair), and DFT for System-on-Chip.

### Workload

2 SWS: (2 SWS + 1.5 x 2 SWS) x 15 + 15 h exam preparation = 90 h = 3 ECTS

### Recommendations

Knowledge of Digital Design and Computer Architecture is helpful.



## 5.311 Module: The de-Casteljau Algorithm [M-INFO-106642]

**Coordinators:** Prof. Dr. Hartmut Prautzsch  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Once

**Duration**  
1 term

**Language**  
German/English

**Level**  
4

**Version**  
1

| Mandatory     |                                            |      |           |
|---------------|--------------------------------------------|------|-----------|
| T-INFO-113389 | <a href="#">The de-Casteljau Algorithm</a> | 3 CP | Prautzsch |

### Competence Goal

People are familiar with de Casteljau's algorithm, its generalisations, possible applications and variants, and have understood how fundamental it is to the development of "Computer Aided Geometric Design" to this day.

### Content

- The history of THE algorithm
- THE algorithm for curves
- THE algorithm for arbitrary dimensional surfaces
- The immediate meanings (evaluation, subdivision, convergence, continuation property, ...)
- THE rational algorithm
- THE focal algorithm
- THE dual algorithm
- THE algorithm for homogeneous polynomials
- THE spherical algorithm
- THE hyperbolic algorithm
- Polar forms
- The de Boor and Oslo algorithm
- B-Patches
- Display conversions using the algorithm
- Grade raising using the DES algorithm
- The connection with forging spaces
- Gk Chebyshev splines
- Matrix subdivision
- Corner cutting
- Focal splines

### Additional Information

UNIQUE in WS 25/26!!!

### Workload

90h



## 5.312 Module: Theoretical Foundations of Cryptography [M-INFO-105584]

**Coordinators:** Prof. Dr. Jörn Müller-Quade  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
German

**Level**  
4

**Version**  
1

| Mandatory     |                                         |      |              |
|---------------|-----------------------------------------|------|--------------|
| T-INFO-111199 | Theoretical Foundations of Cryptography | 6 CP | Müller-Quade |

### Assessment

See Partial Achievements (Teilleistung).

### Prerequisites

See Partial Achievements (Teilleistung).

### Competence Goal

The student

- can motivate and explain the basic concepts of cryptography, point out their differences and relate them to each other.
- is able to compare and evaluate security models and goals.
- knows and understands definitions and constructions, and their relationships and dependencies. For example, properties such as "one-way", "collision-resistant", "pseudo-random", "IND-CPA", "IND-CCA", "EUF-CMA", etc., and candidates, constructions, and schemes with such properties.
- understands elementary proof techniques (such as reductions and hybrid arguments) and can apply them
- can reproduce, check and explain security proofs.
- can construct and evaluate simple new procedures and find possible attacks.
- can prove (simple) secure schemes to be secure using the techniques learned.

### Content

The lecture deals with the theoretical foundations of cryptography, with a focus on non-interactive foundations. The lecture consists of three main parts.

1. Aspects of complexity theory
2. Secret-key cryptography
3. Public-Key Cryptography

The usual contents include:

- Asymptotic security, one-way functions, pseudorandomness and indistinguishability
- Secret-key cryptography (encryption, security notions such as IND-CPA, IND-CCA, authenticity, and authenticated encryption)
- Public-key encryption (security notions in this situation, in particular CCA security)
- Signatures (definition and basic constructions)
- Outlooks on more advanced topics (e.g. as part of the exercises)

The lecture is supplemented by an exercise that recapitulates, deepens and applies the material in a new context.

The specific content of the lecture and exercise varies depending on the focus chosen. It serves as a basis for further lectures and seminars, for example on cryptographic protocols (interactive cryptography) and advanced non-interactive cryptography.

### Workload

Attendance time in the lecture: 48 h

Preparation and follow-up of the same: 52 h

Exam preparation and attendance in the same: 80 h



## 5.313 Module: Theory of Satisfiability Algorithms [M-INFO-107639]

**Coordinators:** Prof. Dr.-Ing. Marvin Künnemann

**Organisation:** KIT Department of Informatics

**Part of:** Informatics

**Credits**  
4 CP

**Grading**  
graded

**Recurrence**  
Irregular

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                     |      |           |
|---------------|-------------------------------------|------|-----------|
| T-INFO-114982 | Theory of Satisfiability Algorithms | 4 CP | Künnemann |

### Assessment

See Partial Achievements (Teilleistung).

### Prerequisites

See Partial Achievements (Teilleistung).

### Competence Goal

Students know the foundations of the rigorous theoretical analysis of algorithms for the Satisfiability problem and its many variants. They have an overview over the state of the art of worst-case time upper bounds. They understand further theoretical aspects such as combinatorial properties, hardness conjectures, etc. and are able to derive implications for the (sub)exponential-time solvability of related problems.

### Content

The Satisfiability (SAT) problem for Boolean formulas is fundamental for computer science, due to a variety of applications (cf. the practical success of SAT solvers) as well as its central role for the theory of computation. This course focuses on theoretical aspects of the problem, which includes topics among:

- exponential-time algorithms with provable worst-case guarantees (e.g., for k-SAT, CNF-SAT and further variants)
- tractable special cases of the problem
- classification of constraint satisfaction problems
- combinatorial insights (e.g., the algorithmic Lovasz Local Lemma)
- the sparsification lemma and its limits
- generalizations: MaxSAT, #SAT, Quantified SAT
- hardness hypotheses and their implications: ETH, SETH, NSETH, MASETH, Formula-SETH
- isolation lemma

### Workload

4 CP correspond to approx. 120 h of work, estimated as follows:

- ca. 30 h attendance in lectures
- ca. 60 h follow-up on lectures, solving exercises, independent review
- ca. 30 h preparation for exam

### Recommendations

See Partial Achievements (Teilleistung).



**M****5.314 Module: Timed Systems [M-INFO-106293]****Coordinators:** Jun.-Prof. Dr. Maike Schwammberger**Organisation:** KIT Department of Informatics**Part of:** Informatics**Credits**  
6 CP**Grading**  
graded**Recurrence**  
Each summer term**Duration**  
1 term**Language**  
English**Level**  
4**Version**  
3

| Mandatory     |               |      |               |
|---------------|---------------|------|---------------|
| T-INFO-112754 | Timed Systems | 6 CP | Schwammberger |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

Students can independently model and analyze software systems with time components. To this end, they can select the appropriate modeling method for the application area from a range of different modeling methods. With the help of formal methods and practical tools (UPPAAL), students analyze their modeling with regard to correctness. Students can transfer the methods they have learned to current problems.

**Content**

Many of the (embedded) software systems we are confronted with in everyday life have time-critical functionalities. For example, an airbag should be activated within a certain, very short period of time in the event of an accident. Similarly, we expect fast response times from the various apps on our smartphones in order to use them conveniently and effectively.

"Time" is therefore a decisive factor when modeling software systems. This lecture describes various mechanisms for formalizing so-called real-time systems. In addition to modeling, the lecture also focuses on the analysis of systems. The following topics are covered in particular:

- Timed automata (an extension of finite automata by time)
- Model checking of timed automata with the help of UPPAAL
- Duration calculus (a logic that talks about time intervals)
- Extensions and applications of timed systems

The weekly lecture consists of both theoretical and applied parts. For application and transfer of the contents, voluntary exercises are offered, which are discussed in the bi-weekly exercise.

**Workload**

4 SWS lecture

6 ECTS equals 180 working hours, of which

approx. 40 hours attending the lecture (theoretical and applied part)

approx. 70 hours preparation and follow-up

approx. 40 hours working on in-depth exercises

approx. 30 hours exam preparation

**Recommendations**

Basic knowledge in areas of theoretical computer science and modeling of (embedded) software systems is helpful (e.g. temporal logics, finite automata, predicate logic), but is not required.

**Literature**

The book "E.-R. Olderog, H. Dierks: Real-Time Systems" is used as reading material for some of the lecture contents (<https://doi.org/10.1017/CBO9780511619953>).

**M****5.315 Module: Tools for Probabilistic Machine Learning [M-INFO-106870]**

**Coordinators:** Prof. Dr.-Ing. Uwe Hanebeck  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
German

**Level**  
3

**Version**  
1

| Mandatory     |                                                                 |      |          |
|---------------|-----------------------------------------------------------------|------|----------|
| T-INFO-113763 | <a href="#">Tools for Probabilistic Machine Learning</a>        | 6 CP | Hanebeck |
| T-INFO-113764 | <a href="#">Tools for Probabilistic Machine Learning - Pass</a> | 0 CP | Hanebeck |

**M****5.316 Module: Transport Infrastructure Policy and Regional Development [M-WIWI-101485]**

**Coordinators:** Prof. Dr. Kay Mitusch  
**Organisation:** KIT Department of Business and Economics  
**Part of:** Economics and Management (Economics)

| Credits | Grading | Recurrence | Duration | Language       | Level | Version |
|---------|---------|------------|----------|----------------|-------|---------|
| 9 CP    | graded  | Each term  | 2 terms  | German/English | 4     | 2       |

| Compulsory Elective Courses (Election: 2 items) |                     |        |                 |
|-------------------------------------------------|---------------------|--------|-----------------|
| T-WIWI-103107                                   | Spatial Economics   | 4,5 CP | Ott             |
| T-WIWI-100007                                   | Transport Economics | 4,5 CP | Mitusch, Szimba |

**Assessment**

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**

None

**Competence Goal**

The students

- understand the economic issues related to transport and regional development with a main focus on economic policy issues generated by the relationship of transport and regional development with the public sector
- are able to compare different considerations of politics, regulation and the private sector and to analyse and assess the respective decision problems both qualitatively and by applying appropriate methods from economic theory
- are prepared for careers in the public sector, particularly for public companies, politics, regulatory agencies, related consultancies, mayor construction companies or infrastructure project corporations

**Content**

The development infrastructure (e.g. transport, energy, telecommunications) has always been one of the most relevant factors for economic development and particularly influences the development of the regional economy. From the repertoire of state actions, investments into transport infrastructure are often regarded the most important measure to foster regional economic growth. Besides the direct effects of transport policy on passenger and freight transport, a variety of individual economic activities is significantly dependent on the available or potential transport options. Decisions on the planning, financing and realization of mayor infrastructure projects require a solid and far-reaching consideration of direct and indirect growth effects with the occurring costs.

Through its combination of lectures the module reflects the complex interdependencies between infrastructure policy, transport industry and regional policy and provides its participants with a comprehensive understanding of the functionalities of one of the most important sectors of the economy and its relevance for economic policy.

**Additional Information**

The courses *Assessment of Public Policies and Projects I* (winter term) and *Assessment of Public Policies and Projects II* (summer term) will no longer be part of this module. Student who have already had exams in this courses can integrate these exams in this module.

**Workload**

The total workload for this module is approximately 270 hours. The exact distribution is based on the credit points of the courses in the module. The total number of hours per course is determined by the amount of time spent attending the lectures and tutorials, 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.

**M****5.317 Module: Type Systems and Program Analysis [M-INFO-107664]**

**Coordinators:** Prof. Dr. Sebastian Erdweg  
**Organisation:** KIT Department of Informatics  
**Part of:** Informatics

**Credits**  
6 CP

**Grading**  
graded

**Recurrence**  
Irregular

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                   |      |        |
|---------------|-----------------------------------|------|--------|
| T-INFO-115016 | Type Systems and Program Analysis | 6 CP | Erdweg |

**Assessment**

See Partial Achievements (Teilleistung).

**Prerequisites**

See Partial Achievements (Teilleistung).

**Competence Goal**

- Students can understand, design, and implement static type systems.
- Students can validate the soundness of static type systems.
- Students know the foundations of abstract interpretation.
- Students can understand, design, and implement data-flow analyses.
- Students can assess analyses based on their soundness, recall, and precision.

**Content**

Static type systems and program analyses predict the behavior of programs through source-code analysis, but without executing the program. They are fundamental for isolating ill-defined program behavior (e.g., from type errors), but can also find bugs or also can provide guarantees (e.g., memory safety). Topics covered in this course include the design, definition, formalization, and application of type systems and static program analyses, including type inference, dependent typing, control flow, data flow, abstract interpretation, soundness, and precision.

**Workload**

1. Attendance time 4 h x 15 weeks = 60 h
2. Self-study 7 h x 15 weeks = 105 h
3. Preparation for the exam 15 h

**Recommendations**

Knowledge of programming semantics is helpful but not required.  
 Knowledge of logic inference systems is helpful but not required.

## M

**5.318 Module: Ubiquitous Computing [M-INFO-107161]**

**Coordinators:** Prof. Dr.-Ing. Michael Beigl  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
5 CP

**Grading**  
graded

**Recurrence**  
Irregular

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                      |      |       |
|---------------|--------------------------------------|------|-------|
| T-INFO-114188 | <a href="#">Ubiquitous Computing</a> | 5 CP | Beigl |

**Assessment**

See partial achievements (Teilleistung)

**Prerequisites**

See partial achievements (Teilleistung)

**Competence Goal**

The aim of the lecture is to impart knowledge of the fundamentals and advanced methods and techniques of ubiquitous computing. After completing the lecture, students will be able to  
 reproduce and discuss what they have learnt about existing ubiquitous computing systems.  
 evaluate the general knowledge of ubiquitous systems and transfer statements and laws to special cases.  
 evaluate and assess different methods for design processes and user studies and select suitable methods for the development of new solutions.  
 invent, plan, design and evaluate new ubiquitous systems for use in everyday or industrial process environments and assess the costs and technical implications.

**Content**

The lecture provides an overview of the history and teaches the concepts, theories and methods of ubiquitous information technology (ubiquitous computing). Based on the appliance concept, students then design their own appliances in the exercise, plan the construction and then develop them. The necessary technical and methodological basics such as hardware for ubiquitous systems, software for ubiquitous systems, principles of context recognition for ubiquitous systems, networking of ubiquitous systems and design of ubiquitous systems and in particular information appliances are discussed. Methods of design and testing for human-machine interaction and human-machine interfaces developed in ubiquitous computing are explained in detail. There is also an introduction to the economic aspects of a ubiquitous system.

In the practical part of the lecture, the understanding of ubiquitous systems is deepened through practical application of the knowledge base of the lecture. The students design and develop their own appliance and test it. The aim is to have gone through the steps towards a prototypical and possibly marketable appliance.

**Workload**

The total workload for this course unit is approximately 150 hours (5.0 credits).

**Activity Workload:**

- Attendance time: Attendance of the lecture  
15 x 90 min; 22 h 30 min
- Attendance time: Attendance of the exercise  
15 x 45 min; 11 h 15 min
- Preparation / follow-up of the lecture and exercise  
15 x 90 min; 22 h 30 min
- Developing a self-developed concept for an information appliance  
33 h 45 min
- Go through set of slides 2x  
2 x 12 h; 24 h 00 min
- Prepare exam  
36 h 00 min

**TOTAL**

150 h 00 min

## M

**5.319 Module: Virtual Systems [M-INFO-100867]**

**Coordinators:** Prof. Dr.-Ing. Frank Bellosa  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

**Credits**  
3 CP

**Grading**  
graded

**Recurrence**  
Each winter term

**Duration**  
1 term

**Language**  
German

**Level**  
4

**Version**  
1

| Mandatory     |                                 |      |         |
|---------------|---------------------------------|------|---------|
| T-INFO-101612 | <a href="#">Virtual Systems</a> | 3 CP | Bellosa |

**Competence Goal**

The students assess influential scientific papers in the area of virtual system and judge the quality concerning the criteria of relevance, novelty, evaluation and presentation.

The students discuss their reviews in a moderated meeting.

**Content**

All areas of virtual systems and distributed systems are relevant such as virtual machines, emulation and interpretation, simulation, trace and replay.

M

5.320 Module: Visualization [M-INFO-100738]

**Coordinators:** Prof. Dr.-Ing. Carsten Dachsbacher  
**Organisation:** KIT Department of Informatics  
**Part of:** [Informatics](#)

| Credits | Grading | Recurrence       | Duration | Language       | Level | Version |
|---------|---------|------------------|----------|----------------|-------|---------|
| 5 CP    | graded  | Each summer term | 1 term   | German/English | 4     | 1       |

| Mandatory     |                               |      |             |
|---------------|-------------------------------|------|-------------|
| T-INFO-101275 | <a href="#">Visualization</a> | 5 CP | Dachsbacher |



## 5.321 Module: Wearable Robotic Technologies [M-INFO-107113]

**Coordinators:** Prof. Dr.-Ing. Tamim Asfour  
Prof. Dr.-Ing. Michael Beigl

**Organisation:** KIT Department of Informatics

**Part of:** [Informatics](#)

**Credits**  
4 CP

**Grading**  
graded

**Recurrence**  
Each summer term

**Duration**  
1 term

**Language**  
English

**Level**  
4

**Version**  
1

| Mandatory     |                                               |      |               |
|---------------|-----------------------------------------------|------|---------------|
| T-INFO-114145 | <a href="#">Wearable Robotic Technologies</a> | 4 CP | Asfour, Beigl |

### Assessment

See partial achievements (Teilleistung)

### Prerequisites

See partial achievements (Teilleistung)

### Competence Goal

Students can explain the fundamentals, motivation, and applications of wearable robotic technologies including exoskeletons, orthoses, and prostheses. They have comprehensive knowledge of human anatomy, biomechanics, and the neuromuscular system relevant to wearable robot design.

Students understand the core components and challenges associated with the design of wearable robotic technologies, including mechanisms, actuation technologies, sensing approaches, and wearable computing concepts. They can analyze design requirements and challenges including kinematic compatibility and human-robot interfaces for wearable robots.

Students can explain control strategies for prosthetic and exoskeleton systems, understand both physical and cognitive aspects of human-robot interaction, and comprehend concepts such as body schema and symbiotic human-machine interaction in wearable systems.

### Content

The lecture provides a comprehensive introduction to wearable robotic technologies. It covers human anatomy and biomechanics as foundations for wearable robot design. Joint biomechanics, locomotion and gait analysis, the neuromuscular system, and models of the human body are discussed to understand how wearable robots can be designed and controlled.

Design principles and mechanisms of wearable robots are addressed. Actuation technologies are covered in depth: requirements analysis based on human motion and user needs, compliant actuation approaches (serial elastic, parallel elastic, variable stiffness actuation), and strategies for increasing efficiency such as energy harvesting, multi-articulation, and underactuation.

The lecture covers wearable computing principles such as body signals and phenomena, design principles for body-worn systems, attachment considerations based on body maps for heat tolerance, weight distribution, and flexibility, and fabric design with textile-embedded electronics.

Exoskeleton systems are presented, covering application areas, design challenges such as redundancy, kinematic compatibility, and misalignments, various types of exoskeletons, and the general design process. Prosthetic systems cover types of hand and lower limb prostheses, hand synergies for control, and mechanical interfaces through socket design.

Human-robot interaction addresses both physical and cognitive interfaces. Control strategies are presented for prosthetic systems (semi-autonomous grasping) and exoskeleton systems (hierarchical control, assistance evaluation). The concept of body schema from both neuroscience and robotics perspectives is discussed, emphasizing symbiotic human-machine interaction in tightly coupled wearable systems. State-of-the-art examples across various application domains illustrate current research and developments.

### Workload

Lecture with 2 SWS, 4 ECTS.

4 ECTS corresponds to ca. 120 hours, thereof

ca. 15 \* 2h = 30h attendance in the lecture

ca. 15 \* 3h = 45h preparation and follow-up of the lecture

ca. 45h preparation for the exam and exam itself



**M****5.322 Module: Web Applications and Service-Oriented Architectures (II) [M-INFO-100734]****Coordinators:** Prof. Dr. Sebastian Abeck**Organisation:** KIT Department of Informatics**Part of:** [Informatics](#)**Credits**  
4 CP**Grading**  
graded**Recurrence**  
Each summer term**Duration**  
1 term**Language**  
German**Level**  
4**Version**  
1

| Mandatory     |                                                                          |      |       |
|---------------|--------------------------------------------------------------------------|------|-------|
| T-INFO-101271 | <a href="#">Web Applications and Service-Oriented Architectures (II)</a> | 4 CP | Abeck |

**Assessment**

Siehe Teilleistung

## 6 Module components

T

### 6.1 Module component: "Practical Seminar in Discrete Optimization: Implementing and Evaluating Solution Methods (with Python)" [T-WIWI-114747]

**Coordinators:** Dr.-Ing. Hannah Bakker

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

**Part of:** [M-WIWI-102832 - Operations Research in Supply Chain Management](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 4,5 CP  | graded  | Once         | 1       |

| Courses  |         |                                                                                                                          |       |          |        |
|----------|---------|--------------------------------------------------------------------------------------------------------------------------|-------|----------|--------|
| WT 25/26 | 2500066 | <a href="#">Practical Seminar in Discrete Optimization: Implementing and Evaluating Solution Methods (with Python)</a>   | 3 SWS | Others / | Bakker |
| Exams    |         |                                                                                                                          |       |          |        |
| WT 25/26 | 7900067 | <a href="#">"Practical Seminar in Discrete Optimization: Implementing and Evaluating Solution Methods (with Python)"</a> |       |          | Nickel |

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

#### Assessment

The assessment is conducted as an alternative exam assessment in the form of a computational experiment. This includes the submission of a documented code project, a written report (6–8 pages), as well as an interim and a final presentation.

The final grade is composed of the graded and weighted assessment components: the code, the written report, and the interim and final presentations. Details will be announced at the beginning of the course.

#### Prerequisites

None

#### Workload

135 hours

Below you will find excerpts from courses related to this module component:

V

### Practical Seminar in Discrete Optimization: Implementing and Evaluating Solution Methods (with Python)

Others (sonst.)  
On-Site

2500066, WS 25/26, 3 SWS, Language: German, [Open in study portal](#)

#### Content

This application-oriented seminar provides students with practical skills in working with heuristic methods for discrete optimization. Participants implement a given solution approach in Python and apply it to defined benchmark instances. The focus is not only on technical implementation but also on the systematic setup, execution, and evaluation of a computational experiment. Students practice presenting and assessing results in a structured manner. The aim of the seminar is to develop fundamental competencies in algorithmic implementation and empirical evaluation of heuristic methods, applied to a concrete optimization problem.

#### Organizational issues

Die Veranstaltung ist teilnahmebeschränkt. Die Anmeldung wird vom 15.08. bis zum 30.09. im Wiwi-Portal freigeschaltet sein.

## T

**6.2 Module component: (Gen)AI and Virtual Reality for Business [T-WIWI-114749]****Coordinators:** Prof. Dr. Jella Pfeiffer**Organisation:** KIT Department of Business and Economics

**Part of:** [M-WIWI-103117 - Data Science: Data-Driven Information Systems](#)  
[M-WIWI-104080 - Designing Interactive Information Systems](#)  
[M-WIWI-107530 - Information Systems: AI & Data Science](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 4,5 CP  | graded  | Irregular    | 1       |

**Assessment**

Success is assessed in the form of an examination of another type. It consists of the creation of a podcast, poster or video and a final presentation. The overall impression will be assessed. Details on the structure of the assessment will be announced during the lecture.

**Prerequisites**

None

**Recommendations**

Basic knowledge of artificial intelligence and data science methods is an advantage.

**Additional Information**

There is a tutorial associated with the lecture, which takes place every two weeks.  
 This course component is expected to be offered firstly in the winter semester of 2026/27.

**Workload:**

- Lecture attendance time (2 SWS × 15 weeks): 30 h
- Attendance time tutorial (1 SWS × 15 weeks): 15 h
- Self-study lecture: 20 h
- Self-study tutorial: 50 h
- Exam preparation: 20 h
- Total: 135 h

**Workload**

135 hours

## T

**6.3 Module component: (Gen)AI-based Automation in Organizations [T-WIWI-114210]****Coordinators:** Prof. Dr. Alexander Mädche**Organisation:** KIT Department of Business and Economics

**Part of:** [M-WIWI-102806 - Service Innovation, Design & Engineering](#)  
[M-WIWI-103117 - Data Science: Data-Driven Information Systems](#)  
[M-WIWI-104068 - Information Systems in Organizations](#)  
[M-WIWI-104080 - Designing Interactive Information Systems](#)  
[M-WIWI-107530 - Information Systems: AI & Data Science](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 4,5 CP  | graded  | Each summer term | 1       |

| Courses |         |                                                           |       |                                                                                               |               |
|---------|---------|-----------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|---------------|
| ST 2026 | 2500015 | <a href="#">(Gen)AI-based Automation in Organizations</a> | 3 SWS | Lecture /  | Mädche, Benke |
| Exams   |         |                                                           |       |                                                                                               |               |
| ST 2026 | 7900308 | <a href="#">(Gen)AI-based Automation in Organizations</a> |       |                                                                                               | Mädche        |

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

**Assessment**

The alternative exam assessment is a single examination of another type that combines a written examination (duration ≈ 60 minutes) with the implementation of a capstone project. Both components are integrated into one overall assessment; the internal weighting of the two parts is defined by the teaching staff, but only one final grade is awarded for the whole examination. The final grade therefore reflects the total impression of the combined performance

**Workload**

135 hours

Below you will find excerpts from courses related to this module component:

## V

**(Gen)AI-based Automation in Organizations**2500015, SS 2026, 3 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
Blended (On-Site/Online)

**Content****Content**

The advent of generative artificial intelligence (GenAI) has received great attention in business and society due to its capabilities of content creation or decision making. Individuals started rapidly to use the capabilities of tools like ChatGPT, Claude or Google Gemini for text and image generation, personal recommendations, or decision support. At the same time, organizations are challenged to leverage GenAI and traditional AI technology within their business models, processes, and information systems. (Gen)AI technologies enable executing cognitive tasks which in the past were carried out manually by organizations' employees. Ultimately, this leads to an increase of automation in organizations. This digital transformation process to higher levels of automation, however, must be managed by organizations.

This course will address this organizational challenge and teach concepts about the automation of organizations and their employees leveraging (Gen)AI technologies. The course is not focusing on the technological foundations of GenAI but looks into the economic and social impact of the technology and its management.

**Learning Objectives**

As a result of attending this program, students will be able to:

- describe key concepts of (Gen)AI technologies enabling the increase of automation in organizations.
- understand the historical evolution and core concepts of automation to drive organizational efficiency and innovation.
- articulate (Gen)AI integration principles for effectively implementing automation in organizations.
- understand and apply automation management strategies and best practices for addressing challenges to ensure adoption of (Gen)AI capabilities for organizational automation from a socio-economic perspective.
- explore and prototype (Gen)AI-based applications to streamline individual tasks and workflows in the context of organizational automation.

**Case-studies & No-code exercise**

The course contains two applied elements:

- Case-study exercises in which the students apply the theoretical knowledge on integrating (Gen)AI-based services into an organization.
- No-code exercises in which the students will develop a no/low-code application using (Gen)AI services to implement automation.

**Organization**

The lecture kickoff will take place on **April 24, 2026** from 14:00 - 15:30 at Building 10.11 Room 213 (Plenarsaal).

More information about the schedule of the lecture, the exercises or any organizational aspect will be posted in advance in the ILIAS course of the lecture. For questions regarding the course please use the ILIAS Forum.

The lecture will be held by Dr. Ivo Benke and Till Carlo Schelhorn.

Lecture contact for organizational questions is Till Carlo Schelhorn (till.schelhorn@kit.edu)

## T

**6.4 Module component: Access Control Systems: Models and Technology [T-INFO-112775]****Coordinators:** Prof. Dr. Hannes Hartenstein**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106303 - Access Control Systems: Models and Technology](#)  
[M-WIWI-107529 - Information Systems: Software & Systems Engineering](#)**Type**  
Written examination**Credits**  
5 CP**Grading**  
graded**Term offered**  
Each summer term**Version**  
1

| Courses  |         |                                                               |       |                                                                                                         |                     |
|----------|---------|---------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------|---------------------|
| ST 2026  | 2400147 | <a href="#">Access Control Systems: Models and Technology</a> | 3 SWS | Lecture / Practice /  | Hartenstein, Hemken |
| Exams    |         |                                                               |       |                                                                                                         |                     |
| WT 25/26 | 7500087 | <a href="#">Access Control Systems: Models and Technology</a> |       |                                                                                                         | Hartenstein         |
| ST 2026  | 7500176 | <a href="#">Access Control Systems: Models and Technology</a> |       |                                                                                                         | Hartenstein         |

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

The assessment is carried out as a written examination (§ 4 Abs. 2 Nr. 1 SPO) lasting 60 minutes.

Depending on the number of participants, it will be announced six weeks before the examination (§ 6 Abs. 3 SPO) whether the examination takes place

- in the form of an oral examination lasting 30 minutes pursuant to § 4 Abs. 2 Nr. 2 SPO or
- in the form of a written examination lasting 60 minutes in accordance with § 4 Abs. 2 Nr. 1 SPO.

**Prerequisites**

None.

**Recommendations**

Basics according to the lectures "Information Security" and "IT Security Management for Networked Systems" are recommended.

Below you will find excerpts from courses related to this module component:

## V

**Access Control Systems: Models and Technology**

2400147, SS 2026, 3 SWS, Language: English, [Open in study portal](#)

Lecture / Practice (VÜ)  
On-Site

**Content****Content:**

Access control systems are everywhere and the backbone of secure services as they incorporate who is and who is not authorized: think of operating systems, information systems, banking, vehicles, robotics, cryptocurrencies, or decentralized applications as examples. The course starts with current challenges of access control in the era of hyperconnectivity, i.e., in cyber-physical or decentralized systems. Based on the derived needs for next generation access control, we first study how to specify access control and analyze strengths and weaknesses of various approaches. We then focus on up-to-date proposals, like IoT and AI access control. We look at current cryptographic access control aspects, blockchains and cryptocurrencies, and trusted execution environments. We also discuss the ethical dimension of access management. Students prepare for lecture and exercise sessions by studying previously announced literature and by preparation of exercises that are jointly discussed in the sessions.

**Competency Goals:**

- The student understands the challenges of access control in the era of hyperconnectivity.
- The student understands that an information security model defines access rights that express for a given system which subjects are allowed to perform which actions on which objects. The student understands that a system is said to be secure with respect to a given information security model, if it enforces the corresponding access rights.
- The student is able to derive suitable access control models from scenario requirements and is able to specify concrete access control systems. The student is able to decide which concrete architectures and protocols are technically suited for realizing a given access control model.
- The student knows access control protocols using cryptographic methods and is able to compare protocol realizations based on different cryptographic building blocks.
- The student is aware of the limits of access control models and systems with respect to their analyzability and performance and security characteristics. The student is able to identify the resulting tradeoffs.
- The student knows the state of the art with respect to current research endeavors, e.g., access control in the context of decentralized and distributed systems, Trusted Execution Environments, AI, robotics, or hash-chain based systems.

**Workload:**

## 1.Attendance time

Lecture: 2 SWS: 2,0h x 15 = 30h

Exercises: 1 SWS: 1,0h x 15 = 15h

## 2.Self-study (e.g., independent review of course material, work on homework assignments)

Weeklypreparation and follow-up ofthelecture: 15 x 1h x 3 = 45h

Weeklypreparation and follow-up oftheexercise: 15 x 2h = 30h

## 3.Preparation for the exam: 30h

$\Sigma = 150h = 5$  ECTS

**Competency certificate:**

Depending on the number of participants, it will be announced six weeks before the examination (§ 6 Abs. 3 SPO) whether the examination takes place

- in the form of an oral examination lasting 30 minutes pursuant to § 4 Abs. 2 Nr. 2 SPO or
- in the form of a written examination lasting 60 minutes in accordance with § 4 Abs. 2 Nr. 1 SPO.

**Recommendations:**

Basics according to the lectures "Information Security" and "IT Security Management for Networked Systems" are recommended.

Duration: One terms

## T

**6.5 Module component: Advanced Algorithmic Programming [T-INFO-111399]****Coordinators:** TT-Prof. Dr. Thomas Bläsius**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-105723 - Advanced Algorithmic Programming](#)**Type**  
Examination of another type**Credits**  
6 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
2

| Courses  |         |                                                        |         |                                                                                               |                    |
|----------|---------|--------------------------------------------------------|---------|-----------------------------------------------------------------------------------------------|--------------------|
| WT 25/26 | 2400145 | <a href="#">ICPC: Advanced Algorithmic Programming</a> | 2 SWS   | Lecture /  | Künnemann, Angrick |
| Exams    |         |                                                        |         |                                                                                               |                    |
| WT 25/26 | 7500284 | <a href="#">Advanced Algorithmic Programming</a>       | Bläsius |                                                                                               |                    |

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



## T

## 6.6 Module component: Advanced Bayesian Data Analysis [T-INFO-113673]

**Coordinators:** Prof. Dr. Nadja Klein

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-106812 - Advanced Bayesian Data Analysis](#)

**Type**  
Written examination

**Credits**  
5 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
1

| Courses  |         |                                                             |       |                                                                                                         |       |
|----------|---------|-------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------|-------|
| WT 25/26 | 2400120 | <a href="#">Advanced Bayesian Data Analysis</a>             | 3 SWS | Lecture / Practice /  | Klein |
| Exams    |         |                                                             |       |                                                                                                         |       |
| WT 25/26 | 7500059 | <a href="#">Advanced Bayesian Data Analysis</a>             | Klein |                                                                                                         |       |
| ST 2026  | 7500233 | <a href="#">Nachklausur Advanced Bayesian Data Analysis</a> | Klein |                                                                                                         |       |

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

### Assessment

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 90 minutes.

*A bonus can be acquired through successful participation in the exercise as a success control of a different kind (§4(2), 3 SPO 2008) or study performance (§4(3) SPO 2015). The exact criteria for awarding a bonus will be announced at the beginning of the lecture. 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). The bonus is only valid for the main and post exams of the semester in which it was earned. After that, the grade bonus expires.*

### Recommendations

- Knowledge in R or Python
- Mathematics-heavy lecture. The basics will be reviewed, but mathematical proficiency is helpful

## T

**6.7 Module component: Advanced Corporate Finance [T-WIWI-113469]****Coordinators:** Prof. Dr. Martin Ruckes**Organisation:** KIT Department of Business and Economics

**Part of:** [M-WIWI-101453 - Applied Strategic Decisions](#)  
[M-WIWI-101480 - Finance 3](#)  
[M-WIWI-101483 - Finance 2](#)  
[M-WIWI-101502 - Economic Theory and its Application in Finance](#)

**Type**  
Written examination

**Credits**  
4,5 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
1

| Courses  |         |                                            |       |                                                                                               |        |
|----------|---------|--------------------------------------------|-------|-----------------------------------------------------------------------------------------------|--------|
| ST 2026  | 2530214 | <a href="#">Advanced Corporate Finance</a> | 2 SWS | Lecture /  | Ruckes |
| Exams    |         |                                            |       |                                                                                               |        |
| WT 25/26 | 7900058 | <a href="#">Advanced Corporate Finance</a> |       |                                                                                               | Ruckes |
| ST 2026  | 7900317 | <a href="#">Advanced Corporate Finance</a> |       |                                                                                               | Ruckes |

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

**Assessment**

The assessment of this course is a written examination (following §4(2), 1 SPO) of 60 mins.

The exam is offered each semester.

Below you will find excerpts from courses related to this module component:

## V

**Advanced Corporate Finance**

2530214, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

**Lecture (V)**  
On-Site

**Content**

The course covers the foundational principles of advanced topics of corporate finance, such as corporate governance, executive compensation, strategy & finance, mergers & acquisitions (M&A), and sustainable finance. Additionally, the course explores the respective institutional aspects within these areas of corporate finance. The approach is holistic, including both theoretical-conceptual aspects (e.g., moral hazard and the influence of asymmetric information) and empirical insights (e.g., the effects of financial decisions on firm value). Throughout, the course will emphasize both fundamental and current research findings.

**Learning outcomes:**

Upon successful completion of the course, students will possess profound knowledge and skills in advanced areas of corporate finance. These areas include topics such as corporate governance, executive compensation, strategy and finance, mergers and acquisitions (M&A), as well as key aspects of sustainable finance. Participants of this course will be able to describe and analyze the theoretical and conceptual foundations of the effects of information asymmetries and moral hazard on corporate financing behavior and assess their impact in corporate practice. Furthermore, upon completion of the course, participants will be familiar with the fundamental institutional elements in these areas and be able to discuss and solve advanced problems in corporate finance from both a theoretical and an empirical perspective. Moreover, students will acquire an advanced understanding of the central scientific findings in these topic areas, which will enable them to critically apply them in scientific and practical contexts.

**Literature**

Verschiedene Literaturquellen, u.a. Brealey/Myers/Allen/Edmans: Principles of Corporate Finance; Thomson/Conyon: Corporate Governance: Mechanisms and Systems; Larcker/Tayan: Corporate Governance Matters. Weitere Literatur wird in der Lehrveranstaltung bekannt gegeben.

Various source of literature, among others Brealey/Myers/Allen/Edmans: Principles of Corporate Finance; Thomson/Conyon: Corporate Governance: Mechanisms and Systems; Larcker/Tayan: Corporate Governance Matters. Additional reading materials will be introduced during the course.

## T

## 6.8 Module component: Advanced Data Structures [T-INFO-114223]

**Coordinators:** Prof. Dr. Peter Sanders

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-107200 - Advanced Data Structures](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 4 CP    | Graded  | Each summer term | 1       |

| Courses |         |                                          |       |                                                                                               |                                                |
|---------|---------|------------------------------------------|-------|-----------------------------------------------------------------------------------------------|------------------------------------------------|
| ST 2026 | 2400164 | <a href="#">Advanced Data Structures</a> | 3 SWS | Lecture /  | Sanders, Hermann,<br>Walzer, Groot<br>Koerkamp |

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

### Assessment

The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting 20 minutes.

### Prerequisites

None.

### Recommendations

The lecture builds on parts of the contents of the lectures Algorithms I and Algorithms II. Corresponding knowledge is therefore helpful.

## T

**6.9 Module component: Advanced Data Structures Project/Experiment [T-INFO-114224]****Coordinators:** Prof. Dr. Peter Sanders**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107200 - Advanced Data Structures](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 1 CP    | Graded  | Each summer term | 1       |

| Courses |         |                                          |       |                                                                                               |                                          |
|---------|---------|------------------------------------------|-------|-----------------------------------------------------------------------------------------------|------------------------------------------|
| ST 2026 | 2400164 | <a href="#">Advanced Data Structures</a> | 3 SWS | Lecture /  | Sanders, Hermann, Walzer, Groot Koerkamp |

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

The examination takes place in the form of an examination of another type (§ 4 Abs. 2 No. 3 SPO) in form of a project/experiment.

An overall grade is awarded.

**Prerequisites**

None.

**Recommendations**

The lecture builds on parts of the contents of the lectures Algorithms I and Algorithms II. Corresponding knowledge is therefore helpful.

## T

## 6.10 Module component: Advanced Game Theory [T-WIWI-102861]

**Coordinators:** Prof. Dr. Karl-Martin Ehrhart  
Prof. Dr. Clemens Puppe  
Prof. Dr. Johannes Philipp Reiß

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

**Part of:** [M-WIWI-101453 - Applied Strategic Decisions](#)  
[M-WIWI-101500 - Microeconomic Theory](#)  
[M-WIWI-101502 - Economic Theory and its Application in Finance](#)

| Type                | Credits | Grading | Term offered     | Version |
|---------------------|---------|---------|------------------|---------|
| Written examination | 4,5 CP  | graded  | Each winter term | 2       |

| Courses  |         |                                               |       |                                                                                                |                       |
|----------|---------|-----------------------------------------------|-------|------------------------------------------------------------------------------------------------|-----------------------|
| WT 25/26 | 2521533 | <a href="#">Advanced Game Theory</a>          | 2 SWS | Lecture /   | Reiß                  |
| WT 25/26 | 2521534 | <a href="#">Übung zu Advanced Game Theory</a> | 1 SWS | Practice /  | Reiß, Peters, Potarca |
| Exams    |         |                                               |       |                                                                                                |                       |
| WT 25/26 | 00076   | <a href="#">Advanced Game Theory</a>          |       |                                                                                                | Puppe                 |
| WT 25/26 | 7910020 | <a href="#">Advanced Game Theory</a>          |       |                                                                                                | Reiß                  |

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

### Assessment

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

### Recommendations

It is recommended that students have basic knowledge in mathematics and statistics.

Below you will find excerpts from courses related to this module component:

## V

### Advanced Game Theory

2521533, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
On-Site

## T

**6.11 Module component: Advanced Lab Informatics (Master) [T-WIWI-110548]****Coordinators:** Professorenschaft des Instituts AIFB**Organisation:** KIT Department of Business and Economics

**Part of:** [M-WIWI-101456 - Intelligent Systems and Services](#)  
[M-WIWI-101477 - Development of Business Information Systems](#)  
[M-WIWI-105366 - Artificial Intelligence](#)  
[M-WIWI-106803 - Advanced Topics in AI: Knowledge Graphs and the Web](#)  
[M-WIWI-106804 - Advanced Topics in AI: Graph Neural Networks and Language Models](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 4,5 CP  | graded  | Each term    | 1       |

| Courses  |         |                                                                |       |                      |                                                                                         |
|----------|---------|----------------------------------------------------------------|-------|----------------------|-----------------------------------------------------------------------------------------|
| WT 25/26 | 2512205 | Lab Realisation of innovative services (Master)                | 3 SWS | Practical course / ☞ | Schiefer, Toussaint                                                                     |
| WT 25/26 | 2512314 | Practical Course Linked Data and the Semantic Web (Master)     | 3 SWS | Practical course / ☞ | Käfer, Braun, Li, Kubelka                                                               |
| WT 25/26 | 2512501 | Practical Course Cognitive automobiles and robots (Master)     | 3 SWS | Practical course / ☞ | Zöllner, Schneider                                                                      |
| WT 25/26 | 2512555 | Praktikum Security, Usability and Society (Master)             | 3 SWS | Practical course / ☞ | Volkamer, Strufe, Berens, Fallahi, Ballreich, Hennig, Länge, Mossano, Hilt              |
| WT 25/26 | 2512600 | Project lab Knowledge-driven Artificial Intelligence (Master)  | 3 SWS | Practical course / ☞ | Sack, Tietz, Vafaie                                                                     |
| ST 2026  | 2512205 | Lab Realisation of innovative services (Master)                | 3 SWS | Practical course / ☞ | Schiefer, Toussaint, Kruse                                                              |
| ST 2026  | 2512207 | Lab Agentic AI im Smart IoT Office (Master)                    | 3 SWS | Practical course / ☞ | Oberweis, Rybinski, Ullrich                                                             |
| ST 2026  | 2512500 | Project Lab Machine Learning                                   | 3 SWS | Practical course / ☞ | Zöllner, Schneider                                                                      |
| ST 2026  | 2512555 | Praktikum Security, Usability and Society (Master)             | 3 SWS | Practical course / ☞ | Volkamer, Strufe, Hennig, Fallahi, Länge, Ballreich, Hilt, Sikra, Algedri, Reimer, Mack |
| Exams    |         |                                                                |       |                      |                                                                                         |
| WT 25/26 | 7900102 | Advanced Lab Knowledge-driven Artificial Intelligence (Master) |       |                      | Sack                                                                                    |
| WT 25/26 | 7900107 | Advanced Lab Cognitive Automobile and Robots (Master)          |       |                      | Zöllner                                                                                 |
| WT 25/26 | 7900218 | Advanced Lab Linked Data and the Semantic Web (Master)         |       |                      | Käfer                                                                                   |
| WT 25/26 | 7900306 | Advanced Lab Realization of Innovative Services (Master)       |       |                      | Oberweis                                                                                |
| WT 25/26 | 7900307 | Advanced Lab Security, Usability and Society (Master)          |       |                      | Volkamer                                                                                |
| ST 2026  | 7900061 | Advanced Lab Agentic AI im Smart IoT Office (Master)           |       |                      | Oberweis                                                                                |
| ST 2026  | 7900086 | Project Lab Machine Learning                                   |       |                      | Zöllner                                                                                 |
| ST 2026  | 7900148 | Advanced Lab Realization of innovative services (Master)       |       |                      | Oberweis, Schiefer                                                                      |
| ST 2026  | 7900178 | Practical Lab Security, Usability and Society (Master)         |       |                      | Volkamer, Strufe                                                                        |

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

**Assessment**

The alternative exam consists of a single examination of another type that combines three mandatory components:

- Practical work
- Presentation
- Written thesis

All three parts are integrated into one overall assessment. Their individual contributions are weighted according to the course-specific weighting scheme, but only one final grade is awarded for the whole examination. The final grade reflects the total impression of the combined performance.

**Prerequisites**

None

**Additional Information**

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>.

**Workload**

135 hours

*Below you will find excerpts from courses related to this module component:*

**Lab Realisation of innovative services (Master)**2512205, WS 25/26, 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).

**Organizational issues**

Informationen zu Themen und die Anmeldung erfolgt vor Praktikumsbeginn im Wiwi-Portal

<https://portal.wiwi.kit.edu/ys>

**Practical Course Linked Data and the Semantic Web (Master)**2512314, WS 25/26, 3 SWS, Language: German/English, [Open in study portal](#)**Practical course (P)  
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.

**Practical Course Cognitive automobiles and robots (Master)**2512501, WS 25/26, 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.

**Praktikum Security, Usability and Society (Master)**

2512555, WS 25/26, 3 SWS, Language: English, [Open in study portal](#)

**Practical course (P)  
Blended (On-Site/Online)**

**Content**

In the lab course "Security, Usability and Society", students explore practical and interdisciplinary topics in the field of IT security and privacy at the cutting edge of society. In addition to the programming of data-saving apps, the development or implementation of user studies can also be possible tasks in this course.

The course can be credited towards the KASTEL certificate. Further information about the KASTEL certificate can be found on the SECUSO website: [https://secuso.aifb.kit.edu/Studium\\_und\\_Lehre.php](https://secuso.aifb.kit.edu/Studium_und_Lehre.php)

**Prerequisites:**

The internship is aimed at Bachelor's and Master's students from the Industrial Engineering and Management, Business Informatics and Computer Science degree programs as well as related degree programs.

**Organization:**

There are two **mandatory** attendance dates: The kick-off is scheduled for the first week of the lectures, and the final presentations will take place in the second-to-last week of lectures. Additional dates will be arranged individually with the supervisors. All in-person lectures will be held in English. The main components of the course are the work on the respective topic, a final presentation, and a final report. After consultation with the supervisor, all components can be completed in either German or English.

Please note: In-person attendance at the kick-off and final presentation is mandatory to be allocated a topic.

If you have any questions about the course or the registration, please contact [contact@secuso.org](mailto:contact@secuso.org).

**Registration:**

The topics for the course, as well as the registration, are organized via the WiWi Portal. To reserve a place and select a topic, students register for the course in the WiWi Portal. A description of the current topics as well as important dates and deadlines can also be found there.

Please note that the number of topics is limited, and topics are allocated in the order of registration.

**Project lab Knowledge-driven Artificial Intelligence (Master)**

2512600, WS 25/26, 3 SWS, Language: English, [Open in study portal](#)

**Practical course (P)  
Blended (On-Site/Online)**



## Content

The **project course Knowledge-driven AI** is based on the summer semester lecture "Information Service Engineering". Goal of the project course is to work on a (real) research problem in small groups related to the ISE lecture topics, including:

- Large Language Models (LLM)
- Natural Language Processing (NLP),
- Knowledge Graphs (KG),
- Machine Learning (ML)

Previous project courses were based on real (funded) research projects and included project tasks, as e.g., leveraging (large) language models for OCR post-processing of scanned historic documents, knowledge extraction and knowledge graph creation from historic documents, entity typing based on knowledge graph embeddings and language models, knowledge graph completion, semantic and exploratory search based on knowledge graphs, and many more.

The project course topics this semester include:

- **"Telling Data Stories with Semantic Technologies and Generative AI".**  
This topic addresses the challenge that large Knowledge Graphs are often overwhelming for non-technical users due to their complexity, making it difficult to understand the structures and contents in a clear and intuitive way. Data Stories are designed to help users explore data; they simplify the complex relationships within Knowledge Graphs, reveal "hidden" connections and patterns, and provide narrative summaries. In this course, we aim to conceptualize and implement methods for creating Data Stories from large and complex Knowledge Graphs. This includes the creation of engaging visualizations and the use of generative AI to bridge the gap between data creators and users. This topic is part of the currently running project NFDI4Culture. The course results will be published on the [NFDI4Culture Portal](#).
- **"Leveraging Large Language Models to Suggest Heuristics for Ontology Reasoning".**  
Ontology reasoning is a key component of semantic technologies, but traditional reasoning engines often face scalability issues with large or complex ontologies. With the rise of Large Language Models (LLMs), there is growing interest in exploring their potential to support symbolic reasoning. This project presents a preliminary study on using LLMs to suggest simple heuristics for ontology reasoning optimization. Rather than replacing existing reasoners, LLMs will serve as heuristic advisors—for example, by identifying structural patterns or recommending strategies for small ontologies. The project will involve lightweight experiments on selected ontology datasets, comparing reasoning performance with and without LLM-guided heuristics. The goal is to provide an initial exploration of the feasibility of LLM-assisted reasoning, laying the foundation for more advanced research.
- **"Large Language Models for Ontology Alignment with Foundational Ontologies"**  
Ontology alignment with foundational ontologies like BFO is important but often complex and time-consuming. This topic explores how Large Language Models (LLMs) can support or automate this process by interpreting ontology classes, suggesting alignments, and explaining their reasoning.
- **"Information Extraction in the era of Large Language Models"**  
Large Language Models (LLMs) are known to produce inaccurate or even misleading answers. One approach to mitigate this gross limitation is to enhance their responses with verified, structured data from knowledge graphs. The process of extracting structured data from unstructured texts often employs task-specific language models. In this project, students will explore and implement cutting-edge techniques for Named Entity Recognition (NER) using LLMs, comparing different approaches and evaluating their effectiveness in transforming unstructured text into structured data.

In this course you have the chance to combine creativity and practical implementation tasks to develop solutions for real-world projects and problems. The project will be worked on in **teams of 3-4 students** each, guided by a tutor from the teaching staff.

The **kick-off meeting** will take place in person on Wednesday, October 29th in room 05-09 (AIFB building 05.20), 9:45am.

The project course will be held in a **hybrid format**. The kick-off session will take place in person, and the individual group meetings throughout the semester will take place online. Each group can decide together with their tutors on regular meeting times (30min each).

For questions, please reach out to Prof. Harald Sack ([harald.sack@kit.edu](mailto:harald.sack@kit.edu)) or Tabea Tietz ([tabea.tietz@kit.edu](mailto:tabea.tietz@kit.edu)).

Required coursework for each student team include:

- Mid term presentation (5-10 min)
- Final presentation (10-15 min)
- Course report (c. 16 pages)
- Participation and contribution of the students during the course
- Software development and delivery

Notes:

- If need be, the ISE project course can also be credited as a seminar.
- The project course will be restricted to overall 16 participants max.
- Participation in the lecture "Information Service Engineering" (summer semester) is not necessarily required, but highly beneficial (the lecture recordings are available on youtube).

Outcomes of previous project course editions:

- Hackathon Coding da Vinci 2022: Winners in the category "most FAIR application"

- Paper publications:
  - M. Li, H. Yang, Z. Liu, M.M. Alam, E. Norouzi, H. Sack and G.A. Gesese: [KGMistral: Towards Boosting the Performance of Large Language Models for Question Answering with Knowledge Graph Integration](#). In Workshop on Deep Learning and Large Language Models for Knowledge Graphs 2024
  - O. Bruns, T. Tietz, M. B. Chaabane, M. Portz, F. Xiong, and H. Sack: [The Nuremberg Address Knowledge Graph](#). In: Proceedings of the 17th Extended Semantic Web Conference, P&D Track 2021 [PDF]

### Literature

ISE video channel on youtube: <https://www.youtube.com/channel/UCjkkhNSNuXrJpMYZoeSBw6Q/>



### Lab Realisation of innovative services (Master)

2512205, SS 2026, 3 SWS, Language: German, [Open in study portal](#)

**Practical course (P)**  
**On-Site**

### Content

As part of the lab, the participants should work together in small groups to realize innovative services (mainly for students).

### Organizational issues

Informationen zu Themen und die Anmeldung erfolgt bis Mitte März im Wiwi-Portal

<https://portal.wiwi.kit.edu/ys>



### Lab Agentic AI im Smart IoT Office (Master)

2512207, SS 2026, 3 SWS, Language: German, [Open in study portal](#)

**Practical course (P)**  
**On-Site**

### 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.

In case of questions, please contact [fabian.rybinski@kit.edu](mailto:fabian.rybinski@kit.edu).

### Organizational issues

Informationen zu Themen und die Anmeldung erfolgt vor Praktikumsbeginn im Wiwi-Portal

<https://portal.wiwi.kit.edu/ys>

Bei Fragen bitte an [fabian.rybinski@kit.edu](mailto:fabian.rybinski@kit.edu) wenden.



### Project Lab Machine Learning

2512500, SS 2026, 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 5 credit points consists of the time spent in the lab for practical implementation of the selected solution, as well as the time spent on literature research and planning/specifying the proposed solution. In addition, a short report and a presentation of the work carried out will be prepared.

### Organizational issues

Anmeldung und weitere Informationen sind im Wiwi-Portal zu finden.

Registration and further information can be found in the WiWi-portal.

**Praktikum Security, Usability and Society (Master)**2512555, SS 2026, 3 SWS, Language: English, [Open in study portal](#)**Practical course (P)  
Blended (On-Site/Online)****Content**

In the lab-course “Security, Usability and Society”, students deal with practical and interdisciplinary topics from the field of IT security and privacy at the cutting edge of society. In addition to the programming of data-saving apps, the development or implementation of user studies can also be possible tasks in this course.

The course can be credited towards the KASTEL certificate. Further information about the KASTEL certificate can be found on the SECUSO website: [https://secuso.aifb.kit.edu/Studium\\_und\\_Lehre.php](https://secuso.aifb.kit.edu/Studium_und_Lehre.php)

**Prerequisites:**

The internship is aimed at Bachelor's and Master's students from the Industrial Engineering and Management, Business Informatics and Computer Science degree programs as well as related degree programs.

**Organization:**

There are two mandatory attendance dates: The kick-off is scheduled for the first week of the lectures, and the final presentations will take place in the second to last week of lectures. Additional dates will be arranged individually with the supervisors. All in-person lectures will be held in English. The main components of the course is the work on the respective topic, a final presentation and a final report. After consultation with the supervisor, all components can be either completed in German or English.

If you have any questions about the course or the registration, please contact [contact@secuso.org](mailto:contact@secuso.org).

**Registration:**

The topics for the course as well as the registration is organized via the WiWi-Portal. To reserve a place and choose a topic, students register for the course in the WiWi-Portal. A description of the current topics as well as important dates and deadlines can also be found there.

Please note that the number of topics is limited and topics are allocated in the order of registration.

## T

## 6.12 Module component: Advanced Lab Realization of Innovative Services (Master) [T-WIWI-112914]

**Coordinators:** Prof. Dr. Andreas Oberweis

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

**Part of:** [M-WIWI-101477 - Development of Business Information Systems](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 4,5 CP  | Graded  | Each term    | 1       |

| Courses  |         |                                                                          |                    |                                                                                                        |                            |
|----------|---------|--------------------------------------------------------------------------|--------------------|--------------------------------------------------------------------------------------------------------|----------------------------|
| WT 25/26 | 2512205 | <a href="#">Lab Realisation of innovative services (Master)</a>          | 3 SWS              | Practical course /  | Schiefer, Toussaint        |
| ST 2026  | 2512205 | <a href="#">Lab Realisation of innovative services (Master)</a>          | 3 SWS              | Practical course /  | Schiefer, Toussaint, Kruse |
| Exams    |         |                                                                          |                    |                                                                                                        |                            |
| WT 25/26 | 7900218 | <a href="#">Advanced Lab Linked Data and the Semantic Web (Master)</a>   | Käfer              |                                                                                                        |                            |
| WT 25/26 | 7900306 | <a href="#">Advanced Lab Realization of Innovative Services (Master)</a> | Oberweis           |                                                                                                        |                            |
| ST 2026  | 7900061 | <a href="#">Advanced Lab Agentive AI im Smart IoT Office (Master)</a>    | Oberweis           |                                                                                                        |                            |
| ST 2026  | 7900148 | <a href="#">Advanced Lab Realization of innovative services (Master)</a> | Oberweis, Schiefer |                                                                                                        |                            |

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

### Assessment

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.

### Additional Information

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.

### Workload

135 hours

Below you will find excerpts from courses related to this module component:

## V

### Lab Realisation of innovative services (Master)

2512205, WS 25/26, 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).

### Organizational issues

Informationen zu Themen und die Anmeldung erfolgt vor Praktikumsbeginn im Wiwi-Portal

<https://portal.wiwi.kit.edu/ys>

## V

### Lab Realisation of innovative services (Master)

2512205, SS 2026, 3 SWS, Language: German, [Open in study portal](#)

Practical course (P)  
On-Site

### Content

As part of the lab, the participants should work together in small groups to realize innovative services (mainly for students).

**Organizational issues**

Informationen zu Themen und die Anmeldung erfolgt bis Mitte März im Wiwi-Portal

<https://portal.wiwi.kit.edu/ys>

## T

**6.13 Module component: Advanced Lab Security, Usability and Society [T-WIWI-108439]**

**Coordinators:** Prof. Dr. Melanie Volkamer  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-104520 - Human Factors in Security and Privacy](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 4,5 CP  | graded  | Each term    | 3       |

| Courses  |         |                                                                          |       |                                                                                                        |                                                                                         |
|----------|---------|--------------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| WT 25/26 | 2512554 | <a href="#">Praktikum Security, Usability and Society (Bachelor)</a>     | 3 SWS | Practical course /  | Volkamer, Strufe, Berens, Fallahi, Ballreich, Hennig, Länge, Mossano, Hilt              |
| WT 25/26 | 2512555 | <a href="#">Praktikum Security, Usability and Society (Master)</a>       | 3 SWS | Practical course /  | Volkamer, Strufe, Berens, Fallahi, Ballreich, Hennig, Länge, Mossano, Hilt              |
| ST 2026  | 2512554 | <a href="#">Practical Course: Security, Usability and Society</a>        | 3 SWS | Practical course /  | Volkamer, Strufe, Hennig, Länge, Fallahi, Ballreich, Sikra, Hilt, Reimer, Algedri, Mack |
| ST 2026  | 2512555 | <a href="#">Praktikum Security, Usability and Society (Master)</a>       | 3 SWS | Practical course /  | Volkamer, Strufe, Hennig, Fallahi, Länge, Ballreich, Hilt, Sikra, Algedri, Reimer, Mack |
| Exams    |         |                                                                          |       |                                                                                                        |                                                                                         |
| WT 25/26 | 7900116 | <a href="#">Advanced Lab Security, Usability and Society (Bachelor)</a>  |       |                                                                                                        | Volkamer                                                                                |
| WT 25/26 | 7900307 | <a href="#">Advanced Lab Security, Usability and Society (Master)</a>    |       |                                                                                                        | Volkamer                                                                                |
| ST 2026  | 7900029 | <a href="#">Practical lab Security, Usability and Society (Bachelor)</a> |       |                                                                                                        | Volkamer, Strufe                                                                        |

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

**Assessment**

Assessment takes the form of an alternative exam. It consists of a practical assignment, a presentation, and, if required, a written report. The lectures and the presentations will be in English. The written report can be written in either English or German after consultation with the supervisor.

Practical work, presentation, and written thesis are weighted according to the course.

**Prerequisites**

None

**Recommendations**

Knowledge from the lecture "Applied Informatics - Cybersecurity" is recommended.

**Workload**

135 hours

Below you will find excerpts from courses related to this module component:

## V

**Praktikum Security, Usability and Society (Bachelor)**

2512554, WS 25/26, 3 SWS, Language: English, [Open in study portal](#)

Practical course (P)  
Blended (On-Site/Online)

**Content**

In the lab course “Security, Usability and Society”, students explore practical and interdisciplinary topics in the field of IT security and privacy at the cutting edge of society. In addition to the programming of data-saving apps, the development or implementation of user studies can also be possible tasks in this course.

The course can be credited towards the KASTEL certificate. Further information about the KASTEL certificate can be found on the SECUSO website: [https://secuso.aifb.kit.edu/Studium\\_und\\_Lehre.php](https://secuso.aifb.kit.edu/Studium_und_Lehre.php)

**Prerequisites:**

The internship is aimed at Bachelor's and Master's students from the Industrial Engineering and Management, Business Informatics and Computer Science degree programs as well as related degree programs.

**Organization:**

There are two **mandatory** attendance dates: The kick-off is scheduled for the first week of the lectures, and the final presentations will take place in the second-to-last week of lectures. Additional dates will be arranged individually with the supervisors. All in-person lectures will be held in English. The main components of the course are the work on the respective topic, a final presentation, and a final report. After consultation with the supervisor, all components can be completed in either German or English.

Please note: In-person attendance at the kick-off and final presentation is mandatory to be allocated a topic.

If you have any questions about the course or the registration, please contact [contact@secuso.org](mailto:contact@secuso.org).

**Registration:**

The topics for the course, as well as the registration, are organized via the WiWi Portal. To reserve a place and select a topic, students register for the course in the WiWi Portal. A description of the current topics as well as important dates and deadlines can also be found there.

Please note that the number of topics is limited, and topics are allocated in the order of registration.

**Praktikum Security, Usability and Society (Master)**

2512555, WS 25/26, 3 SWS, Language: English, [Open in study portal](#)

**Practical course (P)  
Blended (On-Site/Online)**

**Content**

In the lab course “Security, Usability and Society”, students explore practical and interdisciplinary topics in the field of IT security and privacy at the cutting edge of society. In addition to the programming of data-saving apps, the development or implementation of user studies can also be possible tasks in this course.

The course can be credited towards the KASTEL certificate. Further information about the KASTEL certificate can be found on the SECUSO website: [https://secuso.aifb.kit.edu/Studium\\_und\\_Lehre.php](https://secuso.aifb.kit.edu/Studium_und_Lehre.php)

**Prerequisites:**

The internship is aimed at Bachelor's and Master's students from the Industrial Engineering and Management, Business Informatics and Computer Science degree programs as well as related degree programs.

**Organization:**

There are two **mandatory** attendance dates: The kick-off is scheduled for the first week of the lectures, and the final presentations will take place in the second-to-last week of lectures. Additional dates will be arranged individually with the supervisors. All in-person lectures will be held in English. The main components of the course are the work on the respective topic, a final presentation, and a final report. After consultation with the supervisor, all components can be completed in either German or English.

Please note: In-person attendance at the kick-off and final presentation is mandatory to be allocated a topic.

If you have any questions about the course or the registration, please contact [contact@secuso.org](mailto:contact@secuso.org).

**Registration:**

The topics for the course, as well as the registration, are organized via the WiWi Portal. To reserve a place and select a topic, students register for the course in the WiWi Portal. A description of the current topics as well as important dates and deadlines can also be found there.

Please note that the number of topics is limited, and topics are allocated in the order of registration.

**Practical Course: Security, Usability and Society**

2512554, SS 2026, 3 SWS, Language: English, [Open in study portal](#)

**Practical course (P)  
Blended (On-Site/Online)**

**Content**

In the lab-course “Security, Usability and Society”, students deal with practical and interdisciplinary topics from the field of IT security and privacy at the cutting edge of society. In addition to the programming of data-saving apps, the development or implementation of user studies can also be possible tasks in this course.

The course can be credited towards the KASTEL certificate. Further information about the KASTEL certificate can be found on the SECUSO website: [https://secuso.aifb.kit.edu/Studium\\_und\\_Lehre.php](https://secuso.aifb.kit.edu/Studium_und_Lehre.php)

**Prerequisites:**

The internship is aimed at Bachelor's and Master's students from the Industrial Engineering and Management, Business Informatics and Computer Science degree programs as well as related degree programs.

**Organization:**

There are two mandatory attendance dates: The kick-off is scheduled for the first week of the lectures, and the final presentations will take place in the second to last week of lectures. Additional dates will be arranged individually with the supervisors. All in-person lectures will be held in English. The main components of the course is the work on the respective topic, a final presentation and a final report. After consultation with the supervisor, all components can be either completed in German or English.

If you have any questions about the course or the registration, please contact [contact@secuso.org](mailto:contact@secuso.org).

**Registration:**

The topics for the course as well as the registration is organized via the WiWi-Portal. To reserve a place and choose a topic, students register for the course in the WiWi-Portal. A description of the current topics as well as important dates and deadlines can also be found there.

Please note that the number of topics is limited and topics are allocated in the order of registration.

**Praktikum Security, Usability and Society (Master)**

2512555, SS 2026, 3 SWS, Language: English, [Open in study portal](#)

**Practical course (P)**  
**Blended (On-Site/Online)**

**Content**

In the lab-course “Security, Usability and Society”, students deal with practical and interdisciplinary topics from the field of IT security and privacy at the cutting edge of society. In addition to the programming of data-saving apps, the development or implementation of user studies can also be possible tasks in this course.

The course can be credited towards the KASTEL certificate. Further information about the KASTEL certificate can be found on the SECUSO website: [https://secuso.aifb.kit.edu/Studium\\_und\\_Lehre.php](https://secuso.aifb.kit.edu/Studium_und_Lehre.php)

**Prerequisites:**

The internship is aimed at Bachelor's and Master's students from the Industrial Engineering and Management, Business Informatics and Computer Science degree programs as well as related degree programs.

**Organization:**

There are two mandatory attendance dates: The kick-off is scheduled for the first week of the lectures, and the final presentations will take place in the second to last week of lectures. Additional dates will be arranged individually with the supervisors. All in-person lectures will be held in English. The main components of the course is the work on the respective topic, a final presentation and a final report. After consultation with the supervisor, all components can be either completed in German or English.

If you have any questions about the course or the registration, please contact [contact@secuso.org](mailto:contact@secuso.org).

**Registration:**

The topics for the course as well as the registration is organized via the WiWi-Portal. To reserve a place and choose a topic, students register for the course in the WiWi-Portal. A description of the current topics as well as important dates and deadlines can also be found there.

Please note that the number of topics is limited and topics are allocated in the order of registration.



## T

**6.14 Module component: Advanced Machine Learning [T-WIWI-109921]**

**Coordinators:** Prof. Dr. Andreas Geyer-Schulz  
Dr. Abdolreza Nazemi

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

**Part of:** [M-WIWI-105661 - Data Science: Intelligent, Adaptive, and Learning Information Services](#)

**Type**  
Written examination

**Credits**  
4,5 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
1

| Courses  |         |                                                                   |              |          |        |
|----------|---------|-------------------------------------------------------------------|--------------|----------|--------|
| ST 2026  | 2540535 | <a href="#">Advanced Machine Learning</a>                         | 2 SWS        | Lecture  | Nazemi |
| ST 2026  | 2540536 | <a href="#">Exercise Advanced Machine Learning</a>                | 1 SWS        | Practice | Nazemi |
| Exams    |         |                                                                   |              |          |        |
| WT 25/26 | 7900253 | <a href="#">Advanced Machine Learning (Nachklausur SoSe 2025)</a> | Geyer-Schulz |          |        |
| ST 2026  | 7900227 | <a href="#">Advanced Machine Learning</a>                         | Geyer-Schulz |          |        |
| ST 2026  | 7900252 | <a href="#">Advanced Machine Learning (Nachklausur SoSe 2026)</a> | Geyer-Schulz |          |        |

**Assessment**

Written examination (60 minutes) according to §4(2), 1 SPO. The exam is considered passed if at least 50 out of a maximum of 100 possible points are achieved. The grades are graded in five steps (best grade 1.0 from 95 points). Details of the grade formation and scale will be announced in the course.

A bonus can be acquired through successful participation in the practice. If the grade of the written examination is between 4.0 and 1.3, the bonus improves the grade by one grade level (0.3 or 0.4). The exact criteria for awarding a bonus will be announced at the beginning of the course.

**Please note: this exam will no longer be offered after August 2026.**

**Prerequisites**

None

**Additional Information**

Please note: this course, exercises and exam will no longer be offered after August 2026.

*Below you will find excerpts from courses related to this module component:*

## V

**Advanced Machine Learning**

2540535, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

**Lecture (V)**

**Content**

In recent years, the volume, variety, velocity, veracity, and variability of available data have increased due to improvements in computational and storage power. The rise of the Internet has made available large sets of data that allow us to use and merge them for different purposes. Data science helps us to extract knowledge from the continually-increasing large datasets. This course will introduce students to a wide range of machine learning and statistical techniques such as deep learning, LASSO, and support vector machine. You will get familiar with text mining, and the tools you need to analyze the various facets of data sets in practice. Students will learn theory and concepts with real data sets from different disciplines such as marketing, finance, and business.

**Tentative Course Outline:**

- Introduction
- Statistical Inference
- Shrinkage Methods
- Model Assessment and Selection
- Tree-based Machine Learning Algorithms
- Dimensionality Reduction
- Neural Networks and Deep Learning
- Natural Language Processing with Deep Learning
- Support Vector Machine

**Time of attendance**

- Attending the lecture: 13 x 90min = 19h 30m
- Attending the exercise classes: 7 x 90min = 10h 30m

**The student will learn**

- A wide range of machine learning algorithms and their weaknesses.
- The fundamental issues and challenges: data, high-dimension, train, model selection, etc.
- How to imply machine learning algorithms for real-world applications.
- The fundamentals of deep learning, main research activities, and on-going research in this field.

**Literature**

- Alpaydin, E. (2014). Introduction to Machine Learning. Third Edition, MIT Press.
- De Prado, M. L. (2018). Advances in Financial Machine Learning. John Wiley & Sons.
- Goodfellow, I., Bengio, Y., and A. Courville (2017). Deep Learning. MIT Press. (online available)
- Hastie, T., Tibshirani, R., and J. Friedman (2009). Elements of Statistical Learning. Second Edition. Springer. (online available)
- Leskovec, J., Rajaraman, A., Ullman, J. D., (2014). Mining of Massive Datasets. Cambridge University Press. (online available)
- Witten, I. H., Eibe, F., Hall, M. A., Pal, C. J. (2016). Data Mining: Practical Machine Learning Tools and Techniques. Morgan Kaufmann.

## T

**6.15 Module component: Advanced Machine Learning and Data Science [T-WIWI-111305]****Coordinators:** Prof. Dr. Maxim Ulrich**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-105659 - Advanced Machine Learning and Data Science](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 9 CP    | graded  | Each term    | 5       |

| Courses |         |                                                            |       |                                                                                               |        |
|---------|---------|------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|--------|
| ST 2026 | 2500016 | <a href="#">Advanced Machine Learning and Data Science</a> | 4 SWS | Project /  | Ulrich |

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

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

**Additional Information**

The course is aimed at students majoring in data science and/or machine learning. It offers students the opportunity to gain practical knowledge of new developments in the fields of data science and machine learning.

**Kick-off Meeting for Winter Term 2025/26:**

We will introduce project topics designed for students of computer science, engineering, and mathematics. The meeting will provide an overview of the course structure, project topics, and expectations for the semester.

- **Date:** Tuesday, October 28, 2025, Time: 5:00 PM – 7:00 PM
- **Format:** Online (MS Teams link: Kick-Off (WS-2025)-Tuesday, October 28, 2025 | Meeting-Join | Microsoft Teams)
- **Ms Team Meeting link:** <https://teams.microsoft.com/meet/3867172715541?p=GS2swv7ueF5gACIUes>
- **Form link:** [https://docs.google.com/forms/d/e/1FAIpQLSek36NGe9I7Jyllc4iBnd-XEwbhexFS7Wn\\_P6Wga1-EKU8Qw/viewform?usp=dialog](https://docs.google.com/forms/d/e/1FAIpQLSek36NGe9I7Jyllc4iBnd-XEwbhexFS7Wn_P6Wga1-EKU8Qw/viewform?usp=dialog)

After the meeting (within 48 hours): Please submit your Priority A and Priority B topic preferences via the form within 48 hours after the kick-off.

If you need more information, please visit <https://risk.fbv.kit.edu/2307.php>.

**Workload**

270 hours

Below you will find excerpts from courses related to this module component:

|                                                                                     |                                                                                                                                       |                                        |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
|  | <b>Advanced Machine Learning and Data Science</b><br>2500016, SS 2026, 4 SWS, Language: English, <a href="#">Open in study portal</a> | <b>Project (PRO)</b><br><b>On-Site</b> |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|

**Content**

The course is targeted to students with a major in Data Science and/or Machine Learning. It offers students the opportunity to develop hands-on knowledge on new developments in data science and machine learning.

**Organizational issues**

Während des Kick-off Meetings in der ersten Wochen werden Themen vorgestellt.

Wir bereiten Themen für Studenten der Informatik, W-Ing und Wi-Ma vor.

Themen und studentische Bearbeiter werden nach dem Kick-off gematched.

**Literature**

Literatur und Computerprogramme wird in der ersten Vorlesung bekannt gegeben.

## T

**6.16 Module component: Advanced Management Accounting [T-WIWI-102885]****Coordinators:** Prof. Dr. Marcus Wouters**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-101510 - Cross-Functional Management Accounting](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 4,5 CP  | graded  | Each winter term | 2       |

| Courses  |              |                                                |         |                                                                                               |                              |
|----------|--------------|------------------------------------------------|---------|-----------------------------------------------------------------------------------------------|------------------------------|
| WT 25/26 | 2579907      | <a href="#">Advanced Management Accounting</a> | 4 SWS   | Lecture /  | Wouters, Dickemann, Letmathe |
| Exams    |              |                                                |         |                                                                                               |                              |
| WT 25/26 | 79-2579907-M | <a href="#">Advanced Management Accounting</a> | Wouters |                                                                                               |                              |

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

The assessment consists of an oral exam (30 min) (according to §4 (2), 2 of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

**Prerequisites**

None.

**Recommendations**

The course requires significant prior knowledge of Management Accounting, similar to the content of the courses MA 1 and 2, although completion of these particular courses is not a formal requirement.

**Additional Information**

This course is held in English. Lectures and tutorials are integrated.

The course is compulsory and must be examined.

Students who are interested in attending this course should send an e-mail to Professor Wouters ([marc.wouters@kit.edu](mailto:marc.wouters@kit.edu)).

**Workload**

135 hours

Below you will find excerpts from courses related to this module component:

## V

**Advanced Management Accounting**2579907, WS 25/26, 4 SWS, Language: English, [Open in study portal](#)**Lecture (V)  
On-Site**

**Content**

This course is held in English. Students who are interested in attending this course should send an e-mail to Professor Wouters (marc.wouters@kit.edu).

**Inhalt:**

- The course addresses several topics where management accounting is strongly related to marketing, finance, or organization and strategy, such as customer value propositions, financial performance measures, managing new product development, and technology investment decisions.

**Learning objectives:**

- Students will be able to consider advanced management accounting methods in an interdisciplinary way and to apply these to managerial decision-making problems in operations and innovation.
- They will also be able to identify relevant research results on such methods.

**Examination:**

- The assessment consists of an oral exam (30 min) taking place in the recess period (according to § 4 (2) No. 2 of the examination regulation).
- The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

**Required prior Courses:**

- The course is compulsory and must be examined.

**Recommendations:**

- The course requires significant prior knowledge of Management Accounting, similar to the content of the courses MA 1 and 2, although completion of these particular courses is not a formal requirement.

**Workload:**

- The total workload for this course is approximately 135 hours. For further information see German version.

**Organizational issues**

Die LV wird in englischer Sprache gehalten. Studierende, die Interesse haben, an dieser Lehrveranstaltung teilzunehmen, sollten bitte vorher eine E-Mail an Professor Wouters senden (marc.wouters@kit.edu).

**Literature**

Literature is mostly made available via ILIAS.

## T

**6.17 Module component: Advanced Quantitative Finance [T-WIWI-114979]**

**Coordinators:** Prof. Dr. Julian Thimme  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101480 - Finance 3](#)  
[M-WIWI-101483 - Finance 2](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 4,5 CP  | Graded  | Each summer term | 1       |

**Assessment**

The assessment of success in this course is carried out as a non exam assessment. The grade is made up as follows:

1. Written elaboration (weighting: 33 %).
2. Working on and presenting data analysis problems in small groups (weighting: 67 %).

**Additional Information**

New course from summer semester 2026

**Workload**

135 hours

## T

## 6.18 Module component: Advanced Statistics [T-WIWI-103123]

**Coordinators:** Prof. Dr. Oliver Grothe

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

**Part of:** [M-WIWI-101637 - Analytics and Statistics](#)  
[M-WIWI-101639 - Econometrics and Statistics II](#)

**Type**  
Written examination

**Credits**  
4,5 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
1

| Courses  |         |                                                                                                |       |                                                                                                |        |
|----------|---------|------------------------------------------------------------------------------------------------|-------|------------------------------------------------------------------------------------------------|--------|
| WT 25/26 | 2550552 | <a href="#">Advanced Statistical Techniques, Including Multivariate and Simulation Methods</a> | 2 SWS | Lecture /   | Grothe |
| WT 25/26 | 2550553 | <a href="#">Exercises and Computer Labs in Advanced Statistical Techniques</a>                 | 2 SWS | Practice /  | Grothe |
| Exams    |         |                                                                                                |       |                                                                                                |        |
| WT 25/26 | 7900289 | <a href="#">Advanced Statistical Techniques, Including Multivariate and Simulation Methods</a> |       |                                                                                                | Grothe |
| ST 2026  | 7900253 | <a href="#">Advanced Statistical Techniques, Including Multivariate and Simulation Methods</a> |       |                                                                                                | Grothe |

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

### Assessment

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

### Workload

135 hours

Below you will find excerpts from courses related to this module component:

## V

### Advanced Statistical Techniques, Including Multivariate and Simulation Methods

2550552, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
On-Site

### Literature

Skript zur Vorlesung

## T

**6.19 Module component: Advanced Stochastic Optimization [T-WIWI-106548]****Coordinators:** Prof. Dr. Steffen Rebennack**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-101473 - Mathematical Programming](#)  
[M-WIWI-103289 - Stochastic Optimization](#)

| Type             | Credits | Grading | Term offered | Version |
|------------------|---------|---------|--------------|---------|
| Oral examination | 4,5 CP  | Graded  | Irregular    | 2       |

| Courses  |         |                                                           |       |                                                                                                |           |
|----------|---------|-----------------------------------------------------------|-------|------------------------------------------------------------------------------------------------|-----------|
| WT 25/26 | 2500050 | <a href="#">Advanced Stochastic Optimization</a>          | 2 SWS | Lecture /   | Rebennack |
| WT 25/26 | 2550468 | <a href="#">Übung zu Advanced Stochastic Optimization</a> | 1 SWS | Practice /  | Rebennack |
| Exams    |         |                                                           |       |                                                                                                |           |
| WT 25/26 | 7900039 | <a href="#">Advanced Stochastic Optimization</a>          |       |                                                                                                | Rebennack |

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

The assessment consists of an oral exam (20 minutes). The exam is offered every semester.

**Prerequisites**

None.

**Recommendations**

It is recommended to attend the lecture "Introduction to Stochastic Optimization" before attending the lecture "Advanced Stochastic Optimization".

**Additional Information**

Lectures and tutorials are offered irregularly.

**Workload**

135 hours



## T

**6.20 Module component: Advanced Topics in Digital Management [T-WIWI-111912]****Coordinators:** Prof. Dr. Petra Nieken**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-105923 - Incentives, Interactivity & Decisions in Organizations](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 3 CP    | graded  | Each summer term | 1       |

| Courses |         |                                                       |       |                                                                                                  |                     |
|---------|---------|-------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------|---------------------|
| ST 2026 | 2573016 | <a href="#">Advanced Topics in Digital Management</a> | 2 SWS | Colloquium /  | Nieken, Mitarbeiter |

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

Alternative exam assessment. The following aspects are included:

- Regular and active participation in the course dates
- Presentation of a given research topic.

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.

**Recommendations**

We recommend visiting the course Incentives in Organization before taking this course.

The course is strongly recommended for students interested in empirical research in the areas digital HRM, personnel economics, and leadership and those who are interest in an academic career path.

**Workload**

90 hours

Below you will find excerpts from courses related to this module component:

## V

**Advanced Topics in Digital Management**2573016, SS 2026, 2 SWS, Language: English, [Open in study portal](#)Colloquium (KOL)  
On-Site

**Content**

The students will discuss and analyze selected research papers in the areas digital HRM, personnel economics, and leadership with a focus on digital management. The students will present research papers and discuss research methods and designs as well as content. They will develop an own research design on a predefined topic.

**Aim**

The student

- Looks into current research topics in the areas HRM, personnel economics, and leadership with a focus on digital management and AI.
- Analyzes research papers in detail and evaluates the research outcomes.
- Trains their presentation skills and discussion skills.
- Practices scientific debating.
- Learns to critically evaluate research methods and trains the scientific discussion culture.
- Gains deeper knowledge in the area of digital HRM and management.
- Learns to evaluate research designs and takes into account the ethical dimension of research.
- Learns how to develop an own research design and idea.

**Notes**

Due to the interactive nature of the course, the number of participants is limited. If you are interested, please contact Prof. Nieken by email.

**Workload**

The total workload for this course is approximately 90 hours.

Lecture: 30 hours

Preparation: 45 hours

Exam preparation: 15 hours

**Literature**

Selected research papers

**Organizational issues**

Geb. 05.20, Raum 2A-25, Termine werden bekannt gegeben

## T

**6.21 Module component: Advanced Topics in Digital Twins [T-WIWI-114951]****Coordinators:** Prof. Dr.-Ing. Sanja Lazarova-Molnar**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-101456 - Intelligent Systems and Services](#)**Type**  
Written examination**Credits**  
4,5 CP**Grading**  
graded**Term offered**  
Once**Version**  
1

| Courses |         |                                                                                  |       |          |                                                                                         |
|---------|---------|----------------------------------------------------------------------------------|-------|----------|-----------------------------------------------------------------------------------------|
| ST 2026 | 2511104 | <a href="#">Advanced Topics in Digital Twins</a>                                 | 2 SWS | Lecture  | Lazarova-Molnar                                                                         |
| ST 2026 | 2511105 | <a href="#">Exercises Advanced Topics in Digital Twins</a>                       | 1 SWS | Practice | Lazarova-Molnar, Khodadadi, Zare, Götz, Jungmann, Mostafa, Lee, Mahmoud, Daniel, Deufel |
| Exams   |         |                                                                                  |       |          |                                                                                         |
| ST 2026 | 7900050 | <a href="#">Advanced Topics in Digital Twins (Registration until 20.07.2026)</a> |       |          | Lazarova-Molnar                                                                         |

**Assessment**

Written examination (60 minutes).

**Prerequisites**

None

**Recommendations**

Basic knowledge of modeling and simulation is helpful but not mandatory.

An interest in interdisciplinary research and applied innovation in cyber-physical systems is advantageous.

**Additional Information**

The course will be offered once in the summer semester 2026.

The course is conducted in-person only to encourage active participation and hands-on learning.

**Workload**

135 hours

*Below you will find excerpts from courses related to this module component:*

## V

**Advanced Topics in Digital Twins**2511104, SS 2026, 2 SWS, Language: English, [Open in study portal](#)**Lecture (V)**

**Content**

This lecture series provides an overview of current research in Digital Twins, delivered by members of the SYDSEN research group working on active research topics in the field. Each lecture focuses on a specific topic and covers state-of-the-art methods as well as practical applications. Topics include:

1. Comprehensive Digital Twins
2. Digital Twins for Labor-intensive Manufacturing Systems
3. Integration of Expert Knowledge into Data-Driven Digital Twin Models
4. Human-in-the-Loop Digital Twins
5. Validation of Digital Twins for Production Systems
6. Explainability in Digital Twins
7. Automation of Simulation-Based Decision Support in Data-Driven Digital Twins
8. Digital Twins for Enhanced Reliability in Energy Systems
9. Data-driven Agent-Based Simulation for Digital Twins

By the end of the course, students will understand how Digital Twins are applied in different domains. They will be able to analyze research approaches, identify limitations, and assess the practical relevance of current work. Students will also be able to recognize emerging research directions and innovation opportunities.

**Prerequisites**

Basic programming experience and foundational knowledge in mathematics, modeling, and data-driven methods.

**Learning Objectives**

- Conduct critical analysis of Digital Twin research and its practical relevance.
- Evaluate limitations and opportunities for innovation in existing Digital Twin approaches.
- Identify emerging trends across application domains and research areas.
- Connect theoretical knowledge with hands-on experience through demonstrations and tool-based exercises.

**Form of Instruction**

Lectures covering theoretical foundations and research contributions, complemented by practical sessions including demonstrations, case studies, and tool-based exercises. A detailed course plan will be provided before the start of the semester.

**Competence Certificate**

The examination will be offered as a written exam (60 minutes).

## T

**6.22 Module component: Advanced Topics in Economic Theory [T-WIWI-102609]**

**Coordinators:** Prof. Dr. Johannes Brumm  
Prof. Dr. Kay Mitusch

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

**Part of:** [M-WIWI-101406 - Network Economics](#)  
[M-WIWI-101500 - Microeconomic Theory](#)  
[M-WIWI-101502 - Economic Theory and its Application in Finance](#)  
[M-WIWI-107010 - Economics in a Connected World](#)  
[M-WIWI-107011 - Economics of Innovation and Growth](#)

| Type                | Credits | Grading | Term offered | Version |
|---------------------|---------|---------|--------------|---------|
| Written examination | 4,5 CP  | graded  | Irregular    | 1       |

**Assessment**

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

**Recommendations**

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.

## T

**6.23 Module component: Advanced Topics in Human Resource Management [T-WIWI-111913]****Coordinators:** Prof. Dr. Petra Nieken**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-105923 - Incentives, Interactivity & Decisions in Organizations](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 3 CP    | graded  | Irregular    | 1       |

| Courses  |         |                                                              |       |                                                                                                  |                     |
|----------|---------|--------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------|---------------------|
| WT 25/26 | 2573014 | <a href="#">Advanced Topics in Human Resource Management</a> | 2 SWS | Colloquium /  | Nieken, Mitarbeiter |

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

**Assessment**

Alternative exam assessment. The following aspects are included:

- Regular and active participation in the course dates
- Presentation of a given research topic.

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.

**Recommendations**

We recommend visiting the course Incentives in Organization before taking this course.

The course is strongly recommended for students interested in empirical research in the areas HRM, personnel economics, and leadership and those who are interest in an academic career path.

**Additional Information**

Teaching and learning format: Colloquium

**Workload**

90 hours

*Below you will find excerpts from courses related to this module component:*

## V

**Advanced Topics in Human Resource Management**

2573014, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)

Colloquium (KOL)  
On-Site

**Content**

The students will discuss and analyze selected research papers in the areas HRM, personnel economics, and leadership. The students will present research papers and discuss research methods and designs as well as content. They will develop an own research design on a predefined topic.

**Aim**

The student

- Looks into current research topics in the areas HRM, personnel economics, and leadership.
- Analyzes research papers in detail and evaluates the research outcomes.
- Trains their presentation skills and discussion skills.
- Practices scientific debating.
- Learns to critically evaluate research methods and trains the scientific discussion culture.
- Gains deeper knowledge in the area of HRM.
- Learns to evaluate research designs and takes into account the ethical dimension of research.
- Learns how to develop an own research design and idea.

**Notes**

Due to the interactive nature of the course, the number of participants is limited. If you are interested, please contact Prof. Nieken by email.

**Workload**

The total workload for this course is approximately 90 hours.

Lecture: 30 hours

Preparation: 45 hours

Exam preparation: 15 hours

**Literature**

Selected research papers

**Organizational issues**

siehe Homepage

## T

## 6.24 Module component: Algorithm Engineering [T-INFO-101332]

**Coordinators:** Prof. Dr. Peter Sanders

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-100795 - Algorithm Engineering](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 4 CP    | graded  | Each summer term | 4       |

| Courses |         |                                       |       |                                                                                               |                  |
|---------|---------|---------------------------------------|-------|-----------------------------------------------------------------------------------------------|------------------|
| ST 2026 | 2400022 | <a href="#">Algorithm Engineering</a> | 3 SWS | Lecture /  | Sanders, Hermann |

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

### Assessment

The assessment is carried out as an oral examination lasting approximately 20 minutes (§ 4 Abs. 2 Nr. 2 SPO).

### Prerequisites

none.



## T

**6.25 Module component: Algorithm Engineering Pass [T-INFO-111856]**

**Coordinators:** Prof. Dr. Peter Sanders  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-100795 - Algorithm Engineering](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 1 CP    | graded  | Each summer term | 1       |

**Assessment**

The assessment is carried out as an examination of another type (§ 2 Abs. 2 Nr. 3).

The exercise can be evidenced by various performance records. This is determined individually during the lecture. Usually, the student prepares a seminar presentation and/or works on a practical tasks with written elaboration and evaluation (the main performance consists of the programming, documented by the source code that is to be handed in and supplemented by a short written report).

Students may redraw from the examination during the first four weeks after they have been assigned a task.

An overall grade is awarded.

**Prerequisites**

None.

## T

**6.26 Module component: Algorithmic Graph Theory [T-INFO-113918]**

**Coordinators:** Dr. rer. nat. Torsten Ueckerdt  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-106960 - Algorithmic Graph Theory](#)

| Type             | Credits | Grading | Term offered | Version |
|------------------|---------|---------|--------------|---------|
| Oral examination | 5 CP    | Graded  | Irregular    | 1       |

| Exams    |         |                                          |          |
|----------|---------|------------------------------------------|----------|
| WT 25/26 | 7500281 | <a href="#">Algorithmic Graph Theory</a> | Ueckerdt |
| WT 25/26 | 7500410 | <a href="#">Algorithmic Graph Theory</a> | Ueckerdt |

**Assessment**

The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting 20 minutes.

**Prerequisites**

None.

**Recommendations**

Knowledge of the basics of graph theory and algorithm technology is helpful

## T

**6.27 Module component: Algorithmic Network Analysis [T-INFO-114642]**

**Coordinators:** Prof. Dr. Henning Meyerhenke  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-107460 - Algorithmic Network Analysis](#)

| Type             | Credits | Grading | Term offered | Version |
|------------------|---------|---------|--------------|---------|
| Oral examination | 3 CP    | Graded  | Irregular    | 1       |

| Courses  |         |                                              |       |                                                                                                         |                       |
|----------|---------|----------------------------------------------|-------|---------------------------------------------------------------------------------------------------------|-----------------------|
| WT 25/26 | 2400209 | <a href="#">Algorithmic Network Analysis</a> | 3 SWS | Lecture / Practice /  | Meyerhenke, Obergfell |
| Exams    |         |                                              |       |                                                                                                         |                       |
| WT 25/26 | 7500394 | <a href="#">Algorithmic Network Analysis</a> |       |                                                                                                         | Meyerhenke            |
| ST 2026  | 7500394 | <a href="#">Algorithmic Network Analysis</a> |       |                                                                                                         | Meyerhenke            |

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

Below you will find excerpts from courses related to this module component:

|                                                                                   |                                                                                                                         |                                    |
|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|------------------------------------|
|  | <b>Algorithmic Network Analysis</b><br>2400209, WS 25/26, 3 SWS, Language: German, <a href="#">Open in study portal</a> | Lecture / Practice (VÜ)<br>On-Site |
|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|------------------------------------|

**Content****Context**

Nowadays, networks are omnipresent in physical shapes as well as for modeling purposes. Physically realized networks, for example, appear in technical areas (electricity, telephone). Recently, abstract networks, as for example, for modeling the connectivity structure of the World Wide Web or for modeling social contacts, are gaining great importance. Due to the variety of applications and resulting questions, a comprehensive catalogue of methods is used. Techniques from graph theory and linear algebra are used among others. In addition, interesting connections to probabilistic methods begin to show.

**Objectives**

The objective of this lecture is to provide students with theoretical and practical insights into network analysis. The participants apply their knowledge from graph theory and algorithms. After the event, students can formally represent the problems that arise, reduce them to their algorithmic core, and solve them efficiently (both in theory and in practice). Students also learn to apply the methods and techniques presented autonomously to related questions.

**Content**

This event systematically examines selected algorithmic methods, and their basic principles. Questions are motivated by examples of application and practically solved. The focus will be on algorithmic procedures as well as their prerequisites and properties.

- Properties of complex networks
- PageRank and other central dimensions
- Efficient calculation of global network properties such as distances
- Generation of complex networks
- Cluster analysis in graphs
- Possibly other topics (visualization, epidemics)

**Exam**

The examination is carried out in form of an oral exam in accordance with §4, Par. 2, No. 2 of the Student Examination Regulations (dt.: SPO).

**Prerequisites**

None

**Recommendations**

Basic knowledge in graph algorithms, linear algebra, and C++.

**Organizational issues**

Es werden zwei 2-stündige Slots belegt, von denen aber einige ausfallen, so dass sich insgesamt 2+1 SWS ergeben.

Das früher am KIT angebotene Modul "Algorithmische Methoden zur Netzwerkanalyse" darf von Teilnehmenden noch nicht begonnen worden sein.

**Literature**

Siehe ILIAS-Kurs

T

6.28 Module component: Algorithmic Network Analysis - Pass [T-INFO-114643]

**Coordinators:** Prof. Dr. Henning Meyerhenke  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-107460 - Algorithmic Network Analysis](#)

| Type                 | Credits | Grading   | Term offered | Version |
|----------------------|---------|-----------|--------------|---------|
| Coursework (written) | 2 CP    | pass/fail | Irregular    | 1       |

| Exams    |         |                                                     |            |
|----------|---------|-----------------------------------------------------|------------|
| WT 25/26 | 7500396 | <a href="#">Algorithmic Network Analysis - Pass</a> | Meyerhenke |

## T

**6.29 Module component: Algorithms for Routing [T-INFO-100002]**

**Coordinators:** Moritz Laupichler  
Dr. Jonas Sebastian Sauer

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-100031 - Algorithms for Routing](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 5 CP    | graded  | Each summer term | 2       |

| Courses |         |                                                             |       |                                                                                                         |                   |
|---------|---------|-------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------|-------------------|
| ST 2026 | 2424638 | <a href="#">Algorithmen für Routenplanung (mit Übungen)</a> | 3 SWS | Lecture / Practice /  | Laupichler, Sauer |

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

## T

**6.30 Module component: Algorithms for Visualization of Graphs [T-INFO-113919]**

**Coordinators:** Dr. rer. nat. Torsten Ueckerdt  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-106961 - Algorithms for Visualization of Graphs](#)

**Type**  
Oral examination

**Credits**  
5 CP

**Grading**  
graded

**Term offered**  
Irregular

**Version**  
1

| Courses |         |                               |       |                                                                                                         |                  |
|---------|---------|-------------------------------|-------|---------------------------------------------------------------------------------------------------------|------------------|
| ST 2026 | 2400155 | <a href="#">Graph Drawing</a> | 3 SWS | Lecture / Practice /  | Ueckerdt, Merker |

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

**Assessment**

The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting 20 minutes.

**Prerequisites**

None.

**Recommendations**

Knowledge of the basics of graph theory and algorithm technology is helpful.

*Below you will find excerpts from courses related to this module component:*

## V

**Graph Drawing**

2400155, SS 2026, 3 SWS, Language: English, [Open in study portal](#)

Lecture / Practice (VÜ)  
On-Site

**Content****Qualifikationsziele:**

Students acquire a systematic understanding of algorithmic problems and solution approaches in the field of graph visualization, which builds on existing knowledge in the areas of graph theory and algorithmics.

After successfully completing the course, students will be able to

- explain concepts, structures and basic problem definitions from the lecture;
- execute layout algorithms for different graph classes, analyze them mathematically precisely and prove the algorithmic properties;
- explain complexity results from the lecture and independently perform similar reduction proofs for new layout problems;
- select which algorithms are suitable for solving a given layout problem and, if necessary, adapt them to the requirements of a concrete problem; - select which algorithms are suitable for solving a given layout problem and, if necessary, adapt them to the requirements of a concrete problem. adapt them to the requirements of a specific problem;
- analyze unknown visualization problems from graph drawing applications, reduce them to their algorithmic core and create an abstract model from this; design and analyze their own solutions in this model based on the concepts and techniques learned in the lecture and prove the algorithmic properties.

**Inhalt:**

Networks are relationally structured data that are increasingly appearing in a wide variety of application areas. Examples range from physical networks, such as transportation and supply networks, to abstract networks, such as social networks. Network visualization is a fundamental tool for the investigation and understanding of networks.

Mathematically, networks can be modelled as graphs and the visualization problem can be reduced to the algorithmic core problem of determining a layout of the graph, i.e. suitable node and edge positions in the plane. Depending on the application and graph class, different requirements are placed on the type of drawing and the quality criteria to be optimized. The research field of graph drawing draws on approaches from classical algorithmics, graph theory and algorithmic geometry.

During the course, a representative selection of visualization algorithms will be presented and discussed in depth.

**Arbeitsaufwand:**

Lecture and exercise with 3 SWS, 5 LP

5 LP corresponds to approx. 150 working hours, of which

approx. 45 hours attendance of the lecture and exercise,

approx. 25 hours preparation and follow-up,

approx. 40 hours working on the exercise sheets

approx. 40 hours exam preparation

**Organizational issues**

Die Lehrveranstaltung wird unregelmäßig angeboten, Auskünfte erteilt das Institut für Theoretische Informatik, Algorithmik I, Prof. Wagner.



## T

**6.31 Module component: Algorithms II [T-INFO-114225]**

**Coordinators:** Prof. Dr. Peter Sanders  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-107201 - Algorithms II](#)

**Type**  
Written examination

**Credits**  
6 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
1

| Courses  |         |                                             |       |                                                                                               |                                   |
|----------|---------|---------------------------------------------|-------|-----------------------------------------------------------------------------------------------|-----------------------------------|
| WT 25/26 | 2424079 | <a href="#">Algorithms II</a>               | 4 SWS | Lecture /  | Sanders, Künnemann, Redzic, Stieß |
| Exams    |         |                                             |       |                                                                                               |                                   |
| WT 25/26 | 7500245 | <a href="#">Algorithms II</a>               |       |                                                                                               | Künnemann                         |
| ST 2026  | 7500080 | <a href="#">Algorithms II - Nachklausur</a> |       |                                                                                               | Künnemann                         |

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

**Assessment**

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 120 minutes.

**Prerequisites**

None.

Below you will find excerpts from courses related to this module component:

## V

**Algorithms II**

2424079, WS 25/26, 4 SWS, Language: English, [Open in study portal](#)

**Lecture (V)**  
On-Site

**Content**

This module is designed to provide students with the basic theoretical and practical aspects of algorithm design, analysis, and engineering. It teaches general methods for designing and analyzing algorithms for basic algorithmic problems, as well as the basic principles of general algorithmic methods such as approximation algorithms, linear programming, randomized algorithms, parallel algorithms, and parameterized algorithms.

The student has an in-depth insight into the theoretical and practical aspects of algorithms and is able to identify and formally formulate algorithmic problems in various application areas. Furthermore, they know advanced algorithms and data structures from the areas of graph algorithms, algorithmic geometry, string matching, algebraic algorithms, combinatorial optimization, and external memory algorithms. They are able to independently understand algorithms they are unfamiliar with, associate them with the above areas, apply them, determine their running time, evaluate them, and select appropriate algorithms for given applications. Furthermore, the student is able to adapt existing algorithms to related problems. In addition to algorithms for concrete problems, the student knows advanced techniques of algorithmic design. This includes parameterized algorithms, approximation algorithms, online algorithms, randomized algorithms, parallel algorithms, linear programming, and algorithm engineering techniques. For given algorithms, the student is able to identify techniques used to better understand these algorithms. In addition, they are able to select appropriate techniques for a given problem and use them to design their own algorithms.

**Organizational issues**

Erfolgskontrolle

See partial achievements (Teilleistung)

Voraussetzungen

See partial achievements (Teilleistung)

Arbeitsaufwand

Vorlesung mit 3 SWS + 1 SWS Übung.

6 LP entspricht ca. 180 Stunden

ca. 45 Std. Vorlesungsbesuch,

ca. 15 Std. Übungsbesuch,

ca. 90 Std. Nachbearbeitung und Bearbeitung der Übungsblätter

ca. 30 Std. Prüfungsvorbereitung

Lecture with 3 semester hours + 1 semester hour exercise

6 ECTS correspond to about 180 hours

about 45h visiting the lectures

about 15h visiting the exercises

about 90h follow-up of lectures and solving the exercise sheets

about 30h preparation for the exam

**Literature**

K. Mehlhorn, P. Sanders: Algorithms and Data Structures - The Basic Toolbox

Mehlhorn, Naeher: The LEDA Platform of Combinatorial and Geometric Computing Topic: Algorithm Engineering, Flows, Geometrie

Ahuja, Magnanti, Orlin: Network Flows

de Berg, Cheong, van Kreveld, Overmars: Computational Geometry: Algorithms and Applications

Gonzalo Navarro: Compact Data Structures "A Practical Approach", Cambridge University Press

R. Niedermeier: Invitation to Fixed-Parameter Algorithms, Oxford University Press, 2006.

## T

**6.32 Module component: Analysis of Multivariate Data [T-WIWI-103063]****Coordinators:** Prof. Dr. Oliver Grothe**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-105414 - Statistics and Econometrics II](#)**Type**  
Written examination**Credits**  
4,5 CP**Grading**  
graded**Term offered**  
Irregular**Version**  
1

| Exams    |         |                                               |        |
|----------|---------|-----------------------------------------------|--------|
| WT 25/26 | 7900297 | <a href="#">Analysis of Multivariate Data</a> | Grothe |

**Assessment**

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

**Recommendations**

Attendance of the courses Statistics 1 [2600008] and Statistics 2 [2610020] is recommended.

**Additional Information**

The lecture is not offered regularly. The courses planned for three years in advance can be found online.

**Workload**

135 hours

T6.33 Module component: Applied Econometrics [T-WIWI-111388]

**Coordinators:** Prof. Dr. Fabian Krüger  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101638 - Econometrics and Statistics I](#)  
[M-WIWI-101639 - Econometrics and Statistics II](#)  
[M-WIWI-107010 - Economics in a Connected World](#)  
[M-WIWI-107011 - Economics of Innovation and Growth](#)

| Type                | Credits | Grading | Term offered     | Version |
|---------------------|---------|---------|------------------|---------|
| Written examination | 4,5 CP  | graded  | Each winter term | 2       |

| Courses  |         |                                                  |       |            |              |
|----------|---------|--------------------------------------------------|-------|------------|--------------|
| WT 25/26 | 2520020 | <a href="#">Applied Econometrics</a>             | 2 SWS | Lecture /  | Krüger, N.N. |
| WT 25/26 | 2520021 | <a href="#">Tutorial in Applied Econometrics</a> | 2 SWS | Practice / | Krüger, N.N. |
| Exams    |         |                                                  |       |            |              |
| WT 25/26 | 7900251 | <a href="#">Applied Econometrics</a>             |       |            | Krüger       |
| ST 2026  | 7900007 | <a href="#">Applied Econometrics</a>             |       |            | Krüger       |

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

**Assessment**  
The assessment of this course is a written examination (90 min).

**Prerequisites**  
None

Below you will find excerpts from courses related to this module component:

V

**Applied Econometrics**  
2520020, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
On-Site

**Content**  
The course starts with a concise review of the linear regression model. It then presents methods for causal inference: The potential outcomes approach, methods for analyzing randomized controlled trials, and methods for analyzing observational data (e.g., regression discontinuity). Empirical examples and R code are used to illustrate the methodological concepts.

**Learning goals**  
Students understand the properties of various econometric estimators and research designs, and can implement econometric estimators using R software.

**Workload**  
The total workload for this course (4.5 credit points) is approximately 135 hours.

**Literature**  
The following book is the main reference for the course:  
Ding, P. (2024). A First Course in Causal Inference. Routledge.  
Further literature will be announced in class.

## T

**6.34 Module component: Applied material flow simulation [T-MACH-112213]****Coordinators:** 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](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 4,5 CP  | graded  | Each winter term | 1       |

| Courses  |                  |                                                  |                  |                                                                                                         |         |
|----------|------------------|--------------------------------------------------|------------------|---------------------------------------------------------------------------------------------------------|---------|
| WT 25/26 | 2117054          | <a href="#">Applied material flow simulation</a> | 3 SWS            | Lecture / Practice /  | Baumann |
| Exams    |                  |                                                  |                  |                                                                                                         |         |
| WT 25/26 | 76-T-MACH-112213 | <a href="#">Applied material flow simulation</a> | Baumann, Furmans |                                                                                                         |         |

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

**Assessment**

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

**Recommendations**

- 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

**Additional Information**

The course is offered in German.

**Workload**

135 hours

Below you will find excerpts from courses related to this module component:

## V

**Applied material flow simulation**

2117054, WS 25/26, 3 SWS, Language: German, [Open in study portal](#)

Lecture / Practice (VÜ)  
On-Site

**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.

**Requirements:**

- Basic knowledge of the Java programming language

**Recommendations:**

- Basic statistical skills
- 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 2025/2026 ist die Veranstaltung auf maximal 30 Teilnehmer beschränkt.
- Die Anmeldung ist durch Beitritt zum ILIAS-Kurs und Ausfüllen des Anmeldeformulars (erforderliche Felder beim Beitritt zum ILIAS-Kurs) möglich.
- Die Anmeldung ist vom 01.09.2025 bis zum 30.09.2025 möglich.

**Literature**

Borshchev, A. (2022): The Big Book of Simulation Modeling - Multimethod Modeling with AnyLogic 8, <https://www.anylogic.de/resources/books/big-book-of-simulation-modeling/>.

Grigoryev, I. (2021): AnyLogic8 in Three Days, 5. Aufl., <https://www.anylogic.de/resources/books/free-simulation-book-and-modeling-tutorials/>.

Gutenschwager, K. et. al. (2017): Simulation in Produktion und Logistik, Springer Vieweg, Berlin.

VDI (2014): Simulation von Logistik-, Materialfluss- und Produktionssystemen - Grundlagen. VDI Richtlinie 3633, Blatt 1, VDI-Verlag, Düsseldorf.

VDI (2016): Simulation von Logistik-, Materialfluss- und Produktionssystemen - Simulation und Optimierung. VDI Richtlinie 3633, Blatt 12, VDI-Verlag, Düsseldorf

## T

**6.35 Module component: Artificial Intelligence & IT-Security [T-INFO-113668]**

**Coordinators:** Prof. Dr. Christian Wressnegger  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-106810 - Artificial Intelligence & IT-Security](#)

**Type**  
Written examination

**Credits**  
6 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
1

| Courses  |         |                                                           |       |                                                                                                         |             |
|----------|---------|-----------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------|-------------|
| WT 25/26 | 24000   | <a href="#">Artificial Intelligence &amp; IT-Security</a> | 4 SWS | Lecture / Practice /  | Wressnegger |
| Exams    |         |                                                           |       |                                                                                                         |             |
| WT 25/26 | 7500261 | <a href="#">Artificial Intelligence &amp; IT-Security</a> |       |                                                                                                         | Wressnegger |

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

**Assessment**

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 120 minutes.

Depending on the number of participants, it will be announced six weeks before the examination performance (§ 6 Abs. 3 SPO) whether the performance review will be

- in the form of an oral examination according to § 4 Abs. 2 no. 2 SPO **or**
- in the form of a written examination according to § 4 Abs. 2 Nr. 1 SPO

takes place.

**Prerequisites**

None.

**Recommendations**

The basics of IT security and artificial intelligence are a prerequisite.

*Below you will find excerpts from courses related to this module component:*

## V

**Artificial Intelligence & IT-Security**

24000, WS 25/26, 4 SWS, Language: English, [Open in study portal](#)

Lecture / Practice (VÜ)  
On-Site

**Content**

The lecture is about combining the fields of artificial intelligence, machine learning and computer security in practice. Many tasks in the computer security landscape are based on manual labor, such as searching for vulnerabilities or analyzing malware. Here, machine learning can be used to establish a higher degree of automation, providing more “intelligent” security solutions (AI for Security). However, also these learning-based systems can be attacked and need to be secured (Security of AI). As an example, viciously crafted inputs can be exploited by an adversary to cause devastating damage in the application area. It thus is of utmost importance to investigate, research, and know about the security properties of AI methods.

The module introduces students to theoretic and practical aspects of AI in computer security as well as security of AI. We cover basics on features and feature engineering in the security domain, discuss fundamental learning settings in security and point out “Dos and Don’ts” of using AI/ML in computer security. Moreover, we put particular focus on “Explainable AI” (XAI) and its use in computer security, before we introduce attacks and defense against learning-based systems as discussed in the first half of the course. We cover input-manipulation attacks (e.g., adversarial examples), model-manipulation attacks (e.g., backdooring attacks), privacy attacks (e.g., model stealing and membership inference) and attacks against XAI. More details at: <https://intellisec.de/teaching/aisec>

**Organizational issues**

English Course

## T

**6.36 Module component: Artificial Intelligence in Service Systems [T-WIWI-108715]****Coordinators:** Prof. Dr. Gerhard Satzger**Organisation:** KIT Department of Business and Economics

**Part of:** [M-WIWI-101448 - Service Management](#)  
[M-WIWI-101506 - Service Analytics](#)  
[M-WIWI-103117 - Data Science: Data-Driven Information Systems](#)  
[M-WIWI-107528 - Information Systems: Digital Markets & Services](#)

| Type                | Credits | Grading | Term offered     | Version |
|---------------------|---------|---------|------------------|---------|
| Written examination | 4,5 CP  | Graded  | Each winter term | 2       |

| Courses  |         |                                                                               |         |                                                                                                |                                      |
|----------|---------|-------------------------------------------------------------------------------|---------|------------------------------------------------------------------------------------------------|--------------------------------------|
| WT 25/26 | 2595650 | <a href="#">Artificial Intelligence in Service Systems</a>                    | 1.5 SWS | Lecture /   | Spitzer, Holstein, Satzger           |
| WT 25/26 | 2595651 | <a href="#">Übung zu Artificial Intelligence in Service Systems</a>           | 1.5 SWS | Practice /  | Spitzer, Holstein, Hendriks, Satzger |
| Exams    |         |                                                                               |         |                                                                                                |                                      |
| WT 25/26 | 7900032 | <a href="#">Artificial Intelligence in Service Systems</a>                    |         |                                                                                                | Satzger                              |
| ST 2026  | 7900073 | <a href="#">Artificial Intelligence in Service Systems (NK am 15.06.2026)</a> |         |                                                                                                | Satzger                              |

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

**Assessment**

The assessment consists of a written exam (60 min). Successful completion of the exercises is a prerequisite for admission to the written exam.

**Prerequisites**

None

**Additional Information**

The course will be offered in the form of a flipped classroom concept starting in winter semester 2022/2023. The lecture will be recorded in advance and made available online. During the exercise classes, the contents of the lecture will be discussed and applied as part of programming exercises.

**Workload**

135 hours

Below you will find excerpts from courses related to this module component:

## V

**Artificial Intelligence in Service Systems**

2595650, WS 25/26, 1.5 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
Blended (On-Site/Online)



## Content

Artificial Intelligence (AI) and the application of machine learning is becoming more and more popular to solve relevant business challenges – both within isolated entities but also within co-creating systems (like value chains). However, it is not only essential to be familiar with precise algorithms but rather a general understanding of the necessary steps with a holistic view—from real-world challenges to the successful deployment of an AI-based solution. As part of this course, we teach the complete lifecycle of an AI project focusing on supervised machine learning challenges. We do so by also introducing the use of Python and the required packages like scikit-learn, pytorch and langchain with exemplary data and use cases. We then take this knowledge to the more complex case of service systems with different entities (e.g., companies) who interact with each other and show possibilities on how to derive holistic insights. Apart from the technical aspects necessary when developing AI within service systems, we also shed light on the collaboration of humans and AI in such systems (e.g., with the support of XAI), topics of ethics and bias in AI, as well as AI's capabilities on being creative - like generative AI creating songs and images. Students of this course will be able to understand and implement the complete lifecycle of a typical Artificial Intelligence use case with supervised machine learning. Furthermore, they understand the importance and the means of applying AI within service systems, which allows multiple, independent entities to collaborate and derive insights. Besides technical aspects, they will gain an understanding of the broader challenges and aspects when dealing with AI. Students will be proficient with typical Python code for AI challenges.

## Workload:

- Attendance time – Lecture (1.5 SWS × 15 weeks): 22.5 h
- Attendance time – Tutorial (1.5 SWS × 15 weeks): 22.5 h
- Self-study – Lecture: 35 h
- Self-study – Tutorial: 35 h
- Exam preparation: 20 h
- **Total workload: 135 h**

## Organizational issues

The course will be offered in the form of a flipped classroom concept starting in winter semester 2022/2023. The lecture will be recorded in advance and made available online. During the exercise classes, the contents of the lecture will be discussed and applied as part of programming exercises.

## Literature

- Baier, L., Kühl, N., & Satzger, G. (2019). How to cope with change?-preserving validity of predictive services over time. In Proceedings of the 52nd Hawaii International Conference on System Sciences.
- Cawley, G. C., & Talbot, N. L. (2010). On over-fitting in model selection and subsequent selection bias in performance evaluation. *The Journal of Machine Learning Research*, 11, 2079-2107.
- Fink, O., Netland, T., & Feuerriegel, S. (2021). Artificial intelligence across company borders. arXiv preprint arXiv:2107.03912.
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- Hemmer, P., Schemmer, M., Vössing, M., & Kühl, N. (2021). Human-AI Complementarity in Hybrid Intelligence Systems: A Structured Literature Review. *PACIS 2021 Proceedings*.
- Hirt, R., & Kühl, N. (2018). Cognition in the Era of Smart Service Systems: Inter-organizational Analytics through Meta and Transfer Learning. In 39th International Conference on Information Systems, ICIS 2018; San Francisco Marriott Marquis San Francisco; United States; 13 December 2018 through 16 December 2018.
- Holstein, J., Spitzer, P., Hoell, M., Vössing, M., & Kühl, N. (2024). Understanding Data Understanding: A Framework to Navigate the Intricacies of Data Analytics. In European Conference on Information Systems (ECIS 2024), Paphos, Cyprus, 13-19 June, 2024.
- Kühl, N., Goutier, M., Hirt, R., & Satzger, G. (2019, January). Machine Learning in Artificial Intelligence: Towards a Common Understanding. In Proceedings of the 52nd Hawaii International Conference on System Sciences.
- Kühl, N., Hirt, R., Baier, L., Schmitz, B., & Satzger, G. (2021). How to Conduct Rigorous Supervised Machine Learning in Information Systems Research: The Supervised Machine Learning Report Card. *Communications of the Association for Information Systems*, 48(1), 46.
- Maleshkova, M., Kühl, N., & Jussen, P. (Eds.). (2020). *Smart Service Management: Design Guidelines and Best Practices*. Springer Nature.
- Martin, D., Hirt, R., & Kühl, N. (2019). Service Systems, Smart Service Systems and Cyber-Physical Systems—What's the difference? Towards a Unified Terminology. 14. Internationale Tagung Wirtschaftsinformatik 2019 (WI 2019), Siegen, Germany, February 24-27.
- Mehrabi, N., Morstatter, F., Saxena, N., Lerman, K., & Galstyan, A. (2019). A survey on bias and fairness in machine learning. arXiv preprint arXiv:1908.09635.
- Schemmer, M., Bartos, A., Spitzer, P., Hemmer, P., Kühl, N., Liebschner, J., & Satzger, G. (2023). Towards Effective Human-AI Decision-Making: The Role of Human Learning in Appropriate Reliance on AI Advice. In Proceedings of the 44th International Conference on Information Systems (ICIS2023), Hyderabad, India.
- Schöffner, J., Machowski, Y., & Kühl, N. (2021). A Study on Fairness and Trust Perceptions in Automated Decision Making. In Joint Proceedings of the ACM IUI 2021 Workshops, April 13–17, 2021, College Station, USA.
- Spitzer, P., Kühl, N., Goutier, M., Kaschura, M., & Satzger, G. (2024). Transferring Domain Knowledge with (X) AI-Based Learning Systems. In European Conference on Information Systems (ECIS 2024), Paphos, Cyprus, 13-19 June, 2024.
- Zahn, M. V., Feuerriegel, S., & Kühl, N. (2021). The cost of fairness in AI: Evidence from e-commerce. *Business & information systems engineering*.

## T

**6.37 Module component: Artificial Intelligence in Service Systems II: Generative AI Applications & Adoption [T-WIWI-114209]****Coordinators:** Prof. Dr. Gerhard Satzger**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-101448 - Service Management](#)[M-WIWI-101506 - Service Analytics](#)[M-WIWI-103117 - Data Science: Data-Driven Information Systems](#)[M-WIWI-105661 - Data Science: Intelligent, Adaptive, and Learning Information Services](#)[M-WIWI-107528 - Information Systems: Digital Markets & Services](#)

| Type                        | Credits | Grading        | Term offered     | Version |
|-----------------------------|---------|----------------|------------------|---------|
| Examination of another type | 4,5 CP  | Grading graded | Each summer term | 1       |

| Courses |         |                                                                                                      |       |                                                                                               |                            |
|---------|---------|------------------------------------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|----------------------------|
| ST 2026 | 2595501 | <a href="#">Artificial Intelligence in Service Systems - Generative AI Applications and Adoption</a> | 3 SWS | Lecture /  | Spitzer, Holstein, Satzger |

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

Success is assessed in the form of an examination of another type. The following aspects are included in the assessment:

- Collaborative development of a prototype as a group task
- Group presentation of the developed prototype
- Group report detailing the prototype and its development

Further details on the organization of the performance and the points system for the assessment will be announced in the lecture.

**Modeled Prerequisites**

The following conditions have to be fulfilled:

1. The module component [T-WIWI-111219 - Artificial Intelligence in Service Systems - Applications in Computer Vision](#) must not have been started.

**Additional Information**This course is admission restricted (see <https://dsi.win.kit.edu/index.php>). You can apply for this course via the Wiwi-Portal.

The course replaces T-WIWI-111219 "Artificial Intelligence in Service Systems - Applications in Computer Vision" as of summer semester 2025.

**Workload**

135 hours

Below you will find excerpts from courses related to this module component:

## V

**Artificial Intelligence in Service Systems - Generative AI Applications and Adoption**2595501, SS 2026, 3 SWS, Language: English, [Open in study portal](#)Lecture (V)  
On-Site

**Content**

---We renamed this course from "Artificial Intelligence in Service Systems - Applications in Computer Vision" to "Artificial Intelligence in Service Systems - Generative AI Applications and Adoption" ---

**Learning objectives**

This course provides deepens the students's theoretical knowledge and practical skills in developing AI-based services. It adds "state-of-the-art" generative AI technologies and the focus on integrating AI-based services into larger service systems and organizational workflows. Students will not only learn core theoretical concepts and frameworks, but also engage in team projects to gain hands-on experience in implementing and adapting these services for human adoption.

**Description**

This course builds on the course "Artificial Intelligence in Service Systems" (LV-Nr.: [2595650](#)) and applies the "end-to-end" development of AI-based services to particular team projects with two key objectives: (1) capturing new Generative AI methods, but also (2) focus on the integration of the service in organizational workflows and the necessary adoption by humans. Starting with the fundamentals of generative AI, students work with Large Language Models (LLMs) and multimodal architectures to develop practical applications. Building on these implementations, the course investigates how to integrate these services into organizational workflows and information systems, focusing on user interaction, system transparency, and human-AI collaboration mechanisms.

Through a group project, students apply their learning by first implementing a technical artifact to address real-world challenges, then identifying and applying appropriate metrics to design and evaluate adoption while considering human factors such as user acceptance, trust, workflow integration, and ethical implications. This hands-on approach provides students with practical experience in both technical implementation and organizational integration of AI-based services.

**Recommendations**

The course is aimed at students in the Master's program with basic knowledge in statistics and applied programming in Python. Knowledge from the lecture Artificial Intelligence in Service Systems may be beneficial.

**Additional information**

- Group-based project work
- Flipped classroom format with pre-recorded lectures
- Three half-day block sessions for in-depth discussions and optional hands-on coding exercises

**Workload:**

- Attendance time (3 SWS × 15 weeks): 45 h
- Self-study: 60 h
- Exam preparation: 30 h
- **Total workload: 135 h**

**Literature**

- Baltrušaitis, T., Ahuja, C. and Morency, L.P., 2018. Multimodal machine learning: A survey and taxonomy. *IEEE transactions on pattern analysis and machine intelligence*, 41(2), pp.423-443
- Chang, Y., Wang, X., Wang, J., Wu, Y., Yang, L., Zhu, K., Chen, H, Yi, X., Wang, C., Wang, Y., Ye, W., Zhang, Y., Chang, Y., Yu, P, Yang, Q., and Xie, X. (2024). A Survey on Evaluation of Large Language Models. *ACM Trans. Intell. Syst. Technol.* 15, 3, Article 39 (June 2024), 45 pages.
- Fourney, A., Bansal, G., Mozannar, H., Tan, C., Salinas, E., Niedtner, F., Proebsting, G., Bassman, G., Gerrits, J., Alber, J. and Chang, P., 2024. Magentic-one: A generalist multi-agent system for solving complex tasks. *arXiv preprint arXiv:2411.04468*.
- Hemmer, P., Schemmer, M., Kühl, N., Vössing, M., & Satzger, G. (2024). Complementarity in Human-AI Collaboration: Concept, Sources, and Evidence. *arXiv preprint arXiv:2404.00029*.
- Kreuzberger, D., Kühl, N. and Hirschl, S., 2023. Machine learning operations (mlops): Overview, definition, and architecture. *IEEE access*, 11, pp.31866-31879.
- Schemmer, M., Kuehl, N., Benz, C., Bartos, A., & Satzger, G. (2023, March). Appropriate reliance on AI advice: Conceptualization and the effect of explanations. In *Proceedings of the 28th International Conference on Intelligent User Interfaces* (pp. 410-422).
- Zhang, Y., Li, Y., Cui, L., Cai, D., Liu, L., Fu, T., Huang, X., Zhao, E., Zhang, Y., Chen, Y., Wang, L., Luu, A.T., Bi, W., Shi, F., & Shi, S. (2023). Siren's Song in the AI Ocean: A Survey on Hallucination in Large Language Models. *ArXiv, abs/2309.01219*.

## T

**6.38 Module component: Asset Pricing [T-WIWI-102647]**

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

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

**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](#)

| Type                | Credits | Grading | Term offered     | Version |
|---------------------|---------|---------|------------------|---------|
| Written examination | 4,5 CP  | Graded  | Each summer term | 2       |

| Courses  |         |                                         |       |                                                                                                |                             |
|----------|---------|-----------------------------------------|-------|------------------------------------------------------------------------------------------------|-----------------------------|
| ST 2026  | 2530555 | <a href="#">Asset Pricing</a>           | 2 SWS | Lecture /   | Uhrig-Homburg, Thimme       |
| ST 2026  | 2530556 | <a href="#">Asset Pricing Exercises</a> | 1 SWS | Practice /  | Böll, Uhrig-Homburg, Thimme |
| Exams    |         |                                         |       |                                                                                                |                             |
| WT 25/26 | 7900056 | <a href="#">Asset Pricing</a>           |       |                                                                                                | Uhrig-Homburg               |
| ST 2026  | 7900110 | <a href="#">Asset Pricing</a>           |       |                                                                                                | Uhrig-Homburg, Thimme       |

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

**Assessment**

Success is assessed in the form of a written examination (60 minutes). The examination is offered every semester and can be repeated at any regular examination date.

A bonus can be earned for successful participation in the exercises by submitting correct solutions to at least 50% of the bonus exercises set. 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

**Recommendations**

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 courses related to this module component:*

## V

**Asset Pricing Exercises**

2530556, SS 2026, 1 SWS, Language: German, [Open in study portal](#)

Practice (Ü)  
On-Site

**Organizational issues**

Die Übung findet erst ab der 2. Vorlesungswoche statt.

## T

**6.39 Module component: Auction Theory [T-WIWI-102613]**

**Coordinators:** Prof. Dr. Karl-Martin Ehrhart  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101446 - Market Engineering](#)  
[M-WIWI-101453 - Applied Strategic Decisions](#)  
[M-WIWI-101500 - Microeconomic Theory](#)

| Type                | Credits | Grading | Term offered     | Version |
|---------------------|---------|---------|------------------|---------|
| Written examination | 4,5 CP  | graded  | Each winter term | 1       |

| Courses  |         |                                         |       |          |         |
|----------|---------|-----------------------------------------|-------|----------|---------|
| WT 25/26 | 2520408 | <a href="#">Auction Theory</a>          | 2 SWS | Lecture  | Ehrhart |
| WT 25/26 | 2520409 | <a href="#">Auction Theory Exercise</a> | 1 SWS | Practice | Ehrhart |
| Exams    |         |                                         |       |          |         |
| WT 25/26 | 7900033 | <a href="#">Auction Theory</a>          |       |          | Ehrhart |
| ST 2026  | 7900255 | <a href="#">Auction Theory</a>          |       |          | Ehrhart |

**Assessment**

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 courses related to this module component:*

## V

**Auction Theory**

2520408, WS 25/26, 2 SWS, [Open in study portal](#)

Lecture (V)

**Content****Workload:**

- Attendance time lecture (2 SWS × 15 weeks): 30 h
- Exercise attendance time (1 SWS × 15 weeks): 15 h
- Self-study lecture: 45 h
- Self-study exercise: 25 h
- Exam preparation: 20 h
- **Total: 135 h**

**Literature**

- Ehrhart, K.-M. und S. Seifert: Auktionstheorie, Skript zur Vorlesung, KIT, 2011
- Krishna, V.: Auction Theory, Academic Press, Second Edition, 2010
- Milgrom, P.: Putting Auction Theory to Work, Cambridge University Press, 2004
- Ausubel, L.M. und P. Cramton: Demand Reduction and Inefficiency in Multi-Unit Auctions, University of Maryland, 1999

## T

## 6.40 Module component: Authentication and Encryption [T-INFO-110824]

**Coordinators:** Prof. Dr. Jörn Müller-Quade  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-105338 - Authentication and Encryption](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 4 CP    | graded  | Each summer term | 1       |

| Courses  |         |                                               |       |                                                                                               |                                  |
|----------|---------|-----------------------------------------------|-------|-----------------------------------------------------------------------------------------------|----------------------------------|
| ST 2026  | 2400045 | <a href="#">Authentication and Encryption</a> | 2 SWS | Lecture /  | Müller-Quade, Bayreuther, Raiber |
| Exams    |         |                                               |       |                                                                                               |                                  |
| WT 25/26 | 7500255 | <a href="#">Authentication and Encryption</a> |       |                                                                                               | Müller-Quade                     |
| ST 2026  | 7500256 | <a href="#">Authentication and Encryption</a> |       |                                                                                               | Müller-Quade                     |

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

**Assessment**

Success is assessed in the form of an oral examination, usually lasting 30 minutes in accordance with §4 Para. 2 No. 2 SPO

**Prerequisites**

Module may not be taken together with the module M-INFO-100743 Digital Signatures

**Recommendations**

Students should be familiar with the contents of the module "Theoretical Foundations of Cryptography"

## T

**6.41 Module component: Automated Planning and Scheduling [T-INFO-109085]**

**Coordinators:** Prof. Dr. Peter Sanders  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-104447 - Automated Planning and Scheduling](#)

| Type             | Credits | Grading | Term offered | Version |
|------------------|---------|---------|--------------|---------|
| Oral examination | 5 CP    | graded  | Irregular    | 1       |

**Assessment**

The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting 30 minutes.

**Prerequisites**

None.

## T

**6.42 Module component: Automated Visual Inspection and Image Processing [T-INFO-101363]****Coordinators:** Prof. Dr.-Ing. Jürgen Beyerer**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-100826 - Automated Visual Inspection and Image Processing](#)**Type**  
Written examination**Credits**  
6 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
2

| Courses  |         |                                                                  |       |                                                                                               |         |
|----------|---------|------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|---------|
| WT 25/26 | 2424169 | <a href="#">Automated Visual Inspection and Image Processing</a> | 4 SWS | Lecture /  | Beyerer |
| Exams    |         |                                                                  |       |                                                                                               |         |
| WT 25/26 | 7500008 | <a href="#">Automated Visual Inspection and Image Processing</a> |       |                                                                                               | Beyerer |
| ST 2026  | 7500003 | <a href="#">Automated Visual Inspection and Image Processing</a> |       |                                                                                               | Beyerer |

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

Success is assessed in the form of a written examination (usually lasting 60 minutes) in accordance with Section 4 (2) No. 1 SPO.

**Prerequisites**

None.

**Recommendations**

Basic knowledge of optics and signal processing is helpful.

Below you will find excerpts from courses related to this module component:

## V

**Automated Visual Inspection and Image Processing**2424169, WS 25/26, 4 SWS, Language: German, [Open in study portal](#)**Lecture (V)**  
On-Site**Content****Topics covered:**

- sensors and concepts for image acquisition
- light and colour
- image signals (system theory, Fourier transformation, stochastic processes)
- excursion to wave optics
- pre-processing and image enhancement
- image restoration
- segmentation
- morphological image processing
- texture analysis
- detection
- image pyramids, multi scale analysis and wavelet-transform

**Educational objective:**

- Students have a sound knowledge regarding the basic concepts and methods of image processing (pre-processing and image enhancement, image restoration, image segmentation, morphological filtering, texture analysis, detection, image pyramids, multi-scale analysis and the wavelet transform)
- Students are in the position to work out and to evaluate solution concepts for problems of automated visual inspection
- Students have a sound knowledge of the different sensors and methods for the acquisition of image data as well as of the relevant optical principles
- Students know different concepts to describe image data and they know the essential system theoretical concepts and interrelations



**Organizational issues**

Die Erfolgskontrolle wird in der Modulbeschreibung erläutert.

**Empfehlungen:**

Grundkenntnisse der Optik und der Signalverarbeitung sind hilfreich.

**Literature****Weiterführende Literatur**

- R. C. Gonzalez und R. E. Woods, Digital Image Processing, Prentice-Hall, Englewood Cliffs, New Jersey, 2002
- B. Jähne, Digitale Bildverarbeitung, Springer, Berlin, 2002

## T

**6.43 Module component: Basics of German Company Tax Law and Tax Planning [T-WIWI-108711]**

**Coordinators:** Prof. Dr. Gerd Gutekunst  
Prof. Dr. Berthold Wigger

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

**Part of:** [M-WIWI-101511 - Advanced Topics in Public Finance](#)

**Type**  
Written examination

**Credits**  
4,5 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
2

| Courses  |         |                                                                   |       |                                                                                               |                   |
|----------|---------|-------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|-------------------|
| WT 25/26 | 2560134 | <a href="#">Basics of German Company Tax Law and Tax Planning</a> | 3 SWS | Lecture /  | Wigger, Gutekunst |
| Exams    |         |                                                                   |       |                                                                                               |                   |
| WT 25/26 | 790unbe | <a href="#">Basics of German Company Tax Law and Tax Planning</a> |       |                                                                                               | Wigger            |
| ST 2026  | 790unbe | <a href="#">Basics of German Company Tax Law and Tax Planning</a> |       |                                                                                               | Wigger            |

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

**Assessment**

Success is assessed in the form of a written examination (90 minutes). The examination is offered every semester and can be repeated at any regular examination date.

**Prerequisites**

None

**Recommendations**

Knowledge of the collection of public revenues is assumed. Therefore it is recommended to attend the course "Öffentliche Einnahmen" beforehand.

*Below you will find excerpts from courses related to this module component:*

## V

**Basics of German Company Tax Law and Tax Planning**

2560134, WS 25/26, 3 SWS, Language: German, [Open in study portal](#)

**Lecture (V)**  
On-Site

**Content****Workload:**

The total workload for this course is approximately 135.0 hours. For further information see German version.

## T

**6.44 Module component: Bayesian Statistics for Analyzing Data [T-WIWI-113471]**

**Coordinators:** Prof. Dr. Benjamin Scheibehenne  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-103117 - Data Science: Data-Driven Information Systems](#)  
[M-WIWI-105714 - Consumer Research](#)

| Type                        | Credits | Grading | Term offered     | Expansion   | Version |
|-----------------------------|---------|---------|------------------|-------------|---------|
| Examination of another type | 4,5 CP  | graded  | Each summer term | 1 semesters | 1       |

| Courses  |         |                                                        |       |         |              |
|----------|---------|--------------------------------------------------------|-------|---------|--------------|
| WT 25/26 | 2500025 | <a href="#">Bayesian Statistics for Analyzing Data</a> | 2 SWS | Seminar | Scheibehenne |
| Exams    |         |                                                        |       |         |              |
| WT 25/26 | 7900208 | <a href="#">Bayesian Statistics for Analyzing Data</a> |       |         | Scheibehenne |

**Assessment**

Alternative exam assessment (assignments and active participation). Details will be communicated at the first day of class.

**Additional Information**

Participation is limited to 10 participants. Registration is required for the course. If too many students register, students in higher semesters are selected first.

**Workload**

135 hours

*Below you will find excerpts from courses related to this module component:*

## V

**Bayesian Statistics for Analyzing Data**

2500025, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

**Seminar (S)**

**Content**

The goal of this class is to introduce Bayesian statistics as a viable alternative to conventional Null-Hypothesis significance testing (NHST) and the calculation of p-values. The class introduces the theoretical background of Bayesian statistics and its advantages over NHST. Based on this, students will work through hands-on approaches for analyzing various empirical data using Bayesian statistics. These analyses will mainly be conducted with the statistics software R and JASP. The class provides participants with the necessary skills to evaluate and interpret the results of published Bayesian analyses and to use the method for testing hypotheses and estimating model parameters based on empirical data. There will be regular reading and homework assignments.

**Workload:**

Attendance time (7 "double hours"): 45 h

Self-study: 90 h

Exam preparation: 0 h (performance assessment takes place during the semester)

**Total:** 135 h

**Organizational issues**

Beginn 29.10.25, 14:00 - 16:00 Uhr Seminarraum Geb. 01.87, R 5B 25

alle 2 Wochen mittwochs bis 21.2.26

## T

**6.45 Module component: Beating the Worst-Case in Practice: Unexpectedly Efficient Algorithms [T-INFO-114898]****Coordinators:** TT-Prof. Dr. Thomas Bläsius**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107599 - Beating the Worst-Case in Practice: Unexpectedly Efficient Algorithms](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 6 CP    | graded  | Irregular    | 1       |

| Courses  |         |                                                                                       |       |                                                                                                        |                  |
|----------|---------|---------------------------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------|------------------|
| WT 25/26 | 2400253 | <a href="#">Beating the Worst-Case in Practice: Unexpectedly Efficient Algorithms</a> | 4 SWS | Practical course /  | Bläsius, Wilhelm |
| Exams    |         |                                                                                       |       |                                                                                                        |                  |
| WT 25/26 | 7500368 | <a href="#">Beating the Worst-Case in Practice: Unexpectedly Efficient Algorithms</a> |       |                                                                                                        | Bläsius          |

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

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO). An implementation and a written elaboration must be prepared.

**Prerequisites**

None.

Below you will find excerpts from courses related to this module component:

|                                                                                     |                                                                                                                                                                   |                                               |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
|  | <b>Beating the Worst-Case in Practice: Unexpectedly Efficient Algorithms</b><br>2400253, WS 25/26, 4 SWS, Language: English, <a href="#">Open in study portal</a> | <b>Practical course (P)</b><br><b>On-Site</b> |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|

**Content****Content:**

The students

- can practically apply the knowledge acquired in the basic modules on algorithm engineering,
- are able to independently produce efficient implementations of algorithmic methods,
- master the methodology for the practical evaluation of algorithms, including the processing, analysis, and interpretation of measurement data,
- possess the ability to communicate the results they obtain.

In addition, participants are able to analyze how various typical properties of instances influence the efficiency of algorithms.

In this lab, students implement and evaluate a set of given algorithmic approaches on their own. The emphasis is on methods that, on real-world instances, perform far better than worst-case theory would suggest. We investigate this gap in performance using empirical methods throughout the course.

**Workload:**

Practical course with 4 SWS, 6 LP

6 LP corresponds to approx. 180 working hours, of which

approx. 20 hours attendance time,

approx. 130 hours implementation and evaluation,

approx. 30 hours elaboration and preparation of the presentation

**Competency certificate:**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO). An implementation and a written elaboration must be prepared.

## T

**6.46 Module component: Behavioral Dimensions of Energy Transitions [T-WIWI-114980]****Coordinators:** Prof. Dr. Wolf Fichtner**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-101451 - Energy Economics and Energy Markets](#)**Type**  
Written examination**Credits**  
3,5 CP**Grading**  
graded**Term offered**  
Each summer term**Version**  
1

| Exams    |         |                                                         |          |
|----------|---------|---------------------------------------------------------|----------|
| WT 25/26 | 7900280 | <a href="#">Social Dimensions of Energy Transitions</a> | Fichtner |

**Assessment**

Written examination (60 minutes). The examination is offered every semester and can be repeated at any regular examination date.

**Workload**

105 hours

## T

**6.47 Module component: Behavioral Lab Exercise [T-WIWI-113095]**

**Coordinators:** Prof. Dr. Petra Nieken  
Prof. Dr. Benjamin Scheibehenne

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

**Part of:** [M-WIWI-105714 - Consumer Research](#)  
[M-WIWI-105923 - Incentives, Interactivity & Decisions in Organizations](#)

| Type                        | Credits | Grading | Term offered | Expansion   | Version |
|-----------------------------|---------|---------|--------------|-------------|---------|
| Examination of another type | 4,5 CP  | graded  | Irregular    | 1 semesters | 1       |

| Courses  |         |                                         |         |                                                                                               |                      |
|----------|---------|-----------------------------------------|---------|-----------------------------------------------------------------------------------------------|----------------------|
| WT 25/26 | 2500040 | <a href="#">Behavioral Lab Exercise</a> | 4.5 SWS | Seminar /  | Scheibehenne, Nieken |
| Exams    |         |                                         |         |                                                                                               |                      |
| WT 25/26 | 7900368 | <a href="#">Behavioral Lab Exercise</a> |         |                                                                                               | Nieken, Scheibehenne |

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

**Assessment**

Alternative exam assessment (presentation during the semester). Details will be communicated at the first day of class.

**Recommendations**

This class caters towards Master students who are interested in empirical research and in running lab experiments.

**Additional Information**

Due to the interactive nature of the class, the number of participants is limited. If you are interested, please contact the teachers directly via email.

In this class, students learn the core principles of psychological and economic experiments. The course covers topics ranging from design principles, to best-practices, preregistration, and analysis of the experimental data. Students will actively participate in the course by covering one selected topic in a talk. All students will discuss the topics together with the professors to develop solid knowledge about experimental design and analysis plans. In a second step, all students will develop a draft of an experimental design and analysis plan for their own topic and present it to the class. The students will get detailed feedback, enabling them to improve their drafts for future research.

**Workload**

135 hours

Below you will find excerpts from courses related to this module component:

## V

**Behavioral Lab Exercise**

2500040, WS 25/26, 4.5 SWS, Language: English, [Open in study portal](#)

**Seminar (S)**  
On-Site

**Content**

In this class, students learn the core principles of psychological and economic experiments. The course covers topics ranging from design principles, to best-practices, preregistration, and analysis of the experimental data. Students will actively participate in the course by covering one selected topic in a talk. All students will discuss the topics together with the professors to develop solid knowledge about experimental design and analysis plans. In a second step, all students will develop a draft of an experimental design and analysis plan for their own topic and present it to the class. The students will get detailed feedback enabling them to improve their drafts for future research.

## T

**6.48 Module component: Bond Markets [T-WIWI-110995]**

**Coordinators:** Prof. Dr. Marliese Uhrig-Homburg  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101480 - Finance 3](#)  
[M-WIWI-101483 - Finance 2](#)

| Type                | Credits | Grading | Term offered     | Version |
|---------------------|---------|---------|------------------|---------|
| Written examination | 4,5 CP  | Graded  | Each winter term | 1       |

| Courses  |         |                              |       |                                                                                                         |                               |
|----------|---------|------------------------------|-------|---------------------------------------------------------------------------------------------------------|-------------------------------|
| WT 25/26 | 2530560 | <a href="#">Bond Markets</a> | 3 SWS | Lecture / Practice /  | Müller, Uhrig-Homburg, Molnar |
| Exams    |         |                              |       |                                                                                                         |                               |
| WT 25/26 | 7900311 | <a href="#">Bond Markets</a> |       |                                                                                                         | Uhrig-Homburg                 |
| ST 2026  | 7900280 | <a href="#">Bond Markets</a> |       |                                                                                                         | Uhrig-Homburg                 |

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

**Assessment**

The assessment consists of a written exam (75min.)

A bonus can be earned by correctly solving at least 50% of the posed bonus exercises. If the grade of the written examination is between 4.0 and 1.3, the bonus improves the grade by up to one level (0.3 or 0.4). The examination is offered in each semester and can be repeated at any regular examination date.

**Additional Information**

This course will be held in English.

**Workload**

135 hours

Below you will find excerpts from courses related to this module component:

|                                                                                     |                                                                                                          |                                                  |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|--------------------------------------------------|
|  | <b>Bond Markets</b><br>2530560, WS 25/26, 3 SWS, Language: English, <a href="#">Open in study portal</a> | <b>Lecture / Practice (VÜ)</b><br><b>On-Site</b> |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|--------------------------------------------------|

**Content**

The lecture "Bond Markets" deals with the national and international bond markets, which are an important source of financing for companies, as well as for the public sector. After an overview of the most important bond markets, different yield definitions are discussed. Based on this, the concept of the yield curve is presented. In addition, the theoretical and empirical relationships between ratings, default probabilities and spreads are analyzed. The focus will then be on questions regarding the valuation, measurement, management and control of credit risks.

The total workload for this course is approximately 135 hours (4.5 credits).

The assessment consists of a written exam (75min.) (according to §4(2), 1 SPO). A bonus can be earned by correctly solving at least 50% of the posed bonus exercises. If the grade of the written examination is between 4.0 and 1.3, the bonus improves the grade by up to one level (0.3 or 0.4). The examination is offered in each semester and can be repeated at any regular examination date.

Students deepen their knowledge of national and international bond markets. They gain knowledge of the traded instruments and their key figures for describing default risk such as ratings, default probabilities or credit spreads.

**Organizational issues**

Die Veranstaltung wird freitags in der ersten Semesterhälfte am Campus B (Geb. 09.21) im Raum 124 angeboten. Die Klausur findet bereits im Januar statt.

## T

## 6.49 Module component: Bond Markets - Models &amp; Derivatives [T-WIWI-110997]

**Coordinators:** Prof. Dr. Marliese Uhrig-Homburg  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101480 - Finance 3](#)  
[M-WIWI-101483 - Finance 2](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 3 CP    | Graded  | Each winter term | 1       |

| Courses  |         |                                                         |       |                                                                                             |                               |
|----------|---------|---------------------------------------------------------|-------|---------------------------------------------------------------------------------------------|-------------------------------|
| WT 25/26 | 2530565 | <a href="#">Bond Markets - Models &amp; Derivatives</a> | 2 SWS | Block /  | Grauer, Uhrig-Homburg, Müller |
| Exams    |         |                                                         |       |                                                                                             |                               |
| WT 25/26 | 7900318 | <a href="#">Bond Markets - Models &amp; Derivatives</a> |       |                                                                                             | Uhrig-Homburg                 |

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

**Assessment**

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.

**Recommendations**

Knowledge of "Bond Markets" and "Derivatives" courses is very helpful.

**Additional Information**

This course will be held in English.

**Workload**

90 hours

Below you will find excerpts from courses related to this module component:

## V

**Bond Markets - Models & Derivatives**

2530565, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

**Block (B)**  
**On-Site**

**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 mit Seminarcharakter und dem Ziel, ein selbstgewähltes Themenfeld in Form einer schriftlichen Ausarbeitung eigenständig zu erarbeiten, findet in der 2. Semesterhälfte statt.



## T

## 6.50 Module component: Bond Markets - Tools &amp; Applications [T-WIWI-110996]

**Coordinators:** Prof. Dr. Marliese Uhrig-Homburg  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101480 - Finance 3](#)  
[M-WIWI-101483 - Finance 2](#)

**Type**  
Examination of another type

**Credits**  
1,5 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
1

| Courses  |         |                                                         |       |                                                                                             |                               |
|----------|---------|---------------------------------------------------------|-------|---------------------------------------------------------------------------------------------|-------------------------------|
| WT 25/26 | 2530562 | <a href="#">Bond Markets - Tools &amp; Applications</a> | 1 SWS | Block /  | Uhrig-Homburg, Grauer, Müller |
| Exams    |         |                                                         |       |                                                                                             |                               |
| WT 25/26 | 7900317 | <a href="#">Bond Markets - Tools &amp; Applications</a> |       |                                                                                             | Uhrig-Homburg                 |

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

**Assessment**

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.

**Recommendations**

Knowledge of the "Bond Markets" course is very helpful.

**Additional Information**

This course will be held in English.

**Workload**

45 hours

Below you will find excerpts from courses related to this module component:

## V

**Bond Markets - Tools & Applications**

2530562, WS 25/26, 1 SWS, Language: English, [Open in study portal](#)

**Block (B)**  
**On-Site**

**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 und beinhaltet eine eigenständige Projektarbeit im Umgang mit realen Bond Daten. Die Erfolgskontrolle erfolgt anhand einer schriftlichen Ausarbeitung und einer kurzen Präsentation.

## T

**6.51 Module component: Business Data Strategy [T-WIWI-106187]****Coordinators:** Prof. Dr. Christof Weinhardt**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-103117 - Data Science: Data-Driven Information Systems](#)  
[M-WIWI-107530 - Information Systems: AI & Data Science](#)**Type**  
Written examination**Credits**  
4,5 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
1

| Courses  |         |                                                 |       |                                                                                                |                        |
|----------|---------|-------------------------------------------------|-------|------------------------------------------------------------------------------------------------|------------------------|
| WT 25/26 | 2540484 | <a href="#">Business Data Strategy</a>          | 2 SWS | Lecture /   | Weinhardt, van Dinther |
| WT 25/26 | 2540485 | <a href="#">Übung zu Business Data Strategy</a> | 1 SWS | Practice /  | Weinhardt, Schulz      |
| Exams    |         |                                                 |       |                                                                                                |                        |
| WT 25/26 | 7900234 | <a href="#">Business Data Strategy</a>          |       |                                                                                                | Weinhardt              |
| ST 2026  | 7900267 | <a href="#">Business data strategy</a>          |       |                                                                                                | Weinhardt              |

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

The assessment consists of a written exam (60 min.) according to § 4 paragraph 2 Nr. 1 of the examination regulation and an alternative exam assessment according to § 4 paragraph 2 Nr. 3 of the examination regulation. The grade is determined by 2/3 through the written exam and by 1/3 through the alternative exam assessment (e.g., presentation).

**Prerequisites**

None

**Recommendations**

Students should be familiar with basic concepts of business organisations, information systems, and programming. However, all material will be introduced, so no formal pre-conditions are applied.

**Additional Information**

Limited number of participants.

**Workload**

135 hours

Below you will find excerpts from courses related to this module component:

## V

**Business Data Strategy**2540484, WS 25/26, 2 SWS, Language: German/English, [Open in study portal](#)**Lecture (V)**  
On-Site**Content**

With new methods for capturing and using different types of data and industry's recognition that society's use of data is less than optimal, the need for comprehensive strategies is more important than ever before. Advances in cybersecurity and information sharing and the use of data in its raw form for decision making all add to the complexity of integrated processes, ownership, stewardship, and sharing. The life cycle of data in its entirety spans the infrastructure, system design, development, integration, and implementation of information-enabling solutions. This lecture focuses on teaching about these dynamics and tools to comprehend and manage them in organisation contexts. Given the increasing size and complexity of data, methods for the transformation and structured preparation are an important tool in the process of sense-making. Modern software solutions and programming languages provide frameworks for such tasks that form another part of this course ranging from conceptual systems modelling to data manipulation to automated generation of HTML reports and web-applications. Additionally, the disruptive factor of generative AI in the scope of data management is reflected upon.

**Organizational issues****Application/Registration**

Attendance will be limited. Application/registration is therefore preliminary. After the application deadline has passed, positions will be allocated, based on evaluation of the previous study records. Applications are accepted only through the Wiwi-Portal: <https://portal.wiwi.kit.edu/ys/8946>

**Anmeldung**

Die Teilnehmeranzahl ist begrenzt. Eine Anmeldung erfolgt deshalb zunächst unter Vorbehalt. Nach Ablauf der Anmeldefrist werden die Plätze zur Teilnahme, nach Einsicht der Vorleistungen im Studium vergeben. Die Anmeldung/Bewerbung erfolgt ausschließlich über das Wiwi-Portal: <https://portal.wiwi.kit.edu/ys/8946>

**Dates / Termine**

The lecture will be held as a block lecture, the dates and rooms will be published soon.

Die Vorlesung wird als Blockveranstaltung gehalten. Die Termine werden zeitnah bekanntgegeben.

## T

**6.52 Module component: Business Dynamics [T-WIWI-102762]**

**Coordinators:** Prof. Dr. Andreas Geyer-Schulz  
Dr Paul Glenn

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

**Part of:** [M-WIWI-101409 - Electronic Markets](#)  
[M-WIWI-105661 - Data Science: Intelligent, Adaptive, and Learning Information Services](#)

| Type                | Credits | Grading | Term offered     | Version |
|---------------------|---------|---------|------------------|---------|
| Written examination | 4,5 CP  | Graded  | Each winter term | 1       |

| Courses  |         |                                                              |              |                                                                                                |                     |
|----------|---------|--------------------------------------------------------------|--------------|------------------------------------------------------------------------------------------------|---------------------|
| WT 25/26 | 2540531 | <a href="#">Business Dynamics</a>                            | 2 SWS        | Lecture /   | Geyer-Schulz, Glenn |
| WT 25/26 | 2540532 | <a href="#">Exercise Business Dynamics</a>                   | 1 SWS        | Practice /  | Geyer-Schulz, Glenn |
| Exams    |         |                                                              |              |                                                                                                |                     |
| WT 25/26 | 7979777 | <a href="#">Business Dynamics (WS 2025/2026)</a>             | Geyer-Schulz |                                                                                                |                     |
| ST 2026  | 7900065 | <a href="#">Business Dynamics (Nachklausur WS 2025/2026)</a> | Geyer-Schulz |                                                                                                |                     |

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

**Assessment**

Written examination (60 minutes) according to §4(2), 1 SPO. The exam is considered passed if at least 50 out of a maximum of 100 possible points are achieved. The grades are graded in five steps (best grade 1.0 from 95 points). Details of the grade formation and scale will be announced in the course.

A bonus can be acquired through successful participation in the practice. If the grade of the written examination is between 4.0 and 1.3, the bonus improves the grade by one grade level (0.3 or 0.4). The exact criteria for awarding a bonus will be announced at the beginning of the course.

**Please note: this exam will no longer be offered after August 2026.**

**Prerequisites**

None

**Recommendations**

None

Below you will find excerpts from courses related to this module component:

## V

**Business Dynamics**

2540531, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)

Lecture (V)  
On-Site

**Organizational issues**

Termine:

Samstags von 9:00 - 19:00 Uhr

22.11.2025 => Termin 1

13.12.2025 => Termin 2

17.01.2026 => Termin 3 (dieser Termin wird auf den 24. Januar 2026 verschoben)

24.01.2026 => Termin 3

14.02.2026 => Termin 4

**Literature**

John D. Sterman. Business Dynamics: Systems Thinking and Modeling for a Complex World. McGraw-Hill, 2000.

## T

## 6.53 Module component: Business Intelligence Systems [T-WIWI-105777]

**Coordinators:** Prof. Dr. Alexander Mädche**Organisation:** KIT Department of Business and Economics

**Part of:** [M-WIWI-101506 - Service Analytics](#)  
[M-WIWI-101510 - Cross-Functional Management Accounting](#)  
[M-WIWI-103117 - Data Science: Data-Driven Information Systems](#)  
[M-WIWI-104068 - Information Systems in Organizations](#)  
[M-WIWI-107530 - Information Systems: AI & Data Science](#)

**Type**  
Examination of another type

**Credits**  
4,5 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
2

| Courses  |         |                                               |       |                                                                                               |        |
|----------|---------|-----------------------------------------------|-------|-----------------------------------------------------------------------------------------------|--------|
| WT 25/26 | 2540422 | <a href="#">Business Intelligence Systems</a> | 3 SWS | Lecture /  | Mädche |
| Exams    |         |                                               |       |                                                                                               |        |
| WT 25/26 | 7900224 | <a href="#">Business Intelligence Systems</a> |       |                                                                                               | Mädche |
| ST 2026  | 7900149 | <a href="#">Business Intelligence Systems</a> |       |                                                                                               | Mädche |

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

**Assessment**

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

**Recommendations**

Basic knowledge on database systems is helpful.

Below you will find excerpts from courses related to this module component:

## V

**Business Intelligence Systems**

2540422, WS 25/26, 3 SWS, Language: English, [Open in study portal](#)

**Lecture (V)**  
**Blended (On-Site/Online)**

### Content

In most modern enterprises, Business Intelligence & Analytics (BI&A) Systems represent a core enabler of decision-making in that they supply 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. This course aims to introduce theoretical foundations, concepts, tools, and current practice of BI&A Systems from a managerial and technical perspective.

The course is complemented by an engineering capstone project, where students work in a team with real-world use cases and data in order to create a prototypical Business Intelligence & Analytics system using state-of-the-art technologies (e.g., scikit-learn in Python or Microsoft Power BI).

### 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 50 places. The capacity limitation is due to the format of the accompanying engineering capstone project. Strong analytical abilities and profound skills in SQL and Python are required. Students have to apply with their CVs and transcripts of records via the WiWi-Portal. The first lecture will present all organizational details and the underlying registration process for the lecture and the capstone project. The teaching language is English.

Die Erfolgskontrolle erfolgt in Form einer Prüfungsleistung anderer Art (Form) nach § 4 Abs. 2 Nr. 3 SPO. Die Leistungskontrolle erfolgt in Form einer einstündigen Klausur und durch Durchführung eines Capstone Projektes. Details zur Ausgestaltung der Erfolgskontrolle werden im Rahmen der Vorlesung bekannt gegeben.

### Workload:

The total workload for this course is approximately 135 hours.

- Attendance Lecture (2 SWS × 15 weeks): 30 h
- Attendance Exercise (1 SWS × 15 weeks): 15 h
- Preparation and Wrap-up of the lecture: 45 h
- Preparation and Wrap-up of the exercise: 25 h
- Exam preparation: 20 h
- Total: 135 h (equivalent to 4.5 CP)

### Literature

- Turban, E., Aronson, J., Liang T.-P., Sharda, R. 2008. "Decision Support and Business Intelligence Systems".
- Watson, H. J. 2014. "Tutorial: Big Data Analytics: Concepts, Technologies, and Applications," Communications of the Association for Information Systems (34), p. 24.
- Arnott, D., and Pervan, G. 2014. "A critical analysis of decision support systems research revisited: The rise of design science," Journal of Information Technology (29:4), Nature Publishing Group, pp. 269–293 (doi: 10.1057/jit.2014.16 ).
- Carlo, V. (2009). "Business intelligence: data mining and optimization for decision making". Editorial John Wiley and Sons, 308-317.
- Chen, H., Chiang, R. H. L., and Storey, V. C. 2012. „Business Intelligence and Analytics: From Big Data to Big Impact," MIS Quarterly (36:4), pp. 1165-1188.
- Davenport, T. 2014. Big Data @ Work, Boston, MA: Harvard Business Review.
- Economist Intelligence Unit. 2015 "Big data evolution: Forging new corporate capabilities for the long term"
- Power, D. J. 2008. "Decision Support Systems: A Historical Overview," Handbook on Decision Support Systems, pp. 121–140 (doi: 10.1007/978-3-540-48713-5\_7 ).
- Sharma, R., Mithras, S., and Kankanhalli, A. 2014. „Transforming decision-making processes: a research agenda for understanding the impact of business analytics on organisations," European Journal of Information Systems (23:4), pp. 433-441.
- Silver, M. S. 1991. "Decisional Guidance for Computer-Based Decision Support," MIS Quarterly (15:1), pp. 105-122.

Further literature will be made available in the lecture.

**T****6.54 Module component: Business Planning for Founders [T-WIWI-115110]**

**Coordinators:** Prof. Dr. Orestis Terzidis  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101488 - Entrepreneurship \(EnTechnon\)](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 3 CP    | graded  | Irregular    | 1       |

**Assessment**

Alternative exam assessment.

**Prerequisites**

None

**Recommendations**

None

## T

**6.55 Module component: Case Studies Seminar: Innovation Management [T-WIWI-102852]**

**Coordinators:** Prof. Dr. Marion Weissenberger-Eibl  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101488 - Entrepreneurship \(EnTechnon\)](#)  
[M-WIWI-101507 - Innovation Management](#)  
[M-WIWI-101507 - Innovation Management](#)

**Type**  
Examination of another type

**Credits**  
3 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
1

| Courses  |         |                                                             |       |                                                                                               |                    |
|----------|---------|-------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|--------------------|
| WT 25/26 | 2545105 | <a href="#">Case studies seminar: Innovation management</a> | 2 SWS | Seminar /  | Weissenberger-Eibl |
| Exams    |         |                                                             |       |                                                                                               |                    |
| WT 25/26 | 7900237 | <a href="#">Case Studies Seminar: Innovation Management</a> |       |                                                                                               | Weissenberger-Eibl |

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

**Assessment**

Alternative exam assessments (\$4(2), 3 SPO).

The grade is made up of 50% of the grade for the written paper \* and 50% of the grade for the presentation.

\* Scope according to the current requirements for recognition in the seminar module

**Prerequisites**

None

**Recommendations**

Prior attendance of the course Innovation Management is recommended.

**Workload**

90 hours

Below you will find excerpts from courses related to this module component:

## V

**Case studies seminar: Innovation management**

2545105, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)

**Seminar (S)**  
On-Site

**Content**

The objective of the seminar is to acquire selected concepts and methods of innovation management and to apply these in a practical way. The focus is on working on specific issues using a case study from business practice. Students work in groups and transfer the content taught, for example from the areas of scenario development, to entrepreneurial challenges in the context of fictitious case studies. The course follows a didactic interplay of theoretical input and direct application of what has been learned. At the end, the groups present their results in a plenary presentation, which is prepared by a short introduction to presentation techniques. The joint discussion promotes the transfer of knowledge to different contexts and strengthens the participants' ability to reflect.

As part of the seminar, students deal independently with current, research-oriented issues and systematically apply scientific criteria. They research relevant information, analyze, abstract and critically evaluate it. They draw conclusions independently from poorly structured data, incorporate interdisciplinary knowledge and contribute selectively to the further development of existing research perspectives. The results are validated and systematically prepared both orally and in writing using scientific standards - particularly with regard to structuring, terminology and correct citation of sources. In doing so, students argue in a technically sound manner and defend their findings in discourse with other participants and lecturers. They are also familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and apply these standards consistently in the preparation of their scientific work.

**Literature**

Werden in der ersten Veranstaltung bekannt gegeben.



## T

**6.56 Module component: Circular Economy – Challenges and Potentials [T-WIWI-114057]**

**Coordinators:** Prof. Dr. Frank Schultmann  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101412 - Industrial Production III](#)  
[M-WIWI-101471 - Industrial Production II](#)

| Type                | Credits | Grading        | Term offered     | Version |
|---------------------|---------|----------------|------------------|---------|
| Written examination | 3,5 CP  | Grading graded | Each summer term | 1       |

| Courses  |         |                                                              |       |                                                                                               |                  |
|----------|---------|--------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|------------------|
| ST 2026  | 2581965 | <a href="#">Circular Economy - Challenges and Potentials</a> | 2 SWS | Lecture /  | Schultmann, Rudi |
| Exams    |         |                                                              |       |                                                                                               |                  |
| WT 25/26 | 7981965 | <a href="#">Circular Economy – Challenges and Potentials</a> |       |                                                                                               | Schultmann       |
| ST 2026  | 7981965 | <a href="#">Circular Economy – Challenges and Potentials</a> |       |                                                                                               | Schultmann       |

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

**Assessment**

The assessment consists of an oral (30 minutes) or 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.

**Workload**

105 hours

*Below you will find excerpts from courses related to this module component:*

## V

**Circular Economy - Challenges and Potentials**

2581965, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

**Lecture (V)**  
On-Site

**Content**

Circular Economy (CE) is an economic system that on the one hand aims to minimize waste, emissions and resource consumption and on the other hand increase resource efficiency by keeping products and materials in use for as long as possible. Based on basic ideas and principles of CE this lecture tackles potentials and challenges for the design and operations of circular value chains and systems. Different research-orientied case studies reveal and illustrate the potential implementation as well as the limits and future needs of CE as a key element of sustainable industrial development.

**Literature**

Wird in der Lehrveranstaltung bekannt gegeben.

## T

**6.57 Module component: Coding Theory [T-INFO-113693]**

**Coordinators:** Prof. Dr. Jörn Müller-Quade  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-106824 - Coding Theory](#)

**Type**  
Written examination

**Credits**  
3 CP

**Grading**  
graded

**Term offered**  
Irregular

**Version**  
1

| Courses  |         |                               |       |         |                            |
|----------|---------|-------------------------------|-------|---------|----------------------------|
| WT 25/26 | 2400152 | <a href="#">Coding Theory</a> | 2 SWS | Lecture | Müller-Quade, Benz, Hetzel |
| Exams    |         |                               |       |         |                            |
| WT 25/26 | 7500090 | <a href="#">Coding Theory</a> |       |         | Müller-Quade               |
| ST 2026  | 7500382 | <a href="#">Coding Theory</a> |       |         | Müller-Quade               |

**Assessment**

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 120 minutes.

Depending on the number of participants, it will be announced six weeks before the examination (Section 6 (3) SPO) whether the assessment will take the form of an oral examination of approx.

- in the form of an oral examination of approx. 30 minutes in accordance with § 4 Para. 2 No. 2 SPO or
  - in the form of a written examination in accordance with § 4 Para. 2 No. 1 SPO
- takes place.

**Prerequisites**

None.

**Recommendations**

None.

*Below you will find excerpts from courses related to this module component:*

## V

**Coding Theory**

2400152, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)

**Lecture (V)**

**Content**

This lecture mainly deals with channel coding. It examines how signals can be protected against random noise affecting the transmission channel. Bounds of codes (Hamming, Gilbert-Varshamov, Singleton) are presented. In addition to the coding and decoding of classical algebraic codes (linear, Reed Solomon, Goppa and Reed Muller codes), concatenated codes and sums of codes are also covered. In addition, a connection to cryptography, in particular the McEliece encryption method, is established.

**T****6.58 Module component: Collective Intelligence in Human Judgment and Decision Making [T-WIWI-114186]**

**Coordinators:** Prof. Dr. Benjamin Scheibehenne  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-105714 - Consumer Research](#)

| Type                        | Credits | Grading | Term offered     | Expansion   | Version |
|-----------------------------|---------|---------|------------------|-------------|---------|
| Examination of another type | 4,5 CP  | graded  | Each summer term | 1 semesters | 1       |

| Courses |         |                                                                               |       |                                                                                               |          |
|---------|---------|-------------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|----------|
| ST 2026 | 2500026 | <a href="#">Collective Intelligence in Human Judgment and Decision Making</a> | 2 SWS | Lecture /  | Gradwohl |

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

**Assessment**

The overall grade is derived from a weighted score of several assessment components (active participation, presentations, and written assignments). Details regarding the scoring system and the evaluation criteria will be announced at the start of the course.

**Prerequisites**

None

**Recommendations**

Willingness to engage with experimental research papers and basic mathematical models is required.

**Additional Information**

This course covers the key ideas of collective intelligence, asking when it emerges and when it fails. Students will engage with classical and contemporary research papers about how we can combine information from different individuals. They learn to understand and discuss under which conditions combining judgments and decisions of multiple individuals produces collective intelligence and when it creates the risk to run into collective madness and herding.

After the course students can define and describe important concepts of collective intelligence and can name and describe models, theories and experimental paradigms that are used to investigate it. They will practice their ability to read and understand research papers and to critically evaluate the claims in empirical and theoretical research papers.

Moreover, they can apply the concepts and ideas of collective intelligence to examples related to consumer behavior, management and their everyday lives.

All lectures, materials, and assignments will be in English.

The number of participants is limited. The registration will take place via the WiWi portal.

**Workload**

135 hours

*Below you will find excerpts from courses related to this module component:*

**V****Collective Intelligence in Human Judgment and Decision Making**

2500026, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
On-Site

**Content**

This course covers the key ideas of collective intelligence, asking when it emerges and when it fails. Students will engage with classical and contemporary research papers about how we can combine information from different individuals. They learn to understand and discuss under which conditions combining judgments and decisions of multiple individuals produces collective intelligence and when it creates the risk to run into collective madness and herding.

After the course students can define and describe important concepts of collective intelligence and can name and describe models, theories and experimental paradigms that are used to investigate it. They will practice their ability to read and understand research papers and to critically evaluate the claims in empirical and theoretical research papers.

Moreover, they can apply the concepts and ideas of collective intelligence to examples related to consumer behavior, management and their everyday lives. All lectures, materials, and assignments will be in English.

A strong interest in human judgment and decision making, willingness to engage with scientific literature and empirical methods, as well as openness to engage with mathematical models are important prerequisites.

All lectures, materials, and assignments are in English. The number of participants is limited. The registration will take place via the Campus portal.

Grades will be determined based on different parts, including active participation and written assignments. Details will be discussed at the beginning of the course.

**Organizational issues**

Participation is limited to 15 participants. Registration via the WiWi portal is required for the course. If too many students register, students in higher semesters are selected first.

**Literature**

Kameda, T., Toyokawa, W., & Tindale, R. S. (2022). Information aggregation and collective intelligence beyond the wisdom of crowds. *Nature Reviews Psychology*, 1(6), 345-357.

## T

**6.59 Module component: Collective Perception in Autonomous Driving [T-WIWI-113363]****Coordinators:** Prof. Dr. Alexey Vinel**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-106631 - Cooperative Autonomous Vehicles](#)**Type**  
Written examination**Credits**  
4,5 CP**Grading**  
graded**Term offered**  
Each summer term**Version**  
1

| Courses  |                  |                                                                                             |       |                                                                                                |                                                     |
|----------|------------------|---------------------------------------------------------------------------------------------|-------|------------------------------------------------------------------------------------------------|-----------------------------------------------------|
| ST 2026  | 2511456          | <a href="#">Collective Perception in Autonomous Driving</a>                                 | 2 SWS | Lecture /   | Zhao, Bied, Vinel                                   |
| ST 2026  | 2511457          | <a href="#">Exercise Collective Perception in Autonomous Driving</a>                        | 1 SWS | Practice /  | Flores Comeca, Arockiasamy, Bied, Zhao, Khoshkdahan |
| Exams    |                  |                                                                                             |       |                                                                                                |                                                     |
| WT 25/26 | 79AIFB_CPAD_B3   | <a href="#">Collective Perception in Autonomous Driving</a>                                 | Vinel |                                                                                                |                                                     |
| ST 2026  | 791-AIFB-CPAD-HK | <a href="#">Collective Perception in Autonomous Driving (Registration until 20.07.2026)</a> | Vinel |                                                                                                |                                                     |

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

The default assessment of this course is a written examination (60 min).

The exam takes place every semester and can be repeated at every regular examination date.

**Prerequisites**

None.

**Workload**

135 hours

## T

**6.60 Module component: Competition in Networks [T-WIWI-100005]****Coordinators:** Prof. Dr. Kay Mitusch**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-101406 - Network Economics](#)**Type**  
Written examination**Credits**  
4,5 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
3

| Courses  |         |                                               |         |                                                                                                |                |
|----------|---------|-----------------------------------------------|---------|------------------------------------------------------------------------------------------------|----------------|
| WT 25/26 | 2561204 | <a href="#">Competition in Networks</a>       | 2 SWS   | Lecture /   | Mitusch        |
| WT 25/26 | 2561205 | <a href="#">Übung zu Wettbewerb in Netzen</a> | 1 SWS   | Practice /  | Mitusch, Corbo |
| Exams    |         |                                               |         |                                                                                                |                |
| WT 25/26 | 7900221 | <a href="#">Competition in Networks</a>       | Mitusch |                                                                                                |                |

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

Result of success is made by a 60 minutes written examination during the semester break (according to §4(2), 1 ERSC). Examination is offered every semester and can be retried at any regular examination date.

**Prerequisites**

None.

**Recommendations**

Basics of microeconomics obtained within the undergraduate programme (B.Sc) of economics are required.

**Workload**

135 hours

Below you will find excerpts from courses related to this module component:

## V

**Competition in Networks**2561204, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)**Lecture (V)**  
**Blended (On-Site/Online)****Content**

Network or infrastructure industries like telecommunication, transport, and utilities form the backbone of modern economies. The lecture provides an overview of the economic characteristics of network industries. The planning of networks is complicated by the multitude of aspects involved (like spatial differentiation and the like). The interactions of different companies - competition or cooperation or both - are characterized by complex interdependencies within the networks: network effects, economies of scale, effects of vertical integration, switching costs, standardization, compatibility etc. appear increasingly in these sectors and even tend to appear in combination. Additionally, government interventions can often be observed, partly driven by the aims of competition policy and partly driven by the aims industrial policy. All these issues are brought up, analyzed formally (in part) and illustrated by several examples in the lecture

**Literature**

Literatur und Skripte werden in der Veranstaltung angegeben.

## T

**6.61 Module component: Compiler Design [T-INFO-113925]**

**Coordinators:** Prof. Dr. André Platzer  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-106966 - Compiler Design](#)

| Type                | Credits | Grading | Term offered | Version |
|---------------------|---------|---------|--------------|---------|
| Written examination | 9 CP    | graded  | Irregular    | 2       |

**Assessment**

The assessment is usually carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 120 minutes.

Depending on the number of participants, it will be announced six weeks before the examination (Section 6 (3) SPO) whether the assessment will take the form of an oral examination of approx.

- in the form of an oral examination of approx. 30 minutes in accordance with § 4 Para. 2 No. 2 SPO or

- in the form of a written examination in accordance with § 4 Para. 2 No. 1 SPO

takes place.

*In order to receive a bonus, you must earn at least 50% of the points for solving the exercises. 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.

**Recommendations**

Students are expected to have significant experience in a high-level programming language. Students are also expected to follow the lecture notes.

## T

**6.62 Module component: Computational Complexity Theory, with a View Towards Cryptography [T-INFO-103014]**

**Coordinators:** Prof. Dr. Dennis Hofheinz  
Prof. Dr. Jörn Müller-Quade

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-101575 - Computational Complexity Theory, with a View Towards Cryptography](#)

**Type**  
Oral examination

**Credits**  
6 CP

**Grading**  
graded

**Term offered**  
Irregular

**Version**  
1

| Courses |         |                                                                                   |       |         |                            |
|---------|---------|-----------------------------------------------------------------------------------|-------|---------|----------------------------|
| ST 2026 | 2400124 | <a href="#">Computational Complexity Theory, with a View Towards Cryptography</a> | 4 SWS | Lecture | Müller-Quade, Benz, Berger |
| Exams   |         |                                                                                   |       |         |                            |
| ST 2026 | 7500183 | <a href="#">Computational Complexity Theory, with a View Towards Cryptography</a> |       |         | Müller-Quade               |

Below you will find excerpts from courses related to this module component:

## V

**Computational Complexity Theory, with a View Towards Cryptography**

2400124, SS 2026, 4 SWS, Language: German, [Open in study portal](#)

Lecture (V)



## T

**6.63 Module component: Computational Geometry [T-INFO-114251]****Coordinators:** TT-Prof. Dr. Thomas Bläsius**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107228 - Computational Geometry](#)**Type**  
Oral examination**Credits**  
6 CP**Grading**  
graded**Term offered**  
Irregular**Version**  
1

| Exams    |         |                                        |         |
|----------|---------|----------------------------------------|---------|
| WT 25/26 | 7500210 | <a href="#">Computational Geometry</a> | Bläsius |

**Assessment**

The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting 20 minutes.

PLUS: The assessment is carried out in form of course work (German Studienleistung, § 4 Abs. 3 SPO). A total of two repetitions are possible.

**Prerequisites**

None.

**Recommendations**

Basic knowledge of algorithms and data structures (e.g., from the courses Algorithms 1 + 2) is expected.

## T

**6.64 Module component: Computational Geometry - Pass [T-INFO-114252]****Coordinators:** TT-Prof. Dr. Thomas Bläsius**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107228 - Computational Geometry](#)**Type**  
Coursework**Credits**  
0 CP**Grading**  
pass/fail**Term offered**  
Irregular**Version**  
1

| Exams    |         |                                               |         |
|----------|---------|-----------------------------------------------|---------|
| WT 25/26 | 7500213 | <a href="#">Computational Geometry - Pass</a> | Bläsius |

**Assessment**

The assessment is carried out in form of course work (German Studienleistung, § 4 Abs. 3 SPO). A total of two repetitions are possible.

**Prerequisites**

None.

**Recommendations**

Basic knowledge of algorithms and data structures (e.g., from the courses Algorithms 1 + 2) is expected.

## T

**6.65 Module component: Computational Imaging [T-INFO-112573]**

**Coordinators:** Dr.-Ing. Johannes Meyer  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-106190 - Computational Imaging](#)

| Type                | Credits | Grading | Term offered     | Version |
|---------------------|---------|---------|------------------|---------|
| Written examination | 5 CP    | Graded  | Each winter term | 1       |

| Courses  |         |                                       |       |                                                                                                         |                |
|----------|---------|---------------------------------------|-------|---------------------------------------------------------------------------------------------------------|----------------|
| WT 25/26 | 2400173 | <a href="#">Computational Imaging</a> | 3 SWS | Lecture / Practice /  | Meyer, Beyerer |
| Exams    |         |                                       |       |                                                                                                         |                |
| WT 25/26 | 7500276 | <a href="#">Computational Imaging</a> |       |                                                                                                         | Beyerer        |
| ST 2026  | 7500351 | <a href="#">Computational Imaging</a> |       |                                                                                                         | Beyerer        |

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

**Assessment**

The assessment takes the form of a written examination, usually lasting 60 minutes in accordance with Section 4 (2) No. 1 SPO.

Depending on the number of participants, it will be announced six weeks before the examination (Section 6 (3) SPO) whether the assessment will take place

- in the form of an oral examination in accordance with Section 4 (2) No. 2 SPO or
- in the form of a written examination in accordance with Section 4 (2) No. 1 SPO.

**Prerequisites**

None.

Below you will find excerpts from courses related to this module component:

|                                                                                     |                                                                                                                   |                                    |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|------------------------------------|
|  | <b>Computational Imaging</b><br>2400173, WS 25/26, 3 SWS, Language: English, <a href="#">Open in study portal</a> | Lecture / Practice (VÜ)<br>On-Site |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|------------------------------------|

**Content**

Digital image acquisition and processing have revolutionized various fields of applications, e.g., medical imaging or automated visual inspection. Yet, the design of most such systems is still based on the separate and individual optimization of the employed illumination, image acquisition and image processing components. By following a holistic approach for system design, modelling and optimization, computational imaging methods yield superior performance with respect to the state of the art. After introducing the students into relevant basics of optics and signal theory, the lecture will thoroughly cover various topics of computational imaging. Accompanying practical exercises will complement the theoretical part of the lecture. The course will enable students to adequately model artificial vision problems in the sense of computational imaging in order to obtain holistically optimal solutions.

**Organizational issues**

Informationen zur Vorlesung werden über die Homepage <https://computational-imaging.de> bekannt gegeben

## T

**6.66 Module component: Computational Modelling of Judgments, Decisions and Cognition [T-WIWI-114185]**

**Coordinators:** Prof. Dr. Benjamin Scheibehenne  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-105714 - Consumer Research](#)

| Type                        | Credits | Grading        | Term offered     | Expansion   | Version |
|-----------------------------|---------|----------------|------------------|-------------|---------|
| Examination of another type | 4,5 CP  | Grading graded | Each summer term | 1 semesters | 1       |

| Courses |         |                                                                               |       |                                                                                              |          |
|---------|---------|-------------------------------------------------------------------------------|-------|----------------------------------------------------------------------------------------------|----------|
| ST 2026 | 2500119 | <a href="#">Computational Modelling of Judgments, Decisions and Cognition</a> | 2 SWS | Others /  | Gradwohl |

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

**Assessment**

The alternative exam assessment is a single examination of another type that combines four assignments performed during the semester. All four assignments are integrated into one overall assessment; their individual contributions are weighted equally (each  $\approx 25\%$  of the total), but only one final grade is awarded for the whole examination.

**Recommendations**

Basic programming skills (first experience with R or Python is advantageous), willingness to engage with maths and mathematical notation, calculus, and probability theory are required.

**Additional Information**

This course enables students to develop a basic understanding of computational models in the study of human judgment, decision making and cognition. After this course students can describe why we use computational models of cognition and behavior, they will be able to list prominent models and some of their criticisms and weaknesses. Moreover, they will be capable of programming and understanding simple and more advanced computational models in mathematical notation and code. After covering the main ideas of using computational models and preparing technical prerequisites, we will learn how to interpret models with tools like simulations and how to fit models to data.

All lectures, materials, and assignments are in English. The number of participants is limited. The registration will take place via the WiWi portal.

**Workload**

135 hours

Below you will find excerpts from courses related to this module component:

## V

**Computational Modelling of Judgments, Decisions and Cognition**

2500119, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

Others (sonst.)  
On-Site

**Content**

This course enables students to develop a basic understanding of computational models in the study of human judgment, decision making and cognition. After this course students can describe why we use computational models of cognition and behavior, they will be able to list prominent models and some of their criticisms and weaknesses. Moreover, they will be capable of programming and understanding simple and more advanced computational models in mathematical notation and code.

After covering the main ideas of using computational models and preparing technical prerequisites, we will learn how to interpret models with tools like simulations and how to fit models to data.

Grades will be determined based on 4 programming assignments during the semester.

All lectures, materials, and assignments are in English. The number of participants is limited. The registration will take place via the WiWi portal.

**Organizational issues**

Participation is limited to 8 participants. Registration via the WiWi portal is required for the course. If too many students register, students in higher semesters are selected first.

## T

**6.67 Module component: Computational Risk and Asset Management [T-WIWI-102878]**

**Coordinators:** Prof. Dr. Maxim Ulrich  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-105032 - Data Science for Finance](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 4,5 CP  | graded  | Irregular    | 5       |

**Assessment**

The module examination takes the form of an alternative exam assessment.

The alternative exam assessment consists of a Python-based "Takehome Exam". At the end of the third week of January, the student is given a "Takehome Exam" which he processes and sends back independently within 4 hours using Python. Precise instructions will be announced at the beginning of the course. The alternative exam assessment can be repeated a maximum of once. A timely repeat option takes place at the end of the third week in March of the same year. More detailed instructions will be given at the beginning of the course.

**Prerequisites**

None.

**Recommendations**

Basic knowledge of capital markt theory.

**Workload**

135 hours

T

6.68 Module component: Computer Architecture [T-INFO-101355]

Coordinators: Prof. Dr. Wolfgang Karl

Organisation: KIT Department of Informatics

Part of: [M-INFO-100818 - Computer Architecture](#)

| Type                | Credits | Grading | Term offered     | Version |
|---------------------|---------|---------|------------------|---------|
| Written examination | 6 CP    | Graded  | Each summer term | 1       |

| Courses  |         |                                       |       |                                                                                               |      |
|----------|---------|---------------------------------------|-------|-----------------------------------------------------------------------------------------------|------|
| ST 2026  | 2424570 | <a href="#">Computer Architecture</a> | 3 SWS | Lecture /  | Karl |
| Exams    |         |                                       |       |                                                                                               |      |
| WT 25/26 | 7500034 | <a href="#">Computer Architecture</a> |       |                                                                                               | Karl |

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

## T

**6.69 Module component: Computer Contract Law [T-INFO-102036]**

**Coordinators:** Dr. Michael Menk  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-101216 - Private Business Law](#)

**Type**  
Written examination

**Credits**  
3 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
2

| Courses  |         |                                       |       |                                                                                               |         |
|----------|---------|---------------------------------------|-------|-----------------------------------------------------------------------------------------------|---------|
| WT 25/26 | 2411604 | <a href="#">Computer Contract Law</a> | 2 SWS | Lecture /  | Menk    |
| Exams    |         |                                       |       |                                                                                               |         |
| WT 25/26 | 7500065 | <a href="#">Computer Contract Law</a> |       |                                                                                               | Matz    |
| ST 2026  | 7500066 | <a href="#">Computer Contract Law</a> |       |                                                                                               | Sattler |

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

Below you will find excerpts from courses related to this module component:

## V

**Computer Contract Law**

2411604, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)

**Lecture (V)**  
On-Site

**Content**

The course deals with contracts from the following areas:

- Contracts of programming, licencing and maintaining software
- Contracts in the field of IT employment law
- IT projects and IT Outsourcing
- Internet Contracts

From these areas single contracts will be chosen and discussed (e.g. software maintenance, employment contract with a software engineer). Concerning the respective contract the technical features, the economic background and the subsumption in the national law of obligation (BGB-Schuldrecht) will be discussed. As a result different contractual clauses will be developed by the students. Afterwards typical contracts and conditions will be analysed with regard to their legitimacy as standard business terms (AGB). It is the aim to show the effects of the german law of standard business terms (AGB-Recht) and to point out that contracts are a means of drafting business concepts and market appearance.

It is the aim of this course to provide students with knowledge in the area of contract formation and formulation in practice that builds upon the knowledge the students have already acquired concerning the legal protection of computer programs. Students shall understand how the legal rules depend upon, and interact with, the economic background and the technical features of the subject. The contract drafts shall be prepared by the students and will be corporately completed during the lecture. It is the aim of the course that students will be able to formulate contracts by themselves.

**Literature**

- Langenfeld, Gerrit Vertragsgestaltung Verlag C.H.Beck, III. Aufl. 2004
- Heussen, Benno Handbuch Vertragsverhandlung und Vertragsmanagement Verlag C.H.Beck, II. Aufl. 2002
- Schneider, Jochen Handbuch des EDV-Rechts Verlag Dr. Otto Schmidt KG, III. Aufl. 2002

**Weiterführende Literatur**

Ergänzende Literatur wird in den Vorlesungsfolien angegeben.

## T

## 6.70 Module component: Computer Graphics [T-INFO-101393]

**Coordinators:** Prof. Dr.-Ing. Carsten Dachsbacher

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-100856 - Computer Graphics](#)

**Type**  
Written examination

**Credits**  
6 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
1

| Courses  |         |                                   |       |                                                                                               |                     |
|----------|---------|-----------------------------------|-------|-----------------------------------------------------------------------------------------------|---------------------|
| WT 25/26 | 2424081 | <a href="#">Computergraphics</a>  | 4 SWS | Lecture /  | Grauer, Dachsbacher |
| Exams    |         |                                   |       |                                                                                               |                     |
| WT 25/26 | 7500430 | <a href="#">Computer Graphics</a> |       |                                                                                               | Dachsbacher         |

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

### Assessment

Success is assessed in the form of a written examination lasting 90 minutes in accordance with Section 4 (2) No. 1 SPO.

A grade bonus for first attempt examinations can be obtained by successfully completing 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. This bonus is only valid within one year for an examination in the same semester or in the following semester. After that, the grade bonus expires.



## T

**6.71 Module component: Computer Graphics 2 [T-INFO-113441]**

**Coordinators:** Prof. Dr.-Ing. Carsten Dachsbacher  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-106685 - Computer Graphics 2](#)

**Type**  
Oral examination

**Credits**  
5 CP

**Grading**  
graded

**Version**  
2

| Courses  |         |                                     |       |                                                                                               |                            |
|----------|---------|-------------------------------------|-------|-----------------------------------------------------------------------------------------------|----------------------------|
| ST 2026  | 2400111 | <a href="#">Computer Graphics 2</a> | 2 SWS | Lecture /  | Schudeiske,<br>Dachsbacher |
| Exams    |         |                                     |       |                                                                                               |                            |
| WT 25/26 | 7500237 | <a href="#">Computer Graphics 2</a> |       |                                                                                               | Dachsbacher                |

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

## T

**6.72 Module component: Constructive Logic [T-INFO-112704]**

**Coordinators:** Prof. Dr. André Platzer  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-106256 - Constructive Logic](#)

| Type                |
|---------------------|
| Written examination |

| Credits |
|---------|
| 5 CP    |

| Grading |
|---------|
| graded  |

| Term offered     |
|------------------|
| Each summer term |

| Version |
|---------|
| 1       |

**Assessment**

The assessment is usually carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 120 minutes.

Depending on the number of participants, it will be announced six weeks before the examination (Section 6 (3) SPO) whether the assessment will take the form of an oral examination of approx.

- in the form of an oral examination of approx. 30 minutes in accordance with § 4 Para. 2 No. 2 SPO or

- in the form of a written examination in accordance with § 4 Para. 2 No. 1 SPO

takes place.

**Prerequisites**

None.

**Recommendations**

You will be expected to follow the lecture notes.

## T

**6.73 Module component: Context Sensitive Systems [T-INFO-107499]****Coordinators:** Prof. Dr.-Ing. Michael Beigl**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-100728 - Context Sensitive Systems](#)  
[M-WIWI-107531 - Information Systems: Interactive Systems](#)**Type**  
Oral examination**Credits**  
5 CP**Grading**  
graded**Term offered**  
Each summer term**Version**  
1

| Courses  |                    |                                                      |       |            |        |
|----------|--------------------|------------------------------------------------------|-------|------------|--------|
| ST 2026  | 2400099            | <a href="#">Context Sensitive Systems</a>            | 1 SWS | Practice / | Beigl  |
| ST 2026  | 24658              | <a href="#">Context Sensitive Systems</a>            | 2 SWS | Lecture /  | Riedel |
| Exams    |                    |                                                      |       |            |        |
| WT 25/26 | 7500229_18.11.2025 | <a href="#">Context Sensitive Systems</a>            |       |            | Beigl  |
| WT 25/26 | 7500365_21.10.2025 | <a href="#">Context Sensitive Systems</a>            |       |            | Beigl  |
| WT 25/26 | 7500375_22.01.2026 | <a href="#">Context Sensitive Systems</a>            |       |            | Riedel |
| WT 25/26 | 7500375_26.03.2026 | <a href="#">Context Sensitive Systems</a>            |       |            | Riedel |
| ST 2026  | 7500013_2026.07.27 | <a href="#">Context Sensitive Systems_27.07.2026</a> |       |            | Riedel |

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

## T

**6.74 Module component: Convex Analysis [T-WIWI-102856]**

**Coordinators:** Prof. Dr. Oliver Stein  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101473 - Mathematical Programming](#)

| Type                | Credits | Grading | Term offered | Version |
|---------------------|---------|---------|--------------|---------|
| Written examination | 4,5 CP  | graded  | Irregular    | 1       |

**Assessment**

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

**Recommendations**

It is strongly recommended to visit at least one lecture from the Bachelor program of this chair before attending this course.

**Additional Information**

The lecture is offered irregularly. The curriculum of the next three years is available online ([www.ior.kit.edu](http://www.ior.kit.edu)).

## T

**6.75 Module component: Cooperative Autonomous Vehicles [T-WIWI-112690]****Coordinators:** Prof. Dr. Alexey Vinel**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-106631 - Cooperative Autonomous Vehicles](#)**Type**  
Written examination**Credits**  
4,5 CP**Grading**  
graded**Term offered**  
Each summer term**Version**  
1

| Courses  |                 |                                                                                          |       |                                                                                                |       |
|----------|-----------------|------------------------------------------------------------------------------------------|-------|------------------------------------------------------------------------------------------------|-------|
| ST 2026  | 2511450         | <a href="#">Cooperative Autonomous Vehicles</a>                                          | 2 SWS | Lecture /   | Vinel |
| ST 2026  | 2511451         | <a href="#">Exercise Cooperative Autonomous Vehicles</a>                                 | 1 SWS | Practice /  | Vinel |
| Exams    |                 |                                                                                          |       |                                                                                                |       |
| WT 25/26 | 79AIFB_CAV_A3   | <a href="#">Cooperative Autonomous Vehicles (Registration extended until 16.02.2026)</a> |       |                                                                                                | Vinel |
| ST 2026  | 791-AIFB-CAV-HK | <a href="#">Cooperative Autonomous Vehicles (Registration until 20.07.2026)</a>          |       |                                                                                                | Vinel |

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

The default assessment of this course is a written examination (60 min).

The exam takes place every semester and can be repeated at every regular examination date.

**Prerequisites**

None.

**Workload**

135 hours

## T

## 6.76 Module component: Copyright [T-INFO-101308]

**Coordinators:** N.N.

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-101215 - Intellectual Property Law](#)

**Type**  
Written examination

**Credits**  
3 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
1

| Courses  |         |                           |       |                                                                                               |          |
|----------|---------|---------------------------|-------|-----------------------------------------------------------------------------------------------|----------|
| WT 25/26 | 24121   | <a href="#">Copyright</a> | 2 SWS | Lecture /  | Hartmann |
| Exams    |         |                           |       |                                                                                               |          |
| WT 25/26 | 7500064 | <a href="#">Copyright</a> |       |                                                                                               | Matz     |
| ST 2026  | 7500064 | <a href="#">Copyright</a> |       |                                                                                               | Sattler  |

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

### Assessment

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 60 minutes.

### Prerequisites

None.

### Recommendations

None.

**T****6.77 Module component: Corporate Compliance [T-INFO-101288]****Coordinators:** Andreas Herzig**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-101216 - Private Business Law](#)**Type**  
Written examination**Credits**  
3 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
1

| Courses  |         |                                      |         |                                                                                               |                |
|----------|---------|--------------------------------------|---------|-----------------------------------------------------------------------------------------------|----------------|
| WT 25/26 | 2400087 | <a href="#">Corporate Compliance</a> | 2 SWS   | Lecture /  | Herzig, Siddiq |
| Exams    |         |                                      |         |                                                                                               |                |
| WT 25/26 | 7500063 | <a href="#">Corporate Compliance</a> | Matz    |                                                                                               |                |
| ST 2026  | 7500063 | <a href="#">Corporate Compliance</a> | Sattler |                                                                                               |                |

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

## T

**6.78 Module component: Corporate Risk Management [T-WIWI-109050]**

**Coordinators:** Prof. Dr. Martin Ruckes

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

**Part of:** [M-WIWI-101480 - Finance 3](#)  
[M-WIWI-101483 - Finance 2](#)  
[M-WIWI-101502 - Economic Theory and its Application in Finance](#)

| Type                | Credits | Grading | Term offered | Version |
|---------------------|---------|---------|--------------|---------|
| Written examination | 4,5 CP  | graded  | Irregular    | 2       |

**Assessment**

The success of the course (lecture and exercise) is assessed in the form of a written examination (60 min.) in accordance with § 4 para. 2 no. 1 SPO. If the number of participants registered for the written examination is low, we reserve the right to hold an oral examination instead of a written examination.

Please note that the examination is only offered in the semester of the lecture and in the following semester.

**Prerequisites**

None

**Recommendations**

None

**Workload**

135 hours



## T

**6.79 Module component: Cryptographic Protocols [T-INFO-111261]**

**Coordinators:** Prof. Dr. Jörn Müller-Quade  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-105631 - Cryptographic Protocols](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 5 CP    | graded  | Each summer term | 2       |

| Courses  |         |                                         |       |                                                                                               |                       |
|----------|---------|-----------------------------------------|-------|-----------------------------------------------------------------------------------------------|-----------------------|
| ST 2026  | 2400154 | <a href="#">Cryptographic Protocols</a> | 2 SWS | Lecture /  | Mechler               |
| Exams    |         |                                         |       |                                                                                               |                       |
| WT 25/26 | 7500357 | <a href="#">Cryptographic Protocols</a> |       |                                                                                               | Müller-Quade, Mechler |
| ST 2026  | 7500204 | <a href="#">Cryptographic Protocols</a> |       |                                                                                               | Müller-Quade, Mechler |

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

**Assessment**

Success is assessed in the form of an oral examination, usually lasting 30 minutes in accordance with §4 Para. 2 No. 2 SPO

**Prerequisites**

If the module M-INFO-104119 Secure multi-party calculation has already been checked, the module Cryptographic protocols cannot be checked.

**Recommendations**

Students should be familiar with the contents of the module "Theoretical Foundations of Cryptography".

**Additional Information**

The event takes place as an "inverted classroom". The material is presented in the form of videos, which are then interactively deepened in the subsequent face-to-face event.

## T

**6.80 Module component: Cryptographic Protocols II: Universal Composability [T-INFO-114602]****Coordinators:** Prof. Dr. Jörn Müller-Quade**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107435 - Cryptographic Protocols II: Universal Composability](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 3 CP    | graded  | Each winter term | 1       |

| Courses  |         |                                                                     |       |                                                                                               |                       |
|----------|---------|---------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|-----------------------|
| WT 25/26 | 2400022 | <a href="#">Cryptographic Protocols II: Universal Composability</a> | 2 SWS | Lecture /  | Müller-Quade, Mechler |
| Exams    |         |                                                                     |       |                                                                                               |                       |
| WT 25/26 | 7500296 | <a href="#">Cryptographic Protocols II: Universal Composability</a> |       |                                                                                               | Müller-Quade, Mechler |

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

The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) approx. 30 minutes.

**Prerequisites**

None.

**Recommendations**

Students should be familiar with the contents of the modules "Theoretische Grundlagen der Kryptographie" (Theoretical Foundations of Cryptography) and „Kryptographische Protokolle“ (Cryptographic Protocols I).

**T****6.81 Module component: Cryptographic Voting Schemes [T-INFO-101279]**

**Coordinators:** Prof. Dr. Jörn Müller-Quade  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-100742 - Cryptographic Voting Schemes](#)

| Type             | Credits | Grading | Term offered | Version |
|------------------|---------|---------|--------------|---------|
| Oral examination | 3 CP    | graded  | Irregular    | 1       |

## T

**6.82 Module component: Current Directions in Consumer Psychology [T-WIWI-111100]**

**Coordinators:** Prof. Dr. Benjamin Scheibehenne  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-105714 - Consumer Research](#)

| Type                        | Credits | Grading | Term offered | Expansion   | Version |
|-----------------------------|---------|---------|--------------|-------------|---------|
| Examination of another type | 4,5 CP  | Graded  | Each term    | 1 semesters | 2       |

| Courses  |         |                                                           |       |                                                                                               |              |
|----------|---------|-----------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|--------------|
| WT 25/26 | 2540441 | <a href="#">Current Directions in Consumer Psychology</a> | 2 SWS | Seminar /  | Scheibehenne |
| Exams    |         |                                                           |       |                                                                                               |              |
| WT 25/26 | 7900214 | <a href="#">Current Directions in Consumer Psychology</a> |       |                                                                                               | Scheibehenne |

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

**Assessment**

Alternative exam assessment. Grading will be based on a continuous basis throughout the semester.

**Prerequisites**

Strong interest in research. Students who wish to write a master's thesis at our department will be given priority in the allocation of places.

**Additional Information**

**Please note: Due to a research sabbatical of Prof. Scheibehenne, this course will not be offered in the summer semester 2026. The course is expected to be available again in the summer semester 2027.**

This class covers current research topics at the intersection between Psychology, Consumer Behavior, and Behavioral Economics. Based on weekly reading assignments of current scientific journal publications, students will get a first-hand experience of the ongoing topics and discussions at this exciting and dynamic area of research. The reading list will be announced at the first day of class and will be updated throughout the semester. Grades will be based on weekly participation throughout the semester including short oral presentation of papers in class, active engagement in discussions, and homework assignments. Due to the highly interactive format of this class the number of participants is limited.

**Workload**

135 hours

*Below you will find excerpts from courses related to this module component:*

## V

**Current Directions in Consumer Psychology**

2540441, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

**Seminar (S)**  
On-Site

**Content**

**NOTE: sign-up required via the Campus+ Portal**

This class covers current research topics at the intersection between Psychology, Consumer Behavior, and Behavioral Economics. Based on weekly reading assignments of current scientific journal publications, students will get a first-hand experience of the ongoing topics and discussions at this exciting and dynamic area of research. The reading list will be announced at the first day of class. Grades will be based on continuous participation throughout the semester including short oral presentation of papers in class, active engagement in discussions and homework assignments. This class will be taught in English.

**Organizational issues**

Participation is restricted to 6 participants.

If more than 6 students apply, we will assign places by motivation.

Achtung: Seminar findet im Seminarraum Geb 01.87, R 5B 25 statt.

Beginn Mittwoch 29.10.25 09:45 - 11:15 Uhr, dann immer mittwochs bis 18.2.2 gleiche Uhrzeit

**T****6.83 Module component: Cybersecurity for Industrial Automation and Control Systems [T-INFO-112880]****Coordinators:** Prof. Dr.-Ing. Jürgen Beyerer**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106355 - Cybersecurity for Industrial Automation and Control Systems](#)**Type**  
Oral examination**Credits**  
4 CP**Grading**  
graded**Version**  
1

| Courses  |         |                                                                             |       |                                                                                               |               |
|----------|---------|-----------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|---------------|
| ST 2026  | 2400160 | <a href="#">Cybersecurity for Industrial Automation and Control Systems</a> | 2 SWS | Lecture /  | Haas, Beyerer |
| Exams    |         |                                                                             |       |                                                                                               |               |
| WT 25/26 | 7500113 | <a href="#">Cybersecurity for Industrial Automation and Control Systems</a> |       |                                                                                               | Beyerer       |
| ST 2026  | 7500361 | <a href="#">Cybersecurity for Industrial Automation and Control Systems</a> |       |                                                                                               | Beyerer       |

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

## T

**6.84 Module component: Data Science and Artificial Intelligence for Energy Systems [T-INFO-113402]****Coordinators:** TT-Prof. Dr. Benjamin Schäfer**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106655 - Data Science and Artificial Intelligence for Energy Systems](#)

| Type             | Credits | Grading        | Term offered     | Version |
|------------------|---------|----------------|------------------|---------|
| Oral examination | 6 CP    | Grading graded | Each summer term | 1       |

| Courses  |         |                                                                                        |       |                                                                                                |                                |
|----------|---------|----------------------------------------------------------------------------------------|-------|------------------------------------------------------------------------------------------------|--------------------------------|
| WT 25/26 | 2400079 | <a href="#">Data Science and Artificial Intelligence for Energy Systems</a>            | 2 SWS | Lecture /   | Schäfer                        |
| WT 25/26 | 2400082 | <a href="#">Data Science and Artificial Intelligence for Energy Systems</a>            | 2 SWS | Practice /  | Schäfer, Nikoltchovska, Sadric |
| ST 2026  | 2400098 | <a href="#">Data science and Artificial Intelligence for Energy Systems</a>            | 2 SWS | Lecture /   | Schäfer                        |
| ST 2026  | 2400173 | <a href="#">Data science and Artificial Intelligence for Energy Systems (Exercise)</a> | 2 SWS | Practice /  | Schäfer                        |
| Exams    |         |                                                                                        |       |                                                                                                |                                |
| WT 25/26 | 7500398 | <a href="#">Data Science and Artificial Intelligence for Energy Systems</a>            |       |                                                                                                | Schäfer                        |
| WT 25/26 | 7500404 | <a href="#">Data Science and Artificial Intelligence for Energy Systems</a>            |       |                                                                                                | Schäfer                        |
| ST 2026  | 7500309 | <a href="#">Data Science and Artificial Intelligence for Energy Systems</a>            |       |                                                                                                | Schäfer                        |

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

The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting about 30 minutes.

**Prerequisites**

None.

**Recommendations**

Knowledge of AI basics is very helpful.

Previous participation in "Energieinformatik 1" and/or "Energieinformatik 2" is beneficiary but not mandatory.

Knowledge of Python is highly recommended.

*Below you will find excerpts from courses related to this module component:*

## V

**Data Science and Artificial Intelligence for Energy Systems**2400079, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)**Lecture (V)**  
On-Site**Content**

Artificial Intelligence (AI) is a key technology in many areas of society and research. Energy systems with the ongoing energy transition ("Energiewende") make it a fascinating field for deploying AI methods. AI and machine learning algorithms can play a crucial role in improving energy efficiency, optimizing power generation and distribution or enhancing system stability while facilitating additional renewable energy integration. In this lecture, we review some mechanics of energy systems, their design and optimization questions and how to solve these using data-driven approaches. We will discuss deterministic dynamics, as well as stochastic aspects of energy systems and will explore fundamental AI algorithms and their applications in energy systems. We will cover both classical time series methods as well as state-of-the-art AI techniques, e.g. for optimization or forecasting.

## V

**Data science and Artificial Intelligence for Energy Systems**2400098, SS 2026, 2 SWS, Language: English, [Open in study portal](#)**Lecture (V)**  
On-Site

**Content**

Artificial Intelligence (AI) is a key technology in many areas of society and research. Energy systems with the ongoing energy transition (“Energiewende”) make it a fascinating field for deploying AI methods. AI and machine learning algorithms can play a crucial role in improving energy efficiency, optimizing power generation and distribution or enhancing system stability while facilitating additional renewable energy integration. In this lecture, we review some mechanics of energy systems, their design and optimization questions and how to solve these using data-driven approaches. We will discuss deterministic dynamics, as well as stochastic aspects of energy systems and will explore fundamental AI algorithms and their applications in energy systems. We will cover both classical time series methods as well as state-of-the-art AI techniques, e.g. for optimization or forecasting.

## T

**6.85 Module component: Data Science for Business [T-WIWI-114089]****Coordinators:** Prof. Dr. Jella Pfeiffer**Organisation:** KIT Department of Business and Economics

**Part of:** [M-WIWI-103117 - Data Science: Data-Driven Information Systems](#)  
[M-WIWI-103118 - Data Science: Data-Driven User Modeling](#)  
[M-WIWI-107530 - Information Systems: AI & Data Science](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 4,5 CP  | Graded  | Each summer term | 1       |

| Courses  |         |                                                         |       |            |                                |
|----------|---------|---------------------------------------------------------|-------|------------|--------------------------------|
| WT 25/26 | 2540473 | <a href="#">Business Data Analytics</a>                 | 2 SWS | Seminar /  | Hariharan, Grote, Schulz, Motz |
| ST 2026  | 2540466 | <a href="#">Data Science for Business</a>               | 2 SWS | Lecture /  | Pfeiffer                       |
| ST 2026  | 2540467 | <a href="#">Exercise Data Science for Business</a>      | 1 SWS | Practice / | Gutschow, Heßler               |
| Exams    |         |                                                         |       |            |                                |
| WT 25/26 | 7900188 | <a href="#">Data Science for Business (Nachklausur)</a> |       |            | Pfeiffer                       |
| ST 2026  | 7900183 | <a href="#">Data Science for Business</a>               |       |            | Pfeiffer                       |

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

**Assessment**

Success is monitored through ongoing elaborations and presentations of tasks and a written exam (60 minutes) at the end of the lecture period. Successful participation in the exercises is a prerequisite for admission to the written examination. The scoring scheme for the overall evaluation will be announced at the beginning of the course.

The number of participants is limited to 50, as this is the only way to ensure that the case study is supervised conscientiously.

**Prerequisites**

None

**Recommendations**

Knowledge of programming (particular python) and statistics is helpful.

**Additional Information**

The lecture and exercise are blocked. Three units take place consecutively in the first few weeks. The weeks after that can be used to work on the case (team project).

**Workload**

135 hours

Below you will find excerpts from courses related to this module component:

## V

**Business Data Analytics**

2540473, WS 25/26, 2 SWS, Language: German/English, [Open in study portal](#)

Seminar (S)  
On-Site

**Content**

wird auf deutsch und englisch gehalten

**Organizational issues**

Blockveranstaltung, siehe WWW

## V

**Data Science for Business**

2540466, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
On-Site



**Content**

In the course "Data Science for Business":

- You will learn about essential Data Science methods, including clustering and classification techniques (e.g., random forests, SVMs).
- You will understand process models such as CRISP-DM.
- You will explore different types of data, including eye-tracking data, click data, neurophysiological data, sales data, and other business-related data.
- You will gain skills in data visualization and evaluation using programming languages and software tools.

**Workload:**

- Attendance time Lecture (2 SWS × 15 weeks): 30 h
- Attendance time Tutorial (1 SWS × 15 weeks): 15 h
- Self-study Lecture: 20 h
- Self-study Tutorial: 50 h
- Exam preparation: 20 h
- Total: 135 h

**Organizational issues**

- ehemals Business Data Analytics: Applications and Tools
- formerly Business Data Analytics: Applications and Tools

**Exercise Data Science for Business**

2540467, SS 2026, 1 SWS, Language: English, [Open in study portal](#)

**Practice (Ü)  
On-Site**

**Content**

In the course "Data Science for Business":

- You will learn about essential Data Science methods, including clustering and classification techniques (e.g., random forests, SVMs).
- You will understand process models such as CRISP-DM.
- You will explore different types of data, including eye-tracking data, click data, neurophysiological data, sales data, and other business-related data.
- You will gain skills in data visualization and evaluation using programming languages and software tools.

**Organizational issues**

- ehemals Business Data Analytics: Applications and Tools
- formerly Business Data Analytics: Applications and Tools

## T

**6.86 Module component: Decentralized Systems: Fundamentals, Modeling, and Applications [T-INFO-110820]****Coordinators:** Prof. Dr. Hannes Hartenstein**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-105334 - Decentralized Systems: Fundamentals, Modeling, and Applications](#)**Type**  
Written examination**Credits**  
6 CP**Grading**  
graded**Term offered**  
Each summer term**Version**  
5

| Courses  |         |                                                                                 |       |                                                                                                         |                    |
|----------|---------|---------------------------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------|--------------------|
| ST 2026  | 2400089 | <a href="#">Decentralized Systems: Fundamentals, Modeling, and Applications</a> | 4 SWS | Lecture / Practice /  | Hartenstein, Jacob |
| Exams    |         |                                                                                 |       |                                                                                                         |                    |
| WT 25/26 | 7500141 | <a href="#">Decentralized Systems: Fundamentals, Modeling, and Applications</a> |       |                                                                                                         | Hartenstein        |
| ST 2026  | 7500070 | <a href="#">Decentralized Systems: Fundamentals, Modeling, and Applications</a> |       |                                                                                                         | Hartenstein        |

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

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 60 minutes.

Depending on the number of participants, it will be announced six weeks before the examination (§ 6 Abs. 3 SPO) whether the examination takes place

in the form of an oral examination lasting 30 minutes pursuant to § 4 Abs. 2 Nr. 2 SPO or

in the form of a written examination lasting 60 minutes in accordance with § 4 Abs. 2 Nr. 1 SPO.

**Prerequisites**

None.

**Recommendations**

Basics according to the lectures "Information Security" and "Introduction to Computer Networks" are recommended.

Below you will find excerpts from courses related to this module component:

## V

**Decentralized Systems: Fundamentals, Modeling, and Applications**

2400089, SS 2026, 4 SWS, Language: English, [Open in study portal](#)

Lecture / Practice (VÜ)  
On-Site

**Content****Content:**

Decentralized Systems (like blockchain-based systems) are distributed systems under the control of multiple, independent parties that act on their own, autonomous decisions. In this course, we cover fundamental theoretical aspects as well as up-to-date decentralized systems, and connect theory with current practice. We thereby address fault tolerance, security and trust, as well as performance aspects at the example of applications like Bitcoin, Ethereum, IPFS, Matrix, or the Fediverse. As a research-oriented lecture, we cover additional current topics like decentralizing artificial intelligence via decentralized, federated learning, or identity and access management in decentralized systems.

The lecture covers at least the following topics:

- Fundamentals
  - Peer-to-Peer Overlay Networks, Sybil and Eclipse Attacks
  - Formalization of decentralized systems, including models for their computation, communication, faults, and timing.
  - Leader election and broadcast in decentralized systems, based on different models for identities and timing.
  - Byzantine consensus in synchronous and asynchronous settings, including Bracha's fundamental algorithm for reliable broadcast, practical Byzantine fault tolerant consensus, and fundamental limits.
  - Consistency models and protocols, including conflict-free replicated data types.
- Applications
  - Decentralized storage systems, at the example of IPFS
  - Decentralized communication systems, at the example of Matrix for instant messaging
  - Distributed ledgers and blockchains, at the examples of Bitcoin and Ethereum, in particular Proof-of-Work and Proof-of-Stake consensus
  - Scaling techniques for distributed ledgers, at the example of payment channel networks and rollups
  - Decentralized, federated machine learning systems

**Competency Goals:**

## 1. Fundamentals &amp; Modeling

1. The student is able to recognize and distinguish distributed, federated, and decentralized systems.
2. The student understands the role of consensus, consistency, and coordination within the context of networked and decentralized systems.
3. The student understands the concept of Sybil attacks.
4. The student is familiar with decentralized algorithms like leader election for execution contexts with various guarantees.
5. The student understands the formally proven limits of fault tolerance and their underlying assumptions. This includes an understanding of synchronous and asynchronous network models which underpin the respective proofs. The student also understands several models for fault tolerance within the context of decentralized and distributed systems.
6. The student has a basic understanding of state machine replication.
7. The student knows how conflict-free replicated data types employ mathematics to provide eventually consistent data to collaborative peer-to-peer applications.

## 1. Applications

1. The student understands how decentralized storage, replication, and coordination is employed in practice.
2. The student has a fundamental understanding of blockchain-based systems and payment channels, as well as decentralized systems for storage, communication, and machine learning.
3. The student understands trust relations in distributed and decentralized systems applications.
4. The student is able to understand how theoretical foundations relate to networked and decentralized systems in practice.

**Workload:**

Lecture workload:

1. Attendance time (Course, exercise, etc.)

Lecture: 3 SWS: 3,0h x 15 = 45h

Exercise: 1 SWS: 1,0h x 15 = 15h

2. Self-study (e.g. independent review of course material, work on homework assignments)

Weekly preparation and follow-up of the lecture: 15 x 1h x 3 = 45h

Weekly preparation and follow-up of the exercise: 15 x 2h = 30h

3. Preparation for the exam: 45 h

$\Sigma = 180h = 6$  ECTS

**Competency certificate:**

Depending on the number of participants, it will be announced six weeks before the examination (§ 6 Abs. 3 SPO) whether the examination takes place

- written examination lasting 60 minutes in accordance with § 4 Abs. 2 Nr. 1 SPO.

**Recommendations:**

Basics according to the lectures "Information Security" and "Introduction to Computer Networks" are recommended.

## T

**6.87 Module component: Deep Learning and Neural Networks [T-INFO-114219]****Coordinators:** Prof. Dr. Jan Niehues**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107197 - Deep Learning and Neural Networks](#)**Type**  
Written examination**Credits**  
6 CP**Grading**  
graded**Term offered**  
Each summer term**Version**  
1

| Courses  |         |                                                                 |       |                                                                                               |         |
|----------|---------|-----------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|---------|
| ST 2026  | 2400024 | <a href="#">Deep Learning and Neural Networks</a>               | 4 SWS | Lecture /  | Niehues |
| Exams    |         |                                                                 |       |                                                                                               |         |
| WT 25/26 | 7500400 | <a href="#">Deep Learning and Neural Networks (Nachklausur)</a> |       |                                                                                               | Niehues |

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

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 60 minutes.

**Prerequisites**

T-INFO-101383 - Neural networks must not be started.

**Recommendations**

Prior successful completion of the core module "Cognitive Systems" is recommended.

**T****6.88 Module component: Deep Learning for Computer Vision: Advanced Topics [T-INFO-115078]****Coordinators:** Prof. Dr.-Ing. Rainer Stiefelhagen**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107695 - Deep Learning for Computer Vision: Advanced Topics](#)

| Type                | Credits | Grading | Term offered     | Version |
|---------------------|---------|---------|------------------|---------|
| Written examination | 3 CP    | graded  | Each winter term | 1       |

**Assessment**

Success is assessed in the form of a written examination (usually lasting 60 minutes) in accordance with Section 4 (2) No. 1 SPO.

**Prerequisites**

None.

**Recommendations**

Knowledge of deep learning basics is strongly recommended.

## T

**6.89 Module component: Derivatives [T-WIWI-102643]**

**Coordinators:** Prof. Dr. Marliese Uhrig-Homburg  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101480 - Finance 3](#)  
[M-WIWI-101482 - Finance 1](#)  
[M-WIWI-101483 - Finance 2](#)

**Type**  
Written examination

**Credits**  
4,5 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
1

| Courses  |         |                                   |       |                                                                                                |                       |
|----------|---------|-----------------------------------|-------|------------------------------------------------------------------------------------------------|-----------------------|
| ST 2026  | 2530550 | <a href="#">Derivatives</a>       | 2 SWS | Lecture /   | Uhrig-Homburg         |
| ST 2026  | 2530551 | <a href="#">Übung zu Derivate</a> | 1 SWS | Practice /  | Dinger, Uhrig-Homburg |
| Exams    |         |                                   |       |                                                                                                |                       |
| WT 25/26 | 7900051 | <a href="#">Derivatives</a>       |       |                                                                                                | Uhrig-Homburg         |
| ST 2026  | 7900111 | <a href="#">Derivatives</a>       |       |                                                                                                | Uhrig-Homburg         |

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

**Assessment**

Success is assessed in the form of a written examination (60 minutes). The examination is offered every semester and can be repeated at any regular examination date.

A bonus can be earned for successful participation in the exercises by submitting correct solutions to at least 50% of the bonus exercises set. 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

**Recommendations**

None

Below you will find excerpts from courses related to this module component:

## V

**Derivatives**

2530550, SS 2026, 2 SWS, Language: German, [Open in study portal](#)

**Lecture (V)**  
On-Site

**Literature**

- Hull (2012): Options, Futures, & Other Derivatives, Prentice Hall, 8th Edition

**Weiterführende Literatur:**

Cox/Rubinstein (1985): Option Markets, Prentice Hall

## T

**6.90 Module component: Design and Architectures of Embedded Systems (ESII) [T-INFO-114254]****Coordinators:** Prof. Dr.-Ing. Jörg Henkel**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107230 - Design and Architectures of Embedded Systems \(ESII\)](#)**Type**  
Oral examination**Credits**  
3 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
1

| Courses  |         |                                                                        |       |         |              |
|----------|---------|------------------------------------------------------------------------|-------|---------|--------------|
| WT 25/26 | 2424106 | <a href="#">Design and architectures of embedded systems (ES2)</a>     | 2 SWS | Lecture | Khdr, Henkel |
| Exams    |         |                                                                        |       |         |              |
| WT 25/26 | 7500124 | <a href="#">VL: Design and architectures of embedded systems (ES2)</a> |       |         | Henkel       |

**Assessment**

The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting 20 minutes.

**Prerequisites**

None.

**Recommendations**

Knowledge of computer structures is helpful.

*Below you will find excerpts from courses related to this module component:*

## V

**Design and architectures of embedded systems (ES2)**

2424106, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

**Lecture (V)****Content**

State-of-the-art System-on-Chips (SoCs) integrate more than a billion transistors on a single chip. Embedded devices powered by these SoCs would be increasingly ubiquitous and seamlessly integrated into the environment. Therefore they will no longer be perceived as separate computing devices. Such examples can be found in Wireless Sensor Networks (WSNs), Cyber Physical Systems (CPSs), electronic textiles and many more.

However, new efficient ESL (Embedded System Level) design tools as well as novel hardware-software architectures must be developed in order to enable embedded devices to achieve their true potential. The focus of this lecture is therefore on the high-level design methods and architectures for embedded systems. Since the power consumption of embedded systems is of paramount importance, this lecture emphasizes on hardware-software co-design procedures targeting low power consumption.

Appointments for the oral exam can be requested at [ces.itec.kit.edu/972.php](https://ces.itec.kit.edu/972.php)

The student learns complex hardware-software co-design methods that can be applied to the design of embedded systems. The student assesses and selects specific hardware-software architecture most suitable for an embedded system given its function. Furthermore, the student receives an introduction to the relevant current research topics.



## T

**6.91 Module component: Design and Operation of Industrial Plants and Processes [T-WIWI-114618]**

**Coordinators:** Prof. Dr. Frank Schultmann  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101471 - Industrial Production II](#)

| Type                | Credits | Grading | Term offered     | Version |
|---------------------|---------|---------|------------------|---------|
| Written examination | 5,5 CP  | Graded  | Each winter term | 1       |

| Courses  |         |                                                                         |       |                                                                                               |                  |
|----------|---------|-------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|------------------|
| WT 25/26 | 2581952 | <a href="#">Design and Operation of Industrial Plants and Processes</a> | 2 SWS | Lecture /  | Schultmann, Rudi |
| Exams    |         |                                                                         |       |                                                                                               |                  |
| WT 25/26 | 7981952 | <a href="#">Design and Operation of Industrial Plants and Processes</a> |       |                                                                                               | Schultmann       |
| ST 2026  | 7981952 | <a href="#">Design and Operation of Industrial Plants and Processes</a> |       |                                                                                               | Schultmann       |

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

**Assessment**

The assessment consists of a written exam (90 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

**Recommendations**

None

Below you will find excerpts from courses related to this module component:

## V

**Design and Operation of Industrial Plants and Processes**

2581952, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
On-Site

**Content**

Industrial plant management incorporates a complex set of tasks along the entire life cycle of an industrial plant, starting with the initiation and erection up to operating and dismantling.

During this course students will get to know special characteristics of industrial plant management. Students will learn important methods to plan, realize and supervise the supply, start-up, maintenance, optimisation and shut-down of industrial plants. Alongside, students will have to handle the inherent question of choosing between technologies and evaluating each of them. This course pays special attention to the specific characteristics of plant engineering, commissioning and investment.

**Literature**

Wird in der Veranstaltung bekannt gegeben.

## T

**6.92 Module component: Design Thinking [T-WIWI-102866]**

**Coordinators:** Prof. Dr. Orestis Terzidis  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101488 - Entrepreneurship \(EnTechnon\)](#)  
[M-WIWI-101507 - Innovation Management](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 3 CP    | Graded  | Irregular    | 1       |

| Courses  |         |                                           |          |                                                                                               |                  |
|----------|---------|-------------------------------------------|----------|-----------------------------------------------------------------------------------------------|------------------|
| WT 25/26 | 2545008 | <a href="#">Design Thinking (Track 1)</a> | 2 SWS    | Seminar /  | Haller, Terzidis |
| ST 2026  | 2545008 | <a href="#">Design Thinking (Track 1)</a> | 2 SWS    | Seminar /  | Haller           |
| Exams    |         |                                           |          |                                                                                               |                  |
| WT 25/26 | 7900084 | <a href="#">Design Thinking (Track 1)</a> | Terzidis |                                                                                               |                  |
| ST 2026  | 7900053 | <a href="#">Design Thinking (Track 1)</a> | Terzidis |                                                                                               |                  |

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

**Assessment**

Alternative exam assessments (§4(2), 3 SPO).

**Prerequisites**

None

**Recommendations**

None

**Additional Information**

Please note that the number of participants is limited. Registration takes place via the Wiwi-Portal. The seminar contents will be published on the institute's homepage.

Below you will find excerpts from courses related to this module component:

## V

**Design Thinking (Track 1)**

2545008, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

**Seminar (S)**  
**Blended (On-Site/Online)**

**Content****Course Content:**

Design Thinking is a user-centric method for innovation management. The iterative process first analyzes the problem space and builds a sound understanding of the future users. Subsequently, ideas for the solution are generated, prototypes created that get tested by the user group. The result is a validated concept of an innovation or product.

**Learning Objectives**

During the seminar, students learn basic procedures for achieving user-centric innovations. These are concrete methods focusing on actual users' needs and pain points. Design Thinking is problem-oriented and emphasizes specific customer situations. After attending the seminar, students have a clear understanding of the need to explore end-user needs and are able to independently apply the methods of Design Thinking for developing market-driven innovations at a basic level.

**Credentials:**

Registration is via the Wiwi portal.

ATTENTION: Creditability in the seminar module: The seminar is NOT credited in the seminar module! Crediting is only possible in the EXPERT MODULE ENTREPRENEURSHIP.

**Organizational issues**

Registration is via the Wiwi portal.

In the seminar you will work on a project in teams of 4-5 persons. The groups are formed in the seminar

**Design Thinking (Track 1)**2545008, SS 2026, 2 SWS, Language: English, [Open in study portal](#)**Seminar (S)**  
**On-Site****Content****Content**

Design Thinking is a user-centric method for innovation management. The iterative process first analyzes the problem space and builds a sound understanding of the future users. Subsequently, ideas for the solution are generated, prototypes created that get tested by the user group. The result is a validated concept of an innovation or product.

**Learning Objectives**

During the seminar, students learn basic procedures for achieving user-centric innovations. These are concrete methods focusing on actual users' needs and pain points. Design Thinking is problem-oriented and emphasizes specific customer situations. After attending the seminar, students have a clear understanding of the need to explore end-user needs and are able to independently apply the methods of Design Thinking for developing market-driven innovations at a basic level.

**Credentials:**

ATTENTION: Creditability in the seminar module: The seminar is NOT credited in the wiwi seminar module!

## T

**6.93 Module component: Designing Interactive Systems: Human-AI Interaction [T-WIWI-113465]****Coordinators:** Prof. Dr. Alexander Mädche**Organisation:** KIT Department of Business and Economics

**Part of:** [M-WIWI-104068 - Information Systems in Organizations](#)  
[M-WIWI-104080 - Designing Interactive Information Systems](#)  
[M-WIWI-105923 - Incentives, Interactivity & Decisions in Organizations](#)  
[M-WIWI-107531 - Information Systems: Interactive Systems](#)

| Type                        | Credits | Grading        | Term offered     | Version |
|-----------------------------|---------|----------------|------------------|---------|
| Examination of another type | 4,5 CP  | Grading graded | Each summer term | 1       |

| Courses  |         |                                                                     |       |                                                                                               |                       |
|----------|---------|---------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|-----------------------|
| ST 2026  | 2540558 | <a href="#">Designing Interactive Systems: Human-AI Interaction</a> | 3 SWS | Lecture /  | Mädche, Seitz Sängner |
| Exams    |         |                                                                     |       |                                                                                               |                       |
| WT 25/26 | 7900205 | <a href="#">Designing Interactive Systems</a>                       |       |                                                                                               | Mädche                |
| ST 2026  | 7900299 | <a href="#">Designing Interactive Systems: Human-AI Interaction</a> |       |                                                                                               | Mädche                |

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

**Assessment**

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.

**Additional Information**

The course is held in english.

**Workload**

135 hours

Below you will find excerpts from courses related to this module component:

## V

**Designing Interactive Systems: Human-AI Interaction**

2540558, SS 2026, 3 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
Blended (On-Site/Online)

**Content****Description**

The field of computing has transitioned from traditional batch processing toward the development of highly sophisticated interactive and intelligent systems. As artificial intelligence (AI) continues to advance, these systems have gained the capacity to learn, adapt to environmental stimuli, and simulate human cognitive processes. While the capacity of AI-based information technology to augment and automate human tasks has expanded, it simultaneously creates complex new demands for the design of interactive systems and necessitates a sophisticated understanding of the nuances within human-AI interaction.

This Master's course explores the state-of-the-art scientific knowledge and practical applications required to navigate these complexities, specifically focusing on the design of AI-based interactive systems for personal productivity on the individual level and virtual collaboration on the team level within professional environments.

The course is divided into two phases: The first phase establishes a scientific foundation through a **flipped classroom model**. Students engage with conceptual foundations and theoretical frameworks independently, allowing in-person sessions to be dedicated to analysis and critical discussion of existing knowledge for designing interactive systems enabling effective human-AI interaction. The second phase transitions into the practical application of these concepts through a collaborative **capstone project** conducted in partnership with an industry partner. In this phase, students work in teams to apply knowledge acquired in the first phase culminating in the creation of a prototype of an interactive system. The project emphasizes the intricacies of human-AI interaction, requiring students to synthesize their theoretical knowledge into a functional and sophisticated design solution.

**Learning objectives**

- Evaluate existing theories and conceptual frameworks of interactive systems to assess their role in modern computing environments.
- Analyze the unique characteristics of human-AI interaction and determine their impact on future interactive systems design.
- Create a functional interactive prototype by following the human-centered design process and applying state-of-the-art knowledge within a collaborative capstone project to solve real-world problems.
- Get hands-on experience by applying lecture content in a design capstone project

**Prerequisites**

No specific prerequisites are required for the lecture

**Literature**

Further literature will be made available in the lecture.

Die Erfolgskontrolle erfolgt in Form einer Prüfungsleistung anderer Art (Form) nach § 4 Abs. 2 Nr. 3 SPO. Details zur Ausgestaltung der Erfolgskontrolle werden im Rahmen der Vorlesung bekannt gegeben.

**Literature**

Die Vorlesung basiert zu einem großen Teil auf

• Benyon, D. (2014). Designing interactive systems: A comprehensive guide to HCI, UX and interaction design (3. ed.). Harlow: Pearson.

Weiterführende Literatur wird in der Vorlesung bereitgestellt.

**T****6.94 Module component: Development of Sustainable, Digital Business Models [T-WIWI-113663]**

**Coordinators:** Prof. Dr. Marion Weissenberger-Eibl  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101507 - Innovation Management](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 3 CP    | graded  | Irregular    | 1       |

**Assessment**

Non exam assessment. The final grade is composed 50% of the grade of the written paper (ca. 5 Pages /Person) and 50% of the presentation of the results.

**Prerequisites**

None

**Recommendations**

Prior attendance of the course Innovation Management is recommended.

**Workload**

90 hours

**T****6.95 Module component: Digital Accessibility and Assistive Technologies [T-INFO-111830]****Coordinators:** Prof. Dr.-Ing. Rainer Stiefelhagen**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-105882 - Digital Accessibility and Assistive Technologies](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 3 CP    | graded  | Each summer term | 1       |

| Courses  |         |                                                                  |       |                                                                                               |                       |
|----------|---------|------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|-----------------------|
| ST 2026  | 2400165 | <a href="#">Digital Accessibility and Assistive Technologies</a> | 2 SWS | Lecture /  | Stiefelhagen, Schwarz |
| Exams    |         |                                                                  |       |                                                                                               |                       |
| WT 25/26 | 7500320 | <a href="#">Digital Accessibility and Assistive Technologies</a> |       |                                                                                               | Stiefelhagen          |
| ST 2026  | 7500163 | <a href="#">Digital Accessibility and Assistive Technologies</a> |       |                                                                                               | Stiefelhagen          |

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

## T

**6.96 Module component: Digital Democracy [T-WIWI-113160]****Coordinators:** Jonas Fegert**Organisation:** KIT Department of Business and Economics

**Part of:** [M-WIWI-101410 - Business & Service Engineering](#)  
[M-WIWI-101446 - Market Engineering](#)  
[M-WIWI-103117 - Data Science: Data-Driven Information Systems](#)  
[M-WIWI-103118 - Data Science: Data-Driven User Modeling](#)  
[M-WIWI-107528 - Information Systems: Digital Markets & Services](#)

| Type                        | Credits | Grading | Term offered     | Expansion   | Version |
|-----------------------------|---------|---------|------------------|-------------|---------|
| Examination of another type | 4,5 CP  | graded  | Each winter term | 1 semesters | 1       |

| Courses  |         |                                                                                         |           |                                                                                                |                         |
|----------|---------|-----------------------------------------------------------------------------------------|-----------|------------------------------------------------------------------------------------------------|-------------------------|
| WT 25/26 | 00053   | <a href="#">Übung zur Digital Democracy</a>                                             | 1 SWS     | Practice /  | Stein                   |
| WT 25/26 | 2500045 | <a href="#">Digital Democracy - Challenges and Opportunities of the Digital Society</a> | 2 SWS     | Seminar /   | Fegert, Stein, Bezzaoui |
| WT 25/26 | 2600052 | <a href="#">Digital Democracy</a>                                                       | 2 SWS     | Lecture /   | Fegert                  |
| Exams    |         |                                                                                         |           |                                                                                                |                         |
| WT 25/26 | 00059   | <a href="#">Digital Democracy</a>                                                       | Weinhardt |                                                                                                |                         |

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

**Assessment**

Alternative exam assessment. The examination consists of two parts (presentation and oral exam). Details on the design of the exam will be announced at the beginning of the course.

**Additional Information**

Limited to 25 students. Application (cover letter) via the Wiwi-portal.

**Workload**

135 hours

Below you will find excerpts from courses related to this module component:

## V

**Digital Democracy**

2600052, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
Blended (On-Site/Online)

**Content**

The "Digital Democracy" Lecture deals with opportunities and challenges of democracy and participation in a digitalized world. Social networks and other platforms have become a central place for human interaction.

These technologies open up many possibilities to connect people, promote societal discourse, and organize social movements. On the other hand, they are also used to undermine democracy by extremist forces.

One example is the spread of disinformation through social media, which can undermine trust in democratic institutions and exacerbate divisions in society. Big tech actors pursue their own economically driven interests, some of which run counter to societal ones.

So to what extent can Internet platforms help strengthen social discourse? And what measures can be taken to promote the quality and diversity of discourse in the digital world? What role do big tech players play in digital democracy and how can their interests be reconciled with democratic principles? These and many more questions will be explored in the lecture. The lecture introduces theoretical foundations and evidence-based research on digital democracy. It will address the following questions: What characterizes deliberative democracies, how do democracies change, and what can damage them? How does social polarization emerge and what drives it - off- and online. Accordingly, different platform types and phenomena of disinformation, such as clickbait, will be presented. The last part of the lecture series will deal with the search for approaches and alternatives to these problems.

The exercise session connected to this lecture is conducted in cooperation with an NGO and applies the lecture content in a practical context: The formulation of a data-based policy recommendation.

**Organizational issues**

Die Teilnahme am Kurs ist auf 25 Plätze beschränkt, diese erfolgt über das [Wiwi-Portal](#).

Die Termine werden ebenfalls zeitnah bekannt gegeben.



## T

**6.97 Module component: Digital Energy Systems [T-WIWI-114994]**

**Coordinators:** TT-Prof. Dr. Philipp Staudt  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-107649 - Sustainable Information Systems](#)

| Type                | Credits | Grading | Term offered     | Version |
|---------------------|---------|---------|------------------|---------|
| Written examination | 4,5 CP  | graded  | Each winter term | 1       |

**Assessment**

Written examination (60 minutes). The examination is offered every semester and can be repeated at any regular examination date.

**Workload**

135 hours

## T

**6.98 Module component: Digital Marketing [T-WIWI-112693]**

**Coordinators:** Prof. Dr. Ann-Kristin Kupfer  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-105312 - Marketing and Sales Management](#)  
[M-WIWI-106258 - Digital Marketing](#)

| Type                        | Credits | Grading        | Term offered     | Version |
|-----------------------------|---------|----------------|------------------|---------|
| Examination of another type | 4,5 CP  | Grading graded | Each summer term | 1       |

| Courses  |         |                                            |       |               |                        |
|----------|---------|--------------------------------------------|-------|---------------|------------------------|
| ST 2026  | 2571185 | <a href="#">Digital Marketing</a>          | 2 SWS | Lecture / 🗣️  | Kupfer                 |
| ST 2026  | 2571186 | <a href="#">Digital Marketing Exercise</a> | 1 SWS | Practice / 🗣️ | Schmitt, Cinar, Kupfer |
| Exams    |         |                                            |       |               |                        |
| WT 25/26 | 7900021 | <a href="#">Digital Marketing</a>          |       |               | Kupfer                 |
| ST 2026  | 7900064 | <a href="#">Digital Marketing</a>          |       |               | Kupfer                 |

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

**Assessment**

Success is assessed in the form of an examination of another type. The following aspects are included in the assessment:

- Elaboration and presentation of a group task
- Written exam

Further details on the organization of the performance and the points system for the assessment will be announced in the lecture.

**Prerequisites**

None

**Recommendations**

Students are highly encouraged to actively participate in class.

**Workload**

135 hours

Below you will find excerpts from courses related to this module component:

## V

**Digital Marketing**

2571185, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
On-Site

**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.

## T

**6.99 Module component: Digital Marketing and Sales in B2B [T-WIWI-106981]**

**Coordinators:** Prof. Dr. Martin Klarmann  
Anja Konhäuser

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

**Part of:** [M-WIWI-105312 - Marketing and Sales Management](#)  
[M-WIWI-106258 - Digital Marketing](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 1,5 CP  | Graded  | Each summer term | 1       |

| Courses |         |                                                    |       |                                                                                              |           |
|---------|---------|----------------------------------------------------|-------|----------------------------------------------------------------------------------------------|-----------|
| ST 2026 | 2571156 | <a href="#">Digital Marketing and Sales in B2B</a> | 1 SWS | Others /  | Konhäuser |
| Exams   |         |                                                    |       |                                                                                              |           |
| ST 2026 | 7900297 | <a href="#">Digital Marketing and Sales in B2B</a> |       |                                                                                              | Klarmann  |

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

**Assessment**

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.

**Additional Information**

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](http://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](http://marketing.iism.kit.edu)). Please note that only one of the 1.5-ECTS courses can be attended in this module.

**Workload**

45 hours

Below you will find excerpts from courses related to this module component:

## V

**Digital Marketing and Sales in B2B**

2571156, SS 2026, 1 SWS, Language: English, [Open in study portal](#)

Others (sonst.)  
On-Site

**Content****Learning Sessions:**

The class gives insights into digital marketing strategies as well as the effects and potential of different channels (e.g., SEO, SEA, Social Media). After an overview of possible activities and leverages in the digital marketing field, including their advantages and limits, the focus will turn to the B2B markets. There are certain requirements in digital strategy specific to the B2B market, particularly in relation to the value chain, sales management and customer support. Therefore, certain digital channels are more relevant for B2B marketing than for B2C marketing.

Once the digital marketing and tactics for the B2B markets are defined, further insights will be given regarding core elements of a digital strategy: device relevance (mobile, tablet), usability concepts, website appearance, app decision, market research and content management. A major advantage of digital marketing is the possibility of being able to track many aspects of user reactions and user behaviour. Therefore, an overview of key performance indicators (KPIs) will be discussed and relationships between these KPIs will be explained. To measure the effectiveness of digital activities, a digital report should be set up and connected to the performance numbers of the company (e.g. product sales) – within the course the setup of the KPI dashboard and combination of digital and non-digital measures will be shown to calculate the Return on Investment (RoI).

**Presentation Sessions:**

After the learning sessions, the students will form groups and work on digital strategies within a case study format. The presentation of the digital strategy will be in front of the class whereas the presentation will take 20 minutes followed by 10 minutes questions and answers.

- Understand digital marketing and sales approaches for the B2B sector
- Recognise important elements and understand how-to-setup of digital strategies
- Become familiar with the effectiveness and usage of different digital marketing channels
- Understand the effect of digital sales on sales management, customer support and value chain
- Be able to measure and interpret digital KPIs
- Calculate the Return on Investment (RoI) for digital marketing by combining online data with company performance data

time of presentness = 15 hrs.

private study = 30 hrs.

**Organizational issues**

Blockveranstaltung, Raum B5.26, Gebäude 01.87

6.5.26 11:00-17:00 Uhr

7.5.26 09:00-14:00 Uhr

**Literature**

-

## T

**6.100 Module component: Digital Services: Innovation & Business Models [T-WIWI-112757]****Coordinators:** Prof. Dr. Gerhard Satzger**Organisation:** KIT Department of Business and Economics

**Part of:** [M-WIWI-101410 - Business & Service Engineering](#)  
[M-WIWI-101448 - Service Management](#)  
[M-WIWI-102754 - Service Economics and Management](#)  
[M-WIWI-102806 - Service Innovation, Design & Engineering](#)  
[M-WIWI-102808 - Digital Service Systems in Industry](#)  
[M-WIWI-107528 - Information Systems: Digital Markets & Services](#)

**Type**  
Written examination

**Credits**  
4,5 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
2

| Courses  |         |                                                                             |         |                                                                                                |                                |
|----------|---------|-----------------------------------------------------------------------------|---------|------------------------------------------------------------------------------------------------|--------------------------------|
| ST 2026  | 2595468 | <a href="#">Digital Services: Innovation &amp; Business Models</a>          | 1.5 SWS | Lecture /   | Satzger, Benz, Schüritz, Heinz |
| ST 2026  | 2595469 | <a href="#">Übung zu Digital Services: Innovation &amp; Business Models</a> | 1.5 SWS | Practice /  | Satzger, Benz, Schüritz, Heinz |
| Exams    |         |                                                                             |         |                                                                                                |                                |
| WT 25/26 | 7900036 | <a href="#">Digital Services: Innovation &amp; Business Models</a>          |         |                                                                                                | Satzger                        |
| ST 2026  | 7900163 | <a href="#">Digital Services: Innovation &amp; Business Models</a>          |         |                                                                                                | Satzger                        |

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

**Assessment**

The assessment consists of a written exam (60 min.).

**Prerequisites**

None

**Recommendations**

None

**Additional Information**

The course "Digital Services: Innovation & Business Models" replaces the course Service Innovation, based on a revised course concept and content. The focus will be on the closer integration of the topics of service innovation and digitalization. Previous foundational content (e.g., on service innovation challenges or human-centered innovation methods) will remain. New content will cover topics such as digital platforms and ecosystems, IoT and smart service innovation, and business models.

Below you will find excerpts from courses related to this module component:

## V

**Digital Services: Innovation & Business Models**

2595468, SS 2026, 1.5 SWS, Language: English, [Open in study portal](#)

**Lecture (V)**  
**Blended (On-Site/Online)**

### Content

Leveraging data and digital technologies for business success is a key challenge for organizations as they need to

- get aware of the newly arising potential
- develop suitable digital services that are user-centric and individualized
- “servitize” their offering portfolio and business model
- transform their organizations

This course will equip students with concepts and methods to tackle this challenge along two dimensions: First, we will cover innovation as a concept as well as apply contemporary innovation methods (like Design Thinking, Open Innovation) to the services space. Second, we deal with leveraging innovation to develop new business models (including multi-partner concepts in platforms or ecosystems), to servitize existing business models (e.g., via product-service-systems), and to accordingly transform the organization.

The course links innovation and business model theories with practical examples and exercises. Students are asked to actively engage in the discussion.

### Organizational issues

The course will be offered in the form of a flipped classroom concept. The lecture will be recorded in advance and made available online. During the “in presence” sessions, the contents of the lecture will be applied and expanded on.

### Literature

- Bohmann, T./ Leimeister, J.M./ Möslin, K. (2014), Service Systems Engineering, Business & Information Systems Engineering, Vol. 6, No.2, 73-79.
- Cardoso, J., Fromm, H., Nickel, S., Satzger, G., Studer, R., & Weinhardt, C. (Eds.) (2015). Fundamentals of service systems (Vol. 12). Heidelberg: Springer.
- Chesbrough, H. (2011). Open services innovation: Rethinking your business to grow and compete in a new era. John Wiley & Sons.
- Rogers, S. (2003). Diffusion of Innovations. 5. ed. New York: Free Press.
- Satzger, G., Benz, C., Bohmann, T., Roth, A. (2022). Servitization and Digitalization as Siamese Twins – Concepts and Research Agenda. Edvardsson/Tronvoll (eds.): The Palgrave Handbook of Service Management, 967-989.
- Uebernickel, F., Brenner, W., Pukall, B., Naef, T., & Schindlholzer, B. (2015). Design Thinking: Das Handbuch. Frankfurt am Main: Frankfurter Allgemeine Buch.
- Vargo, S.L., Lusch, R.F. (2017). Service-dominant logic 2025. Int. J. Res. Mark. 34, 46–67.
- Weill, P.; Woerner, S.L. (2018): “What’s your Digital Business Model? – Six Questions to Help you Build the Next-Generation Enterprise“. Boston, Massachusetts: Harvard Business Review Press.



### Übung zu Digital Services: Innovation & Business Models

2595469, SS 2026, 1.5 SWS, Language: English, [Open in study portal](#)

Practice (Ü)  
On-Site

### Content

Leveraging data and digital technologies for business success is a key challenge for organizations as they need to

- get aware of the newly arising potential
- develop suitable digital services that are user-centric and individualized
- “servitize” their offering portfolio and business model
- transform their organizations

This course will equip students with concepts and methods to tackle this challenge along two dimensions: First, we will cover innovation as a concept as well as apply contemporary innovation methods (like Design Thinking, Open Innovation) to the services space. Second, we deal with leveraging innovation to develop new business models (including multi-partner concepts in platforms or ecosystems), to servitize existing business models (e.g., via product-service-systems), and to accordingly transform the organization.

The course links innovation and business model theories with practical examples and exercises. Students are asked to actively engage in the discussion.

### Organizational issues

The course will be offered in the form of a flipped classroom concept. The lecture will be recorded in advance and made available online. During the “in presence” sessions, the contents of the lecture will be applied and expanded on.

**Literature**

- Bohmann, T./ Leimeister, J.M./ Möslin, K. (2014), Service Systems Engineering, Business & Information Systems Engineering, Vol. 6, No.2, 73-79.
- Cardoso, J., Fromm, H., Nickel, S., Satzger, G., Studer, R., & Weinhardt, C. (Eds.) (2015). Fundamentals of service systems (Vol. 12). Heidelberg: Springer.
- Chesbrough, H. (2011). Open services innovation: Rethinking your business to grow and compete in a new era. John Wiley & Sons.
- Rogers, S. (2003). Diffusion of Innovations. 5. ed. New York: Free Press.
- Satzger, G., Benz, C., Bohmann, T., Roth, A. (2022). Servitization and Digitalization as Siamese Twins – Concepts and Research Agenda. Edvardsson/Tronvoll (eds.): The Palgrave Handbook of Service Management, 967-989.
- Uebernickel, F., Brenner, W., Pukall, B., Naef, T., & Schindlholzer, B. (2015). Design Thinking: Das Handbuch. Frankfurt am Main: Frankfurter Allgemeine Buch.
- Vargo, S.L., Lusch, R.F. (2017). Service-dominant logic 2025. Int. J. Res. Mark. 34, 46–67.
- Weill, P.; Woerner, S.L. (2018): "What's your Digital Business Model? – Six Questions to Help you Build the Next-Generation Enterprise". Boston, Massachusetts: Harvard Business Review Press.

**T****6.101 Module component: Digital Transformation of Public Administration [T-WIWI-114977]**

**Coordinators:** Philipp Bauer  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101507 - Innovation Management](#)  
[M-WIWI-101507 - Innovation Management](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 3 CP    | Graded  | Irregular    | 1       |

**Assessment**

The assessment of success in this course is carried out as a non exam assessment. The grade is made up as follows:

1. **Written elaboration:** (weighting: 75 %). The required scope depends on the current requirements of the degree program for recognition in the seminar module.
2. **Presentation of the final project:** (weighting: 25 %).

**Prerequisites**

None

**Recommendations**

Prior attendance of the course Innovation Management is recommended.

**Workload**

90 hours



## T

**6.102 Module component: Discrete-Event Simulation in Production and Logistics [T-WIWI-102718]****Coordinators:** Hon.-Prof. Dr. Sven Spieckermann**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-102805 - Service Operations](#)[M-WIWI-102832 - Operations Research in Supply Chain Management](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 4,5 CP  | Graded  | Each summer term | 2       |

| Courses |         |                                                                        |       |                                                                                               |              |
|---------|---------|------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|--------------|
| ST 2026 | 2550488 | <a href="#">Ereignisdiskrete Simulation in Produktion und Logistik</a> | 3 SWS | Lecture /  | Spieckermann |
| Exams   |         |                                                                        |       |                                                                                               |              |
| ST 2026 | 7900244 | <a href="#">Discrete-Event Simulation in Production and Logistics</a>  |       |                                                                                               | Spieckermann |

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

The assessment consists of a written paper and an oral exam of about 30-40 min (alternative exam assessment).

**Prerequisites**

None

**Recommendations**

Basic knowledge as conveyed in the module "Introduction to Operations Research" is assumed.

**Additional Information**

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 courses related to this module component:*

## V

**Ereignisdiskrete Simulation in Produktion und Logistik**2550488, SS 2026, 3 SWS, Language: German, [Open in study portal](#)**Lecture (V)**  
**On-Site****Content**

Simulation of production and logistics systems is an interdisciplinary subject connecting expert knowledge from production management and operations research with mathematics/statistics as well as computer science and software engineering. With completion of this course, students know statistical foundations of discrete simulation, are able to classify and apply related software applications, and know the relation between simulation and optimization as well as a number of application examples. Furthermore, students are enabled to structure simulation studies and are aware of specific project scheduling issues.

**Organizational issues**Den Bewerbungszeitraum finden Sie auf der Veranstaltungswebseite im Lehre-Bereich unter [dol.ior.kit.edu](http://dol.ior.kit.edu)

**Literature**

- Gutenschwager K., Rabe M., Spieckermann S. und S. Wenzel (2017): Simulation in Produktion und Logistik, Springer, Berlin.
- Banks J., Carson II J. S., Nelson B. L., Nicol D. M. (2010) Discrete-event system simulation, 5.Aufl., Pearson, Upper Saddle River.
- Eley, M. (2012): Simulation in der Logistik - Einführung in die Erstellung ereignisdiskreter Modelle unter Verwendung des Werkzeuges "Plant Simulation", Springer, Berlin und Heidelberg
- Kosturiak, J. und M. Gregor (1995): Simulation von Produktionssystemen. Springer, Wien und New York.
- Law, A. M. (2015): Simulation Modeling and Analysis. 5th Edition, McGraw-Hill, New York usw.
- Liebl, F. (1995): Simulation. 2. Auflage, Oldenbourg, München.
- Noche, B. und S. Wenzel (1991): Marktspiegel Simulationstechnik. In: Produktion und Logistik. TÜV Rheinland, Köln.
- Pidd, M. (2004): Computer Simulation in Management Science. 5th Edition, Wiley, Chichester.
- Robinson S (2004) Simulation: the practice of model development and use. John Wiley & Sons, Chichester
- VDI (2014): Simulation von Logistik-, Materialfluß- und Produktionssystemen. VDI Richtlinie 3633, Blatt 1, VDI-Verlag, Düsseldorf.

## T

**6.103 Module component: Distributed Computing [T-INFO-114235]**

**Coordinators:** Prof. Dr. Achim Streit  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-107215 - Distributed Computing](#)

| Type                | Credits | Grading        | Term offered     | Version |
|---------------------|---------|----------------|------------------|---------|
| Written examination | 4 CP    | Grading graded | Each winter term | 1       |

| Courses  |         |                                       |       |                                                                                               |                        |
|----------|---------|---------------------------------------|-------|-----------------------------------------------------------------------------------------------|------------------------|
| WT 25/26 | 2400050 | <a href="#">Distributed Computing</a> | 2 SWS | Lecture /  | Streit, Krauß, Schnepf |
| Exams    |         |                                       |       |                                                                                               |                        |
| WT 25/26 | 7500178 | <a href="#">Distributed Computing</a> |       |                                                                                               | Streit                 |

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

**Assessment**

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 60 minutes. Depending on the number of participants it will be announced six weeks before the assessment (§3 Abs. 3 SPO) if the assessment is done

- as an oral examination according to § 4 Abs. 2 No. 2 SPO or
- as a written examination according to § 4 Abs. 2 No. 1 SPO.

**Prerequisites**

None.

**Recommendations**

Knowledge in the area of computer networks helpful.

Below you will find excerpts from courses related to this module component:

## V

**Distributed Computing**

2400050, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

**Lecture (V)**  
On-Site

**Content**

The lecture "Distributed Computing" provides an introduction to the world of distributed computing with a focus on the fundamentals and technologies of Grid and Cloud computing as well as the handling of Big Data. The lecture combines theory and application with the help of relevant application examples and common methods from science and business.

First, an introduction to the main characteristics of distributed systems is given. Then the topic of grid computing is discussed in more detail and the close relationship between Grid Computing and distributed data management is illustrated using the example of the WLCG, the infrastructure for distributing, storing and analyzing data from the particle accelerator at CERN. The topic of Cloud Computing is then discussed and contrasted with the previous section. After defining basic terms and concepts, virtualization is presented as one of the basic technologies of cloud computing; finally, common architectures, services and components in the cloud environment are discussed using examples and in general.

In the further course of the lecture, common procedures for authorization and authentication in distributed environments are discussed. The lecture includes a description of the basics of Authentication and Authorization Infrastructures (AAI) as well as different technologies, such as certificate or token-based procedures.

In a further thematic block, concepts for the management of large or distributed data are presented. Common tools and frameworks are discussed, as well as the life cycle of data, its metadata and data storage.

Finally, the topics of the lecture, grid computing, big data and cloud computing, are reflected and linked and different paradigms for data analysis are presented. Corresponding examples are introduced for each of the topics.

Success is assessed in the form of a written examination/e-exam (usually lasting 60 minutes) in accordance with Section 4 (2) No. 1 SPO. Depending on the number of participants, it will be announced six weeks before the examination (§ 6 Para. 3 SPO) whether the assessment will take place

- in the form of an oral examination in accordance with § 4 Para. 2 No. 2 SPO or
- in the form of a written examination/e-exam in accordance with § 4 Para. 2 No. 1 SPO

120 h / semester, of which 30 h attendance time and 90 h self-study due to the complexity of the subject matter

**Literature**

1. Andrew Tanenbaum, Maarten van Steen: "Distributed systems: principles and paradigms", Prentice Hall, 2007, ISBN 0-13-613553-6
2. Ian Foster, Carl Kesselmann: "The Grid. Blueprint for a New Computing Infrastructure (2nd Edition)", Morgan Kaufmann, 2004, ISBN 1-55860-933-4
3. Fran Berman, Geoffrey Fox, Anthony J.G. Hey: "Grid Computing: Making the Global Infrastructure a Reality", Wiley, 2003, ISBN 0-470-85319-0
4. Tony Hey: "The Fourth Paradigm: Data-intensive Scientific Discovery", Microsoft Research, 2009, ISBN 978-0-9825442-0-4
5. Rajkumar Buyya, James Broberg und Andrzej M. Goscinski: "Cloud Computing: Principles and Paradigms", Wiley, 2011, ISBN 978-0-470-88799-8

## T

**6.104 Module component: Dynamic Macroeconomics [T-WIWI-109194]****Coordinators:** Prof. Dr. Johannes Brumm**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-107010 - Economics in a Connected World](#)  
[M-WIWI-107011 - Economics of Innovation and Growth](#)**Type**  
Written examination**Credits**  
4,5 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
4

| Courses  |         |                                                 |       |                                                                                                |                   |
|----------|---------|-------------------------------------------------|-------|------------------------------------------------------------------------------------------------|-------------------|
| WT 25/26 | 2560402 | <a href="#">Dynamic Macroeconomics</a>          | 2 SWS | Lecture /   | Brumm, Schang     |
| WT 25/26 | 2560403 | <a href="#">Übung zu Dynamic Macroeconomics</a> | 1 SWS | Practice /  | Hußmann, Kissling |
| Exams    |         |                                                 |       |                                                                                                |                   |
| WT 25/26 | 7900261 | <a href="#">Dynamic Macroeconomics</a>          | Brumm |                                                                                                |                   |

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

The assessment is a written exam (60 min.).

**Prerequisites**

None.

**Workload**

135 hours

Below you will find excerpts from courses related to this module component:

## V

**Dynamic Macroeconomics**2560402, WS 25/26, 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 quantitative dynamic models and their fundamental role in modern macroeconomics in explaining observed phenomena and their use as a laboratory for policy exercises.

The first part of the course introduces seminal workhorse models in the representative agent framework. We will cover the Ramsey model for optimal growth, the Real Business Cycle (RBC) model for business cycle dynamics, and the New Keynesian (NK) model for analysing monetary economics. The second part expands these basic models to incorporate household heterogeneity and incomplete markets. We will analyse the Aiyagari model and the state-of-the-art Heterogeneous Agent New Keynesian (HANK) model to investigate more realistic economic inequality and analyse the distributional impact of policies along the income and wealth distribution.

Alongside the economic models, the course introduces advanced methods to numerically solve, simulate and estimate quantitative models in economics. The course pursues a hands-on approach: students will gain not only theoretical insights but also learn numerical tools to solve dynamic economic models using the programming language Python. The course will be an excellent preparation for writing a thesis at the Chair of Macroeconomics and for engaging with economic research more generally.

**Literature**

Literatur und Skripte werden in der Veranstaltung angegeben.

## T

**6.105 Module component: Economic Decision Making [T-WIWI-114174]**

**Coordinators:** Prof. Dr. Benjamin Scheibehenne  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-105312 - Marketing and Sales Management](#)  
[M-WIWI-105714 - Consumer Research](#)  
[M-WIWI-105923 - Incentives, Interactivity & Decisions in Organizations](#)  
[M-WIWI-106258 - Digital Marketing](#)

| Type                        | Credits | Grading | Term offered     | Expansion   | Version |
|-----------------------------|---------|---------|------------------|-------------|---------|
| Examination of another type | 4,5 CP  | graded  | Each winter term | 1 semesters | 1       |

| Courses  |         |                                          |       |                                                                                                         |              |
|----------|---------|------------------------------------------|-------|---------------------------------------------------------------------------------------------------------|--------------|
| WT 25/26 | 2500059 | <a href="#">Economic Decision Making</a> | 3 SWS | Lecture / Practice /  | Scheibehenne |
| Exams    |         |                                          |       |                                                                                                         |              |
| WT 25/26 | 7900173 | <a href="#">Economic Decision Making</a> |       |                                                                                                         | Scheibehenne |

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

**Assessment**

Alternative exam assessment. The course format consists of a lecture and a corresponding exercise. The grading includes the following aspects:

- A written exam (60 minutes)
- A presentation during the exercise
- Regular attendance
- In-class assignments

The scoring system for the grading will be announced at the beginning of the course.

**Prerequisites**

Registration via the WiWi Portal is required for participation in the Übung. The Übung is a prerequisite for the exam.

**Additional Information**

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.

**Workload**

135 hours

Below you will find excerpts from courses related to this module component:

## V

**Economic Decision Making**

2500059, WS 25/26, 3 SWS, Language: English, [Open in study portal](#)

Lecture / Practice (VÜ)  
On-Site

**Content**

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

## T

**6.106 Module component: Economics of Innovation [T-WIWI-112822]****Coordinators:** Prof. Dr. Ingrid Ott**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-107010 - Economics in a Connected World](#)  
[M-WIWI-107011 - Economics of Innovation and Growth](#)**Type**  
Written examination**Credits**  
4,5 CP**Grading**  
graded**Term offered**  
Each summer term**Version**  
1

| Courses  |         |                                                      |       |                                                                                                |               |
|----------|---------|------------------------------------------------------|-------|------------------------------------------------------------------------------------------------|---------------|
| ST 2026  | 2560236 | <a href="#">Economics of Innovation</a>              | 2 SWS | Lecture /   | Ott           |
| ST 2026  | 2560237 | <a href="#">Exercises of Economics of Innovation</a> | 1 SWS | Practice /  | Ott, Mirzoyan |
| Exams    |         |                                                      |       |                                                                                                |               |
| WT 25/26 | 7900077 | <a href="#">Economics of Innovation</a>              |       |                                                                                                | Ott           |
| ST 2026  | 7900107 | <a href="#">Economics of Innovation</a>              |       |                                                                                                | Ott           |

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

Success is assessed in the form of a written examination (60 minutes). The examination is offered every semester and can be repeated at any regular examination date.

A bonus can be earned by completing a short written assignment and presenting it in the tutorial. If the grade of the written examination is between 4.0 and 1.3, the bonus improves the grade by a maximum of one grade level (0.3 or 0.4). The exact criteria for awarding a bonus will be announced at the beginning of the lecture.

**Prerequisites**

None

**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.

**Additional Information**

Due to Prof. Dr. Ingrid Ott's research semester, the lectures for this course will not be offered in the summer semester 2026.

Below you will find excerpts from courses related to this module component:

## V

**Economics of Innovation**2560236, SS 2026, 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.

**Organizational issues**

Die Vorlesung wird im SoSe 2026 aufgrund eines Forschungssemesters nicht gelesen. Die Prüfung findet statt. Vorbereitungsunterlagen finden Sie im ILIAS.

**Literature**

Auszug:

- Aghion, P., Howitt, P. (2009), The Economics of Growth, MIT Press, Cambridge MA.
- de la Fuente, A. (2000), Mathematical Methods and Models for Economists. Cambridge University Press, Cambridge, UK.
- Klodt, H. (1995), Grundlagen der Forschungs- und Technologiepolitik. Vahlen, München.
- Linde, R. (2000), Allokation, Wettbewerb, Verteilung - Theorie, UNIBUCH Verlag, Lüneburg.
- Ruttan, V. W. (2001), Technology, Growth, and Development. Oxford University Press, Oxford.
- Scotchmer, S. (2004), Incentives and Innovation, MIT Press.
- Tirole, Jean (1988), The Theory of Industrial Organization, MIT Press, Cambridge MA.

## T

**6.107 Module component: Efficient Energy Systems and Electric Mobility [T-WIWI-102793]**

**Coordinators:** Prof. Dr. Patrick Jochem  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101452 - Energy Economics and Technology](#)

| Type                | Credits | Grading | Term offered     | Version |
|---------------------|---------|---------|------------------|---------|
| Written examination | 3,5 CP  | Graded  | Each summer term | 1       |

| Courses  |         |                                                                |       |                                                                                               |          |
|----------|---------|----------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|----------|
| ST 2026  | 2581006 | <a href="#">Efficient Energy Systems and Electric Mobility</a> | 2 SWS | Lecture /  | Jochem   |
| Exams    |         |                                                                |       |                                                                                               |          |
| WT 25/26 | 7981006 | <a href="#">Efficient Energy Systems and Electric Mobility</a> |       |                                                                                               | Fichtner |
| ST 2026  | 7981006 | <a href="#">Efficient Energy Systems and Electric Mobility</a> |       |                                                                                               | Fichtner |

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

**Assessment**

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.

**Prerequisites**

None

**Recommendations**

Literature:

Masters, G. M. & K. F. Hsu (2023). Renewable and efficient electric power systems. John Wiley & Sons. (Chapter 9).  
 Viral, R., Tomar, A., Asija, D., Rao, U. M., & Sarwar, A. (Eds.). (2024). Smart Grids for Renewable Energy Systems, Electric Vehicles and Energy Storage Systems. CRC Press.

Below you will find excerpts from courses related to this module component:

## V

**Efficient Energy Systems and Electric Mobility**

2581006, SS 2026, 2 SWS, Language: German/English, [Open in study portal](#)

Lecture (V)  
On-Site

**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**

Termine: 24.04., 08.05., 22.05., 05.06., 19.06., 03.07., 17.07., 24.07.26

**Literature**

Wird in der Vorlesung bekanntgegeben.

## T

**6.108 Module component: eFinance: Information Systems for Securities Trading [T-WIWI-110797]**

**Coordinators:** Prof. Dr. Christof Weinhardt  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101446 - Market Engineering](#)  
[M-WIWI-101480 - Finance 3](#)  
[M-WIWI-101483 - Finance 2](#)  
[M-WIWI-107528 - Information Systems: Digital Markets & Services](#)

| Type                | Credits | Grading        | Term offered     | Version |
|---------------------|---------|----------------|------------------|---------|
| Written examination | 4,5 CP  | Grading graded | Each winter term | 2       |

| Courses  |         |                                                                                         |           |                                                                                                |            |
|----------|---------|-----------------------------------------------------------------------------------------|-----------|------------------------------------------------------------------------------------------------|------------|
| WT 25/26 | 2540454 | <a href="#">eFinance: Information Systems for Securities Trading</a>                    | 2 SWS     | Lecture /   | Weinhardt  |
| WT 25/26 | 2540455 | <a href="#">Übungen zu eFinance: Information Systems for Securities Trading</a>         | 1 SWS     | Practice /  | Motz, Motz |
| Exams    |         |                                                                                         |           |                                                                                                |            |
| WT 25/26 | 7900182 | <a href="#">eFinance: Information Engineering and Management for Securities Trading</a> | Weinhardt |                                                                                                |            |
| ST 2026  | 7900269 | <a href="#">eFinance: Information Systems for Securities Trading</a>                    | Weinhardt |                                                                                                |            |

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

**Assessment**

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.

**Additional Information**

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.

**Workload**

135 hours

Below you will find excerpts from courses related to this module component:

## V

**eFinance: Information Systems for Securities Trading**

2540454, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
On-Site

**Literature**

- Picot, Arnold, Christine Bortenlänger, Heiner Röhl (1996): "Börsen im Wandel". Knapp, Frankfurt
- Harris, Larry (2003): "Trading and Exchanges - Market Microstructure for Practitioners". Oxford University Press, New York

**Weiterführende Literatur:**

- Gomber, Peter (2000): "Elektronische Handelssysteme - Innovative Konzepte und Technologien". Physika Verlag, Heidelberg
- Schwartz, Robert A., Reto Francioni (2004): "Equity Markets in Action - The Fundamentals of Liquidity, Market Structure and Trading". Wiley, Hoboken, NJ

## T

**6.109 Module component: Emissions into the Environment [T-WIWI-102634]**

**Coordinators:** Ute Karl  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101412 - Industrial Production III](#)  
[M-WIWI-101471 - Industrial Production II](#)

| Type                | Credits | Grading | Term offered     | Version |
|---------------------|---------|---------|------------------|---------|
| Written examination | 3,5 CP  | Graded  | Each winter term | 1       |

| Courses  |         |                                                |            |                                                                                               |      |
|----------|---------|------------------------------------------------|------------|-----------------------------------------------------------------------------------------------|------|
| WT 25/26 | 2581962 | <a href="#">Emissions into the Environment</a> | 2 SWS      | Lecture /  | Karl |
| Exams    |         |                                                |            |                                                                                               |      |
| WT 25/26 | 7981962 | <a href="#">Emissions into the Environment</a> | Schultmann |                                                                                               |      |
| ST 2026  | 7981962 | <a href="#">Emissions into the Environment</a> | Schultmann |                                                                                               |      |

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

**Assessment**

The assessment consists of an oral (30 minutes) or 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.

**Recommendations**

None

**Workload**

105 hours

Below you will find excerpts from courses related to this module component:

## V

**Emissions into the Environment**

2581962, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)

Lecture (V)  
On-Site

**Content**

Emission sources/emission monitoring/emission reduction: The lecture gives an overview of relevant emissions of air pollutants and greenhouse gases, emission monitoring and pollutant abatement options together with relevant legal regulations at national and international level. In addition, the fundamentals of circular economy, waste management and recycling are explained.

**Structure:**

## Air pollution control

- Introduction, terms and definitions
- Sources of air pollutants
- Legal framework of air quality control
- Technical measures to reduce air pollutant emissions

## Circular economy, recycling and waste management

- Waste collection and logistics
- Dual systems for packaging waste
- Recycling
- Thermal and biological waste treatment
- Final waste disposal

**Literature**

Wird in der Veranstaltung bekannt gegeben.

## T

**6.110 Module component: Empirical Software Engineering [T-INFO-115054]**

**Coordinators:** Raziye Dehghani  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-107685 - Empirical Software Engineering](#)

| Type             | Credits | Grading | Term offered | Version |
|------------------|---------|---------|--------------|---------|
| Oral examination | 4 CP    | graded  | Each term    | 1       |

**Assessment**

The assessment is carried out as an oral examination, lasting approx. 30 minutes in accordance with Section 4 (2) No. 2 SPO.

**Prerequisites**

None.

**Recommendations**

Familiarity with statistical analysis methods is highly recommended.

**T****6.111 Module component: Employment Law [T-INFO-111436]**

**Coordinators:** Dr. Alexander Hoff  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-101216 - Private Business Law](#)

**Type**  
Written examination

**Credits**  
3 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
2

| Courses  |         |                                |       |                                                                                               |         |
|----------|---------|--------------------------------|-------|-----------------------------------------------------------------------------------------------|---------|
| ST 2026  | 24668   | <a href="#">Employment Law</a> | 2 SWS | Lecture /  | Steg    |
| Exams    |         |                                |       |                                                                                               |         |
| WT 25/26 | 7500001 | <a href="#">Employment Law</a> |       |                                                                                               | Matz    |
| ST 2026  | 7500082 | <a href="#">Employment Law</a> |       |                                                                                               | Sattler |

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

## T

**6.112 Module component: Energy and Environment [T-WIWI-102650]****Coordinators:** Ute Karl**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-101452 - Energy Economics and Technology](#)  
[M-WIWI-101468 - Environmental Economics](#)**Type**  
Written examination**Credits**  
3,5 CP**Grading**  
graded**Term offered**  
Each summer term**Version**  
2

| Courses  |         |                                            |       |                                                                                               |      |
|----------|---------|--------------------------------------------|-------|-----------------------------------------------------------------------------------------------|------|
| ST 2026  | 2581003 | <a href="#">Energy and Environment</a>     | 2 SWS | Lecture /  | Karl |
| Exams    |         |                                            |       |                                                                                               |      |
| WT 25/26 | 7900302 | <a href="#">Energy and Environment NEW</a> |       |                                                                                               | Karl |
| ST 2026  | 7900294 | <a href="#">Energy and Environment NEW</a> |       |                                                                                               | Karl |

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

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.

**Prerequisites**

None.

**Workload**

105 hours

Below you will find excerpts from courses related to this module component:

## V

**Energy and Environment**2581003, SS 2026, 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)

## T

**6.113 Module component: Energy Informatics 1 [T-INFO-103582]**

**Coordinators:** Prof. Dr. Veit Hagenmeyer  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-106864 - Energy Informatics](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 5 CP    | graded  | Each winter term | 2       |

| Courses  |         |                                      |       |                    |                                          |
|----------|---------|--------------------------------------|-------|--------------------|------------------------------------------|
| WT 25/26 | 2400058 | <a href="#">Energy Informatics 1</a> | 4 SWS | Lecture / Practice | Hagenmeyer, Rapp, Dorn, Schmurr, Langner |
| Exams    |         |                                      |       |                    |                                          |
| WT 25/26 | 7500174 | <a href="#">Energy informatics 1</a> |       |                    | Hagenmeyer                               |
| ST 2026  | 7500079 | <a href="#">Energy informatics 1</a> |       |                    | Hagenmeyer                               |

**Assessment**

The assessment takes the form of an oral examination, usually lasting 30 minutes in accordance with Section 4 (2) No. 2 SPO.

Depending on the number of participants, it will be announced six weeks before the examination (§ 6 Para. 3 SPO) whether the performance assessment

- in the form of an oral examination in accordance with § 4 Para. 2 No. 2 SPO **or**
- in the form of a written examination in accordance with § 4 Para. 2 No. 1 SPO

will take place.

**Prerequisites**

The preliminary work (T-INFO-110356) must be passed.

*Below you will find excerpts from courses related to this module component:*

## V

**Energy Informatics 1**

2400058, WS 25/26, 4 SWS, Language: German/English, [Open in study portal](#)

Lecture / Practice (VÜ)

**Content**

This module provides an overview of the physical and technical principles of different forms of energy, their storage, their transmission and the corresponding energy conversion processes. Furthermore, this module covers the system-technical combination of different local energy systems to form an overall energy system and provides an outlook on typical information technology applications in the energy sector.

In detail, the following topics are discussed with examples:

- Energy forms, systems and storage
- Energy conversion processes in power plants
- Renewable resources
- Energy transmission (electricity/gas/heat networks)
- Electrical networks of the future, load management
- Use of information and communication technology (ICT)
- Energy Economics

**Literature**

Diese werden in der Vorlesung gegeben.



**T****6.114 Module component: Energy Informatics 1 - Preliminary Work [T-INFO-110356]**

**Coordinators:** Prof. Dr. Veit Hagenmeyer  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-106864 - Energy Informatics](#)

**Type**  
Coursework

**Credits**  
0 CP

**Grading**  
pass/fail

**Term offered**  
Each term

**Version**  
1

| Exams    |         |                                                         |            |
|----------|---------|---------------------------------------------------------|------------|
| WT 25/26 | 7500235 | <a href="#">Energy Informatics 1 - preliminary work</a> | Hagenmeyer |
| ST 2026  | 7500065 | <a href="#">Energy Informatics 1 - preliminary work</a> | Hagenmeyer |

**Assessment**

Success is assessed in the form of coursework in accordance with Section 4 (3) SPO.

**Prerequisites**

None

## T

**6.115 Module component: Energy Informatics 2 [T-INFO-106059]**

**Coordinators:** Prof. Dr. Veit Hagenmeyer  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-106864 - Energy Informatics](#)

**Type**  
Oral examination

**Credits**  
5 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
2

| Courses  |         |                                      |       |                           |                                                                                        |
|----------|---------|--------------------------------------|-------|---------------------------|----------------------------------------------------------------------------------------|
| ST 2026  | 2400017 | <a href="#">Energy Informatics 2</a> | 4 SWS | Lecture / Practice /<br>● | Hagenmeyer, Förderer,<br>Bao, Suess, Cakmak,<br>Mikut, Schmurr,<br>Langner, Rapp, Dorn |
| Exams    |         |                                      |       |                           |                                                                                        |
| WT 25/26 | 7500156 | <a href="#">Energy Informatics 2</a> |       |                           | Hagenmeyer                                                                             |
| ST 2026  | 7500156 | <a href="#">Energy Informatics 2</a> |       |                           | Hagenmeyer                                                                             |

Legend: ■ Online, 🔄 Blended (On-Site/Online), ● On-Site, ✕ Cancelled

**Assessment**

The assessment takes the form of an oral examination, usually lasting 30 minutes in accordance with Section 4 (2) No. 2 SPO.

Depending on the number of participants, it will be announced six weeks before the examination (§ 6 Para. 3 SPO) whether the performance assessment

- in the form of an oral examination in accordance with § 4 Para. 2 No. 2 SPO or
- in the form of a written examination in accordance with § 4 Para. 2 No. 1 SPO

will take place.

**Prerequisites**

Energy Informatics I

*Below you will find excerpts from courses related to this module component:*

## V

**Energy Informatics 2**

2400017, SS 2026, 4 SWS, Language: German/English, [Open in study portal](#)

**Lecture / Practice (VÜ)**  
On-Site

**Content**

This module builds on the module “Energy Informatics 1.” Based on the physical and technical fundamentals of energy forms, conversion, storage, and transmission described there, as well as an overview of typical applications of energy informatics, this module teaches information technology approaches and methods that are necessary for the transformation of the existing energy system into an energy system of the future (e.g., smart grid, microgrid).

Specifically, this includes the following topics, for example:

- Modern control center software and concepts for use in smart grids
- Hardware and software infrastructure for the simulation and analysis of energy networks:
  - Power grid analysis, simulation, and modeling
  - Measurement and monitoring in microgrids
  - 3D building and neighborhood models
  - Building-based heat/cold storage for load control in smart grids
  - Energy system modeling
- Big data in the context of future energy systems:
  - Energy data management, data types, data storage
  - Data analysis (forecasting, data mining)
- Control and optimization of energy systems
- Real-time capable, reliable, and secure software systems in energy systems

**Literature**

Diese werden in der Vorlesung gegeben.

## T

**6.116 Module component: Energy Market Engineering [T-WIWI-107501]****Coordinators:** Prof. Dr. Christof Weinhardt**Organisation:** KIT Department of Business and Economics

**Part of:** [M-WIWI-101411 - Information Engineering](#)  
[M-WIWI-101446 - Market Engineering](#)  
[M-WIWI-101451 - Energy Economics and Energy Markets](#)  
[M-WIWI-103720 - eEnergy: Markets, Services and Systems](#)  
[M-WIWI-107528 - Information Systems: Digital Markets & Services](#)

**Type**  
Written examination

**Credits**  
4,5 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
1

| Courses  |         |                                                    |           |                                                                                                |                    |
|----------|---------|----------------------------------------------------|-----------|------------------------------------------------------------------------------------------------|--------------------|
| ST 2026  | 2540464 | <a href="#">Energy Market Engineering</a>          | 2 SWS     | Lecture /   | Semmelmann, Miskiw |
| ST 2026  | 2540465 | <a href="#">Übung zu Energy Market Engineering</a> | 1 SWS     | Practice /  | Resch              |
| Exams    |         |                                                    |           |                                                                                                |                    |
| WT 25/26 | 7900127 | <a href="#">Energy Market Engineering</a>          | Weinhardt |                                                                                                |                    |

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

**Assessment**

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

**Recommendations**

None

**Additional Information**

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 courses related to this module component:

## V

**Energy Market Engineering**

2540464, SS 2026, 2 SWS, Language: German/English, [Open in study portal](#)

**Lecture (V)**  
On-Site

### Content

The lecture "Energy Market Engineering" addresses the design and analysis of energy markets considering current developments and challenges. A particular focus is on the integration of renewable energies and the associated market mechanisms and regulations.

Specifically, the following topics are covered:

- **Introduction to Market Engineering:** What design elements do markets and specifically auctions have in general, and what influence does this have on participant behavior.
- **Introduction to Energy Markets:** Fundamentals and current trends in the energy system, including climate change and the expansion of renewable energies.
- **Market Design and Products:** Various pricing models such as nodal pricing, zonal pricing, and the structure of capacity markets.
- **Grid Expansion, Distribution Networks, and Flexibility Markets:** Analysis of distribution network markets and the role of flexibility options like demand response and storage technologies.
- **Intermittent Generation and Grid Stability:** Challenges posed by fluctuating renewable energies and strategies to ensure grid stability.
- **Digitalization and Market Transparency:** The role of digitalization in improving market transparency and efficiency, including the use of smart metering systems and data-driven approaches.
- **Current Research Projects and Developments:** Presentation of ongoing research projects and their significance for the future design of energy markets.

### Organizational issues

Die Vorlesung wird als zweiwöchige Blockveranstaltung gehalten. Die genauen Termine und Themenblöcke werden in der Auftaktveranstaltung sowie auf Ilias kommuniziert.

### Literature

- Erdmann G, Zweifel P. *Energieökonomik, Theorie und Anwendungen*. Berlin Heidelberg: Springer; 2007.
- Grimm V, Ockenfels A, Zoettl G. Strommarktdesign: Zur Ausgestaltung der Auktionsregeln an der EEX \*. *Zeitschrift für Energiewirtschaft*. 2008:147-161.
- Stoft S. *Power System Economics: Designing Markets for Electricity*. IEEE; 2002.,
- Ströbele W, Pfaffenberger W, Heuterkes M. *Energiewirtschaft: Einführung in Theorie und Politik*. 2nd ed. München: Oldenbourg Verlag; 2010:349.

## T

**6.117 Module component: Energy Networks and Regulation [T-WIWI-107503]****Coordinators:** Prof. Dr. Christof Weinhardt**Organisation:** KIT Department of Business and Economics

**Part of:** [M-WIWI-101446 - Market Engineering](#)  
[M-WIWI-103720 - eEnergy: Markets, Services and Systems](#)  
[M-WIWI-107528 - Information Systems: Digital Markets & Services](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 4,5 CP  | Graded  | Each winter term | 2       |

| Courses  |         |                                                         |           |                                                                                                |                |
|----------|---------|---------------------------------------------------------|-----------|------------------------------------------------------------------------------------------------|----------------|
| WT 25/26 | 2540494 | <a href="#">Energy Networks and Regulation</a>          | 2 SWS     | Lecture /   | Rogat, Miskiwi |
| WT 25/26 | 2540495 | <a href="#">Übung zu Energy Networks and Regulation</a> | 1 SWS     | Practice /  | Rogat, Miskiwi |
| Exams    |         |                                                         |           |                                                                                                |                |
| WT 25/26 | 7900198 | <a href="#">Energy Networks and Regulation</a>          | Weinhardt |                                                                                                |                |

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

**Assessment**

Success is assessed in the form of an oral examination (in accordance with §4(2), 1 SPO).  
 The examination is offered in the semester of the lecture.

**Prerequisites**

None

**Recommendations**

None

Below you will find excerpts from courses related to this module component:

## V

**Energy Networks and Regulation**

2540494, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)

Lecture (V)  
On-Site

## 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

Linnemann, M. (2024). *Energiewirtschaft für (Quer-)Einsteiger: Einmaleins der Stromwirtschaft*. Deutschland: Springer Fachmedien Wiesbaden.

Averch, H.; Johnson, L.L (1962). Behavior of the firm under regulatory constraint, in: *American Economic Review*, 52 (5), S. 1052 – 1069.

Bundesnetzagentur (2006): Bericht der Bundesnetzagentur nach § 112a EnWG zur Einführung der Anreizregulierung nach § 21a EnWG, [http://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/Sachgebiete/Energie/Unternehmen\\_Institutionen/Netzentgelte/Anreizregulierung/BerichtEinfuehrgAnreizregulierung.pdf?\\_\\_blob=publicationFile&v=3](http://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/Sachgebiete/Energie/Unternehmen_Institutionen/Netzentgelte/Anreizregulierung/BerichtEinfuehrgAnreizregulierung.pdf?__blob=publicationFile&v=3).

Bundesnetzagentur (2015): Evaluierungsbericht nach § 33 Anreizregulierungsverordnung, [https://www.bmwi.de/Redaktion/DE/Downloads/A/anreizregulierungsverordnung-evaluierungsbericht.pdf?\\_\\_blob=publicationFile&v=1](https://www.bmwi.de/Redaktion/DE/Downloads/A/anreizregulierungsverordnung-evaluierungsbericht.pdf?__blob=publicationFile&v=1).

Filippini, M.; Wild, J.; Luchsinger, C. (2001): *Regulierung der Verteilnetzpreise zu Beginn der Marktöffnung. Erfahrungen in Norwegen und Schweden*, Bundesamt für Energie, Bern, [http://www.iaea.org/inis/collection/NCLCollectionStore/\\_Public/34/066/34066585.pdf](http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/34/066/34066585.pdf).

Gómez, T. (2013): Monopoly Regulation, in: Pérez-Arriaga, I.J. (Hg.): *Regulation of the Power Sector*, S. 151 – 198, Springer-Verlag, London.

Gómez, T. (2013): Electricity Distribution, in: Pérez-Arriaga, I.J. (Hg.): *Regulation of the Power Sector*, S. 199 – 250, Springer-Verlag, London.

Pérez-Arriaga, I.J. (2013): Challenges in Power Sector Regulation, in: Pérez-Arriaga, I.J. (Hg.): *Regulation of the Power Sector*, S. 647 – 678, Springer-Verlag, London.

Rivier, M.; Pérez-Arriaga, I.J.; Olmos, L. (2013): Electricity Transmission, in: Pérez-Arriaga, I.J. (Hg.): *Regulation of the Power Sector*, S. 251 – 340, Springer-Verlag, London.

## T

**6.118 Module component: Energy Trading and Risk Management [T-WIWI-112151]****Coordinators:** N.N.**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-101451 - Energy Economics and Energy Markets](#)**Type**  
Written examination**Credits**  
3,5 CP**Grading**  
graded**Term offered**  
Each summer term**Version**  
2

| Courses  |         |                                                    |       |                                                                                               |                          |
|----------|---------|----------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|--------------------------|
| ST 2026  | 2581020 | <a href="#">Energy Trading and Risk Management</a> | 2 SWS | Lecture /  | Kraft, Fichtner, Beranek |
| Exams    |         |                                                    |       |                                                                                               |                          |
| WT 25/26 | 7981020 | <a href="#">Energy Trading and Risk Management</a> |       |                                                                                               | Fichtner                 |
| ST 2026  | 7981020 | <a href="#">Energy Trade and Risk Management</a>   |       |                                                                                               | Fichtner                 |

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

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.

**Prerequisites**

None

**Recommendations**

None

**Workload**

105 hours

Below you will find excerpts from courses related to this module component:

## V

**Energy Trading and Risk Management**2581020, SS 2026, 2 SWS, Language: English, [Open in study portal](#)**Lecture (V)**  
On-Site**Content**

1. Introduction to Markets, Mechanisms and Interaction
2. Electricity Trading (platforms, products, mechanisms)
3. Balancing Energy Markets and Congestion Management
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

**T****6.119 Module component: Engineering Interactive Systems: AI & Wearables [T-WIWI-113460]****Coordinators:** Prof. Dr. Alexander Mädche**Organisation:** KIT Department of Business and Economics

**Part of:** [M-WIWI-102806 - Service Innovation, Design & Engineering](#)  
[M-WIWI-104080 - Designing Interactive Information Systems](#)  
[M-WIWI-107531 - Information Systems: Interactive Systems](#)

**Type**  
Examination of another type

**Credits**  
4,5 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
1

| Courses  |         |                                                                     |       |                                                                                               |                        |
|----------|---------|---------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|------------------------|
| WT 25/26 | 2540420 | <a href="#">Engineering Interactive Systems: AI &amp; Wearables</a> | 3 SWS | Lecture /  | Mädche, Feick, Kretzer |
| Exams    |         |                                                                     |       |                                                                                               |                        |
| WT 25/26 | 7900195 | <a href="#">Engineering Interactive Systems: AI &amp; Wearables</a> |       |                                                                                               | Mädche                 |

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

**Assessment**

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

**Recommendations**

None

**Additional Information**

The course is held in English.

**Workload**

135 hours

Below you will find excerpts from courses related to this module component:

**V****Engineering Interactive Systems: AI & Wearables**

2540420, WS 25/26, 3 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
Blended (On-Site/Online)

**Literature**

Siehe Englische Literatur



## T

**6.120 Module component: Engineering Self-Adaptive Systems [T-INFO-113349]**

**Coordinators:** Prof. Dr. Raffaella Mirandola  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-106626 - Engineering Self-Adaptive Systems](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 3 CP    | graded  | Each winter term | 1       |

| Courses  |         |                                                   |  |         |           |
|----------|---------|---------------------------------------------------|--|---------|-----------|
| WT 25/26 | 2400186 | <a href="#">Engineering Self-Adaptive Systems</a> |  | Lecture | Mirandola |
| Exams    |         |                                                   |  |         |           |
| WT 25/26 | 7500381 | <a href="#">Engineering Self-Adaptive Systems</a> |  |         | Mirandola |

**Assessment**

The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting 20 minutes.

**Prerequisites**

None.

*Below you will find excerpts from courses related to this module component:*

## V

**Engineering Self-Adaptive Systems**

2400186, WS 25/26, SWS, Language: English, [Open in study portal](#)

Lecture (V)

**Content****Learning objectives**

- Understand the motivation for self-adaptation
- Get familiar with the basic principles and conceptual model of self-adaptation
- Understand how to engineer self-adaptive software systems from a software engineering perspective
- Understand the decision-making process using formal analysis at runtime for quality assurance
- Understand the notion of uncertainty in self-adaptive systems and how to tame it with formal verification at runtime
- Understand the level of adoption of self-adaptive system in industry

## T

**6.121 Module component: Entrepreneurship [T-WIWI-102864]**

**Coordinators:** Prof. Dr. Orestis Terzidis  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101488 - Entrepreneurship \(EnTechnon\)](#)  
[M-WIWI-101507 - Innovation Management](#)  
[M-WIWI-105010 - Student Innovation Lab \(SIL\) 1](#)

| Type                | Credits | Grading | Term offered | Version |
|---------------------|---------|---------|--------------|---------|
| Written examination | 3 CP    | graded  | Each term    | 1       |

| Courses  |         |                                  |          |                                                                                               |                       |
|----------|---------|----------------------------------|----------|-----------------------------------------------------------------------------------------------|-----------------------|
| WT 25/26 | 2545001 | <a href="#">Entrepreneurship</a> | 2 SWS    | Lecture /  | Malik, Terzidis, Dang |
| ST 2026  | 2545001 | <a href="#">Entrepreneurship</a> | 2 SWS    | Lecture /  | Terzidis, Dang        |
| Exams    |         |                                  |          |                                                                                               |                       |
| WT 25/26 | 7900045 | <a href="#">Entrepreneurship</a> | Terzidis |                                                                                               |                       |
| ST 2026  | 7900002 | <a href="#">Entrepreneurship</a> | Terzidis |                                                                                               |                       |

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

**Assessment**

The assessment consists of a written exam (60 minutes) (following §4(2), 1 of the examination regulation).

Students are offered the opportunity to earn a grade bonus through separate assignments. 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). The exact criteria for awarding a bonus will be announced at the beginning of the lecture.

**Prerequisites**

None

**Recommendations**

None

Below you will find excerpts from courses related to this module component:

## V

**Entrepreneurship**

2545001, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
Blended (On-Site/Online)

**Content**

The lecture as an obligatory part of the module "Entrepreneurship" introduces the basic concepts of entrepreneurship. Important concepts and empirical facts are presented that relate to the conception and implementation of newly founded companies.

The focus here is on the introduction to methods for generating innovative business ideas, for transferring patents into business concepts and general principles of business modelling and business planning. In particular approaches such as Lean Startup and Effectuation as well as concepts for the financing of young enterprises are treated.

A "KIT Entrepreneurship Talk" is part of each session, in which experienced founder and entrepreneur personalities report on their experiences in practice of the establishment of an enterprise. Dates and speakers will be announced on the EnTechnon homepage.

**Learning objectives:**

The students are introduced to the topic Entrepreneurship. After successful attendance of the meeting they are to have an overview of the subranges of the Entrepreneurships and be able to understand basic concepts of the Entrepreneurships and apply key concepts.

**Workload:**

Total effort with 3 credit points: approx. 90 hours

Presence time: 30 hours

Pre- and postprocessing of the LV: 45.0 hours

Exam and exam preparation: 15.0 hours

**Examination:**

The assessment of success takes place in the form of a written examination (60 min.) (according to §4(2), 1 SPO). The grade is the grade of the written exam.

A grade bonus can be earned through successful participation in a case study in the Entrepreneurship lecture. If the grade of the written exam is between 4.0 and 1.3, the bonus improves the grade by up to 0.3 or 0.4. The bonus only applies if you have passed the exam with at least a 4.0. More details will be provided in the lecture. Participation in the case study is voluntary.

**Exam date:** tba

**Organizational issues**

VL findet jeweils Mo, 15:45 - 19:00 an folgenden Terminen statt:

27.10.2025

03.11.2025

10.11.2025

17.11.2025

24.11.2025

01.12.2025

08.12.2025 (inkl. Prep Session)

**Literature**

Aulet, Bill (2013): Disciplined Entrepreneurship. 24 Steps to a Successful Startup. Hoboken: Wiley.

R.C. Dorf, T.H. Byers: Technology Ventures – From Idea to Enterprise., (McGraw Hill 2008)

Füglister, Urs, Müller, Christoph and Volery, Thierry (2008): Entrepreneurship

Hisrich, Robert D.; Ramadani, Veland (2017): Effective entrepreneurial management. Strategy, planning, risk management, and organization. Cham, Switzerland: Springer.

Ries, Eric (2011): The Lean Startup.

Osterwalder, Alexander (2010): Business Model Generation.

**Entrepreneurship**

2545001, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

**Lecture (V)  
On-Site**

**Content**

The lecture as a compulsory part of the module "Entrepreneurship" introduces the basic concepts of entrepreneurship. Important concepts and empirical facts are introduced, which relate to the conception and implementation of newly founded companies.

The focus here is on introducing methods for generating innovative business ideas, translating patents into business concepts, and general principles of business modeling and business planning. In particular, approaches such as Lean-Startup and Effectuation as well as concepts for financing young companies are covered.

A "KIT Entrepreneurship Talk" is part of each session, in which experienced founder and entrepreneur personalities report on their experiences in the practice of the establishment of an enterprise. Dates and speakers will be announced on the EnTechnon homepage.

**Learning objectives:**

The students will be introduced to the topic of entrepreneurship. After successful attendance of the course they should have an overview of the sub-areas of entrepreneurship and be able to understand basic concepts of entrepreneurship and apply key concepts.

**Workload:**

The total effort with 3 credit points: approx. 90 hours

Presence time: 30 hours

Pre- and postprocessing of the LV: 45.0 hours

Exam and exam preparation: 15.0 hours

**Examination:**

The assessment consists of a written exam (60 minutes) (following §4(2), 1 of the examination regulation)

A grade bonus can be earned by successfully participating in a case study as part of the Entrepreneurship lecture. If the grade of the written exam is between 4.0 and 1.3, the bonus improves the grade by up to 0.3 or 0.4. The bonus only applies if you have passed the exam with at least a 4.0. More details will be provided in the lecture. Participation in the case study is voluntary.

Exam dates: tbd

**Organizational issues**

VL findet jeweils Di, 15:45 - 19:00 an folgenden Terminen statt:

21.04.2026

28.04.2026

05.05.2026

12.05.2026

19.05.2026

02.06.2026

09.06.2026 (inkl. Prep Session)

16.06.2026 (Klausur)

**Literature**

Füglister, Urs, Müller, Christoph und Volery, Thierry (2008): Entrepreneurship

Ries, Eric (2011): The Lean Startup

Osterwalder, Alexander (2010): Business Model Generation

Aulet, Bill (2013): Disciplined Entrepreneurship. 24 Steps to a Successful Startup. Hoboken: Wiley.

R.C. Dorf, T.H. Byers: Technology Ventures – From Idea to Enterprise., (McGraw Hill 2008)

Hisrich, Robert D.; Ramadani, Veland (2017): Effective entrepreneurial management. Strategy, planning, risk management, and organization. Cham, Switzerland: Springer.

## T

**6.122 Module component: Entrepreneurship Research [T-WIWI-102894]**

**Coordinators:** Prof. Dr. Orestis Terzidis  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101488 - Entrepreneurship \(EnTechnon\)](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 3 CP    | Graded  | Each summer term | 1       |

| Courses |         |                                           |          |                                                                                               |                |
|---------|---------|-------------------------------------------|----------|-----------------------------------------------------------------------------------------------|----------------|
| ST 2026 | 2545002 | <a href="#">Entrepreneurship Research</a> | 2 SWS    | Seminar /  | Kuschel, Malik |
| Exams   |         |                                           |          |                                                                                               |                |
| ST 2026 | 7900052 | <a href="#">Entrepreneurship Research</a> | Terzidis |                                                                                               |                |

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

**Assessment**

The performance review is done via a so called other methods of performance review (term paper) (alternative exam assessment). The final grade is a result from both, the grade of the term paper and its presentation, as well as active participation during the seminar.

**Prerequisites**

None

**Recommendations**

None

**Additional Information**

The topics will be prepared in groups. The presentation of the results is done during a a block period seminar at the end of the semester. Students have to be present all day long during the seminar.

*Below you will find excerpts from courses related to this module component:*

## V

**Entrepreneurship Research**

2545002, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

**Seminar (S)**  
On-Site

**Content****Content**

In this course, the students choose from various relevant and current research topics in entrepreneurship and independently develop a topic that suits them in small teams. Initially, there is an introduction to standard methods such as systematic literature review, design science, qualitative and quantitative data analysis, and more. The seminar topic must be scientifically prepared and presented in 15-20 pages as part of a written elaboration. The seminar results are presented in a block event at the end of the semester (20 min + 10 min open discussion).

**Learning Objectives**

The foundations of independent scholarly work (literature review, argumentation + discussion, citation of literature sources, application of qualitative, quantitative, and simulation methods) are developed as part of the written elaboration. The competencies acquired in the seminar can be utilized in preparing for a potential master's thesis. Therefore, the seminar is mainly aimed at students who intend to write their thesis at the Chair of Entrepreneurship and Technology Management and wish to gain substantial experience in entrepreneurship research.

**Organizational issues**

Registration is via the Wiwi-Portal.

Seminar dates will probably be (as announced in Wiwi-Portal):

Wednesday, 29.04.2026, 10.00-16.00

Wednesday, 20.05.2026, 10.00-16.00

Wednesday, 24.06.2026, 09.00-12.00

**Literature**

Will be announced in the seminar.

## T

**6.123 Module component: Entrepreneurship Seasonal School [T-WIWI-113151]**

**Coordinators:** Prof. Dr. Orestis Terzidis  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101488 - Entrepreneurship \(EnTechnon\)](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 3 CP    | graded  | Irregular    | 1       |

**Assessment**

Alternative exam assessment. The grade is composed of the presentation and the written elaboration. Details on the design of the examination will be announced in the course.

**Prerequisites**

The Seasonal School is intended for advanced bachelor's and all master's students (all disciplines). Participation in the selection process is a prerequisite.

**Recommendations**

Basic knowledge of business administration, attendance of the lecture Entrepreneurship as well as openness and interest in intercultural exchange are recommended. Solid knowledge of the English language is an advantage.

**Additional Information**

Entrepreneurship Seasonal School

**Workload**

90 hours

## T

**6.124 Module component: Environmental and Resource Policy [T-WIWI-102616]****Coordinators:** Rainer Walz**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-101468 - Environmental Economics](#)**Type**  
Written examination**Credits**  
4 CP**Grading**  
graded**Term offered**  
Each summer term**Version**  
1

| Courses  |         |                                                    |       |                    |      |
|----------|---------|----------------------------------------------------|-------|--------------------|------|
| ST 2026  | 2560548 | <a href="#">Environmental and Ressource Policy</a> | 2 SWS | Lecture / Practice | Walz |
| Exams    |         |                                                    |       |                    |      |
| WT 25/26 | 7900252 | <a href="#">Environmental and Resource Policy</a>  |       |                    | Walz |

**Assessment**

See German version

**Recommendations**

It is recommended to already have knowledge in the area of industrial organization and economic policy. This knowledge may be acquired in the courses *Introduction to Industrial Organization* [2520371] and *Economic Policy* [2560280].

Below you will find excerpts from courses related to this module component:

## V

**Environmental and Ressource Policy**2560548, SS 2026, 2 SWS, Language: German, [Open in study portal](#)**Lecture / Practice (VÜ)****Literature****Weiterführende Literatur:**

Michaelis, P.: *Ökonomische Instrumente in der Umweltpolitik*. Eine anwendungsorientierte Einführung, Heidelberg  
 OECD: *Environmental Performance Review Germany*, Paris

## T

**6.125 Module component: Environmental Economics and Sustainability [T-WIWI-102615]****Coordinators:** Prof. Dr. Rainer Walz**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-101468 - Environmental Economics](#)

| Type                | Credits | Grading | Term offered     | Version |
|---------------------|---------|---------|------------------|---------|
| Written examination | 3 CP    | Graded  | Each winter term | 2       |

| Courses  |         |                                                               |       |                    |      |
|----------|---------|---------------------------------------------------------------|-------|--------------------|------|
| WT 25/26 | 2521547 | <a href="#">Umweltökonomik und Nachhaltigkeit (mit Übung)</a> | 2 SWS | Lecture / Practice | Walz |
| Exams    |         |                                                               |       |                    |      |
| WT 25/26 | 7900250 | <a href="#">Environmental Economics and Sustainability</a>    |       |                    | Walz |

**Assessment**

See German version

**Prerequisites**

None

**Recommendations**

It is recommended to already have knowledge in the area of macro- and microeconomics. This knowledge may be acquired in the courses *Economics I: Microeconomics* [2600012] and *Economics II: Macroeconomics* [2600014].

**Workload**

90 hours



## T

## 6.126 Module component: Environmental Law [T-BGU-111102]

**Coordinators:** Dr. Ulrich Smeddinck

**Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences

**Part of:** [M-WIWI-101468 - Environmental Economics](#)

| Type                | Credits | Grading | Term offered     | Expansion   | Version |
|---------------------|---------|---------|------------------|-------------|---------|
| Written examination | 3 CP    | graded  | Each winter term | 1 semesters | 1       |

| Courses  |              |                                   |       |                                                                                               |           |
|----------|--------------|-----------------------------------|-------|-----------------------------------------------------------------------------------------------|-----------|
| WT 25/26 | 6111177      | <a href="#">Environmental Law</a> | 2 SWS | Lecture /  | Smeddinck |
| Exams    |              |                                   |       |                                                                                               |           |
| WT 25/26 | 8262111102_1 | <a href="#">Environmental Law</a> |       |                                                                                               | Smeddinck |
| WT 25/26 | 8262111102_2 | <a href="#">Environmental Law</a> |       |                                                                                               | Smeddinck |

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

### Assessment

Written exam with 120 min

### Prerequisites

None

### Additional Information

None

### Workload

90 hours

## T

**6.127 Module component: EU Data Protection Law [T-INFO-113887]****Coordinators:** Gustavo Gil Gasiola**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106754 - Public Economic and Technology Law](#)**Type**  
Written examination**Credits**  
3 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
1

| Courses  |         |                                        |       |                                                                                               |             |
|----------|---------|----------------------------------------|-------|-----------------------------------------------------------------------------------------------|-------------|
| WT 25/26 | 2424019 | <a href="#">EU Data Protection Law</a> | 2 SWS | Lecture /  | Gil Gasiola |
| Exams    |         |                                        |       |                                                                                               |             |
| WT 25/26 | 7500378 | <a href="#">EU Data Protection Law</a> |       |                                                                                               | Zufall      |

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

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 60 minutes.

**Prerequisites**

None

**Additional Information****Competency Goals:**

Students are able to comprehend the EU data protection regulation, including the General Data Protection Regulation and related EU data regulations.

They know the foundations of data protection rules, including fundamental concepts (e.g., “personal data”, “processing”, “data subject”). They are also familiar with the principles of personal data processing (lawfulness, limited purpose, transparency, accountability) as well as the rights of the data subject.

They can identify the main obligations of the controller and the processor.

Students understand the conditions for the transfer of personal data to third countries.

They can identify the other regulations that govern data in the European Union.

Students are able to read and understand legal text related to data regulation.

They can understand and solve simple data protection cases.

**Content:**

The General Data Protection Regulation (GDPR) of the European Union is a milestone in protecting individuals from the unlawful use of their data. In a data-driven society, economy, and government, this protection has become essential to guarantee fundamental rights. In addition to its direct impact on the legal systems of all Member States, the GDPR has a major influence on third countries that have adopted similar regulations (e.g. Switzerland, Argentina, Brazil, South Africa, and many others). In this way, the EU Data Protection Regulation has established itself as the “gold standard” of data protection, providing guidance to address the challenges posed by new technologies and new ways of creating, using and sharing personal data. Understanding the structure of data protection in the EU is therefore essential to grasp its impact on individual rights, public administration, business models, and even technological development.

This lecture aims to provide a structured overview of the EU Data Protection Regulation, and to offer tools to understand the regulatory structure of the EU Data Regulation. The lecture will cover the following topics:

- Introduction to EU law
- Development of the EU data protection regulation
- Legal structure of data protection in the EU
- Role of national and sectoral laws
- Data protection as fundamental right
- Principles of data protection
- Lawfulness of personal data processing
- Anonymization and pseudonymization of personal data
- Special categories of personal data
- Rights of the data subject
- Transfer of personal data to third countries
- Responsibility of the controller and the processor
- Security of personal data and personal data breach
- Open Data Directive
- Data Governance Act
- Data Act

**Workload**

- Attendance time to the lectures = 15 x 90 min = 22 h 30 min
- Self-study during the semester = 47 h 30 min
- Preparation for the exam = 20 h
- Total = 90 h

*Below you will find excerpts from courses related to this module component:*

**EU Data Protection Law**

2424019, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

**Lecture (V)**  
**On-Site**

**Content**

The General Data Protection Regulation (GDPR) of the European Union is a milestone in protecting individuals from the unlawful use of their data. In a data-driven society, economy, and government, this protection has become essential to guarantee fundamental rights. In addition to its direct impact on the legal systems of all Member States, the GDPR has a major influence on third countries that have adopted similar regulations (e.g. Switzerland, Argentina, Brazil, South Africa, and many others). In this way, the EU Data Protection Regulation has established itself as the “gold standard” of data protection, providing guidance to address the challenges posed by new technologies and new ways of creating, using and sharing personal data. Understanding the structure of data protection in the EU is therefore essential to grasp its impact on individual rights, public administration, business models, and even technological development.

This lecture aims to provide a structured overview of the EU Data Protection Regulation, and to offer tools to understand the regulatory structure of the EU Data Regulation. The lecture will cover the following topics:

- Introduction to EU law
- Development of the EU data protection regulation
- Legal structure of data protection in the EU
- Role of national and sectoral laws
- Data protection as fundamental right
- Principles of data protection
- Lawfulness of personal data processing
- Anonymization and pseudonymization of personal data
- Special categories of personal data
- Rights of the data subject
- Transfer of personal data to third countries
- Responsibility of the controller and the processor
- Security of personal data and personal data breach
- Open Data Directive
- Data Governance Act
- Data Act

**Organizational issues**

Winter term 2025/26:

**\*\*\*IMPORTANT\*\*\***

The sessions on **29.10.**, **5.11.** and **12.11.** will take place online via Zoom. All other sessions will take place in person in Seminar Room Nr. 303 at Vincenz-Prießnitz-Straße 3, in Karlsruhe.

Zoom link: <https://kit-lecture.zoom-x.de/j/63132854819?pwd=6kyXgflG7H2SNwLX4qyerDasd56C5L.1>

Wintersemester 2025/26:

**\*\*\*WICHTIG\*\*\***

Die Sitzungen am **29.10.**, **5.11.** und **12.11.** finden online über Zoom statt. Alle anderen Sitzungen finden persönlich im Seminarraum Nr. 303 in der Vincenz-Prießnitz-Straße 3 in Karlsruhe statt.

Zoomlink: <https://kit-lecture.zoom-x.de/j/63132854819?pwd=6kyXgflG7H2SNwLX4qyerDasd56C5L.1>

## T

## 6.128 Module component: European and International Law [T-INFO-101312]

Coordinators: Ulf Brühann

Organisation: KIT Department of Informatics

Part of: [M-INFO-106754 - Public Economic and Technology Law](#)Type  
Written examinationCredits  
3 CPGrading  
gradedTerm offered  
Each summer termVersion  
1

| Courses  |         |                                                        |       |                                                                                               |         |
|----------|---------|--------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|---------|
| ST 2026  | 24666   | <a href="#">Europäisches und Internationales Recht</a> | 2 SWS | Lecture /  | Brühann |
| Exams    |         |                                                        |       |                                                                                               |         |
| WT 25/26 | 7500048 | <a href="#">European and International Law</a>         |       |                                                                                               | Zufall  |
| ST 2026  | 7500084 | <a href="#">European and International Law</a>         |       |                                                                                               | Zufall  |

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

Below you will find excerpts from courses related to this module component:

## V

## Europäisches und Internationales Recht

24666, SS 2026, 2 SWS, Language: German, [Open in study portal](#)Lecture (V)  
On-Site

## Content

The course will be held in German.

The total workload for this course unit is 90 hours for 3 credit points, of which 22.5 hours are spent in attendance.

## Organizational issues

Die drei folgenden Blockveranstaltungen finden jeweils im Seminarraum Nr. 313 (Geb. 07.08) statt:

- Montag, den 27.04.2026, 09:30 - 17:00 (Mittagspause wird flexibel gehalten);
- Montag, den 01.06.2026, 09:30 - 17:00 (Mittagspause wird flexibel gehalten);
- Montag, den 29.06.2026, 09:30 - 17:00 Uhr (Mittagspause wird flexibel gehalten).

(Stand per 13.11.2025)

## Literature

Literatur wird in der Vorlesung angegeben.

## Weiterführende Literatur

Erweiterte Literaturangaben werden in der Vorlesung bekannt gegeben.

## T

## 6.129 Module component: Experimental Economics [T-WIWI-102614]

**Coordinators:** Prof. Dr. Christof Weinhardt

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

**Part of:** [M-WIWI-107528 - Information Systems: Digital Markets & Services](#)

**Type**  
Written examination

**Credits**  
4,5 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
1

| Courses  |         |                                                 |           |                                                                                                |           |
|----------|---------|-------------------------------------------------|-----------|------------------------------------------------------------------------------------------------|-----------|
| WT 25/26 | 2540489 | <a href="#">Experimental Economics</a>          | 2 SWS     | Lecture /   | Knierim   |
| WT 25/26 | 2540493 | <a href="#">Übung zu Experimental Economics</a> | 1 SWS     | Practice /  | del Puppo |
| Exams    |         |                                                 |           |                                                                                                |           |
| WT 25/26 | 7900096 | <a href="#">Experimental Economics</a>          | Weinhardt |                                                                                                |           |

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

### Assessment

The assessment consists of a written exam (60 min).

### Prerequisites

None

### Additional Information

The lecture will be taught in English.

Below you will find excerpts from courses related to this module component:

## V

### Experimental Economics

2540489, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
On-Site

### Literature

- Strategische Spiele; S. Berninghaus, K.-M. Ehrhart, W. Güth; Springer Verlag, 2. Aufl. 2006.
- Handbook of Experimental Economics; J. Kagel, A. Roth; Princeton University Press, 1995.
- Experiments in Economics; J.D. Hey; Blackwell Publishers, 1991.
- Experimental Economics; D.D. Davis, C.A. Holt; Princeton University Press, 1993.
- Experimental Methods: A Primer for Economists; D. Friedman, S. Sunder; Cambridge University Press, 1994.

## T

**6.130 Module component: Experimental Research in Economics and Information Systems [T-WIWI-115061]****Coordinators:** Prof. Dr. Christof Weinhardt**Organisation:** KIT Department of Business and Economics

**Part of:** [M-WIWI-101446 - Market Engineering](#)  
[M-WIWI-101453 - Applied Strategic Decisions](#)  
[M-WIWI-101505 - Experimental Economics](#)  
[M-WIWI-103118 - Data Science: Data-Driven User Modeling](#)  
[M-WIWI-105923 - Incentives, Interactivity & Decisions in Organizations](#)

| Type                | Credits | Grading        | Term offered     | Version |
|---------------------|---------|----------------|------------------|---------|
| Written examination | 4,5 CP  | Grading graded | Each winter term | 1       |

| Courses  |         |                                                 |       |                                                                                                |           |
|----------|---------|-------------------------------------------------|-------|------------------------------------------------------------------------------------------------|-----------|
| WT 25/26 | 2540489 | <a href="#">Experimental Economics</a>          | 2 SWS | Lecture /   | Knierim   |
| WT 25/26 | 2540493 | <a href="#">Übung zu Experimental Economics</a> | 1 SWS | Practice /  | del Puppo |

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

**Assessment**

Success is assessed in the form of a written examination (60 min).

**Prerequisites**

None

**Additional Information**

The language of the course is English.

Below you will find excerpts from courses related to this module component:

## V

**Experimental Economics**

2540489, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
On-Site

**Literature**

- Strategische Spiele; S. Berninghaus, K.-M. Ehrhart, W. Güth; Springer Verlag, 2. Aufl. 2006.
- Handbook of Experimental Economics; J. Kagel, A. Roth; Princeton University Press, 1995.
- Experiments in Economics; J.D. Hey; Blackwell Publishers, 1991.
- Experimental Economics; D.D. Davis, C.A. Holt; Princeton University Press, 1993.
- Experimental Methods: A Primer for Economists; D. Friedman, S. Sunder; Cambridge University Press, 1994.

## T

**6.131 Module component: Explainable Artificial Intelligence [T-INFO-112774]**

**Coordinators:** TT-Prof. Dr. Rudolf Lioutikov  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-106302 - Explainable Artificial Intelligence](#)

| Type                | Credits | Grading | Term offered     | Version |
|---------------------|---------|---------|------------------|---------|
| Written examination | 3 CP    | Graded  | Each summer term | 1       |

| Courses  |         |                                                     |       |                                                                                               |           |
|----------|---------|-----------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|-----------|
| ST 2026  | 2400128 | <a href="#">Explainable Artificial Intelligence</a> | 2 SWS | Lecture /  | Lioutikov |
| Exams    |         |                                                     |       |                                                                                               |           |
| WT 25/26 | 7500370 | <a href="#">Explainable Artificial Intelligence</a> |       |                                                                                               | Lioutikov |
| ST 2026  | 7500359 | <a href="#">Explainable Artificial Intelligence</a> |       |                                                                                               | Lioutikov |

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

**Assessment**

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 120 minutes.

A bonus can be acquired through successful participation in the exercise as a success control of a different kind (§4(2), 3 SPO 2008) or study performance (§4(3) SPO 2015). The exact criteria for awarding a bonus will be announced at the beginning of the lecture. 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). The bonus is only valid for the main and post exams of the semester in which it was earned. After that, the grade bonus expires.

**Prerequisites**

None.

**Recommendations**

- Experience in Machine Learning is recommended, e.g. through prior coursework.
  - The Computer Science Department offers several great lectures e.g., “Maschinelles Lernen - Grundlagen und Algorithmen” and “Deep Learning”
- A good mathematical background will be beneficial
- Python / PyTorch experience could be beneficial when we discuss practical examples/implementations.

*Below you will find excerpts from courses related to this module component:*

## V

**Explainable Artificial Intelligence**

2400128, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

**Lecture (V)**  
On-Site



## Content

Recent advances in Machine Learning and Deep Learning in particular have lead to the imminent introduction of AI agents into a wide variety of applications. However, the apparent “black-box” nature of these approaches hinders their application in both critical systems and close human-robot interactions. The sub-field of eXplainable Artificial Intelligence (XAI) aims to address this shortcoming. This lecture will introduce and discuss various concepts and methods of XAI and consider them from perspective of Robot Learning and Human-Robot Interaction.

The lecture will start with a (brief) introduction into relevant deep learning approaches, before discussing interpretable scene, task and behavior representations. Afterward the lecture will consider itself with Data-Driven and Goal-Driven AI. Finally, first approaches that incorporate XAI and XAI-based human feedback directly into the learning process itself will be discussed. An exemplary list of topics is given below:

- Introduction to XAI
- Interpretable Machine Learning vs Explainable Machine Learning
  - Primer / Introduction to relevant Deep Learning Concepts
- MLPs and CNNs
- Graph Neural Networks
- Transformers
- Diffusion Models
- Score Based Methods
  - Interpretable Structures
- Scene Representations
- Task Representations
- Behavior Representations
  - Data-Driven Explainable AI: XAI Methods for
- Shapley Values
- Saliency Maps
- Concept Activation Vectors
- Linguistic Neuron Annotation
  - Goal-Driven Explainable AI: XAI Methods for
- Generative Explaining Models
- Behavior Verbalization
- Behavior Visualization
  - Interactive Learning
- Integrating Human Feedback
- Explanatory Interactive Learning
  - Experience in Machine Learning is recommended, e.g. through prior coursework.
    - The Computer Science Department offers several great lectures e.g., “Maschinelles Lernen - Grundlagen und Algorithmen” and “Deep Learning”
  - A good mathematical background will be beneficial

Python / PyTorch experience could be beneficial when we discuss practical examples/implementations.

Arbeitsaufwand = 90h = 3 ECTS

- ca 30h Vorlesungsbesuch
- ca 30h Nachbearbeitung
- ca 30h Prüfungsvorbereitung

## Organizational issues

Als Blockvorlesung 03.-07. August 2026

**T****6.132 Module component: Extraordinary Additional Course in the Module Cross-Functional Management Accounting [T-WIWI-108651]****Coordinators:** Prof. Dr. Marcus Wouters**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-101510 - Cross-Functional Management Accounting](#)

| Type                | Credits | Grading | Term offered | Version |
|---------------------|---------|---------|--------------|---------|
| Written examination | 4,5 CP  | graded  | Each term    | 1       |

**Assessment**

The assessment depends on which extraordinary course becomes part of the module "Cross-Functional Management Accounting".

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**Prerequisites**

None

**Additional Information**

The pupose of this placeholder is to make it possible zu include an extraordinary course in the module "Cross-Functional Management Accounting". Proposals for specific courses have to be approved in advance by the module coordinator.

## T

## 6.133 Module component: Financial Analysis [T-WIWI-102900]

**Coordinators:** Dr. Torsten Luedecke

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

**Part of:** [M-WIWI-101480 - Finance 3](#)  
[M-WIWI-101483 - Finance 2](#)

**Type**  
Written examination

**Credits**  
4,5 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
2

| Courses  |         |                                               |       |                                                                                                |                  |
|----------|---------|-----------------------------------------------|-------|------------------------------------------------------------------------------------------------|------------------|
| ST 2026  | 2530205 | <a href="#">Financial Analysis</a>            | 2 SWS | Lecture /   | Luedecke         |
| ST 2026  | 2530206 | <a href="#">Übungen zu Financial Analysis</a> | 2 SWS | Practice /  | Luedecke         |
| Exams    |         |                                               |       |                                                                                                |                  |
| WT 25/26 | 7900059 | <a href="#">Financial Analysis</a>            |       |                                                                                                | Ruckes, Luedecke |
| ST 2026  | 7900075 | <a href="#">Financial Analysis</a>            |       |                                                                                                | Luedecke         |

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

### Assessment

See German version.

### Prerequisites

None

### Recommendations

Basic knowledge in corporate finance, accounting, and valuation is required.

*Below you will find excerpts from courses related to this module component:*

## V

### Financial Analysis

2530205, SS 2026, 2 SWS, Language: German, [Open in study portal](#)

Lecture (V)  
On-Site

### Literature

- Alexander, D. and C. Nobes (2017): Financial Accounting – An International Introduction, 6th ed., Pearson.
- Penman, S.H. (2013): Financial Statement Analysis and Security Valuation, 5th ed., McGraw Hill.

## T

**6.134 Module component: Financial Econometrics [T-WIWI-103064]****Coordinators:** Prof. Dr. Melanie Schienle**Organisation:** KIT Department of Business and Economics

**Part of:** [M-WIWI-101638 - Econometrics and Statistics I](#)  
[M-WIWI-101639 - Econometrics and Statistics II](#)  
[M-WIWI-105414 - Statistics and Econometrics II](#)

**Type**  
Written examination

**Credits**  
4,5 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
2

| Courses  |         |                                                     |       |                                                                                                |          |
|----------|---------|-----------------------------------------------------|-------|------------------------------------------------------------------------------------------------|----------|
| WT 25/26 | 2520022 | <a href="#">Financial Econometrics I</a>            | 2 SWS | Lecture /   | Schienle |
| WT 25/26 | 2520023 | <a href="#">Übungen zu Financial Econometrics I</a> | 2 SWS | Practice /  | Buse     |
| Exams    |         |                                                     |       |                                                                                                |          |
| WT 25/26 | 7900126 | <a href="#">Financial Econometrics</a>              |       |                                                                                                | Schienle |
| ST 2026  | 7900223 | <a href="#">Financial Econometrics</a>              |       |                                                                                                | Schienle |

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

**Assessment**

The assessment consists of a written exam (90 minutes) (following §4(2), 1 of the examination regulation).

**Prerequisites**

None

**Recommendations**

It is recommended that students have substantive knowledge of the course “Economics III: Introduction to Econometrics”.

**Additional Information**

The course will be held in English.

Below you will find excerpts from courses related to this module component:

## V

**Financial Econometrics I**

2520022, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

**Lecture (V)**  
On-Site

**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**

Taylor, S. J. (2005): "Asset Price Dynamics, Volatility, and Prediction", Princeton University Press.

Tsay, R. S. (2005): "Analysis of Financial Time Series: Financial Econometrics", Wiley, 2nd edition.

Cochrane, J. H. (2005): "Asset Pricing", revised edition, Princeton University Press.

Campbell, J. Y., A. W. Lo, and A. C. MacKinlay (1997): "The Econometrics of Financial Markets", Princeton University Press.

Hamilton, J. D. (1994): "Time Series Analysis", Princeton University Press.

Additional literature will be discussed in the lecture.

## T

## 6.135 Module component: Financial Econometrics II [T-WIWI-110939]

**Coordinators:** Prof. Dr. Melanie Schienle

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

**Part of:** [M-WIWI-101638 - Econometrics and Statistics I](#)  
[M-WIWI-101639 - Econometrics and Statistics II](#)  
[M-WIWI-105414 - Statistics and Econometrics II](#)

**Type**  
Written examination

**Credits**  
4,5 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
3

| Courses |         |                                                    |          |                                                                                                |                |
|---------|---------|----------------------------------------------------|----------|------------------------------------------------------------------------------------------------|----------------|
| ST 2026 | 2521302 | <a href="#">Financial Econometrics II</a>          | 2 SWS    | Lecture /   | Schienle, Buse |
| ST 2026 | 2521303 | <a href="#">Übung zu Financial Econometrics II</a> | 2 SWS    | Practice /  | Buse, Schienle |
| Exams   |         |                                                    |          |                                                                                                |                |
| ST 2026 | 7900081 | <a href="#">Financial Econometrics II</a>          | Schienle |                                                                                                |                |

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

### Assessment

Written examination (90 minutes). If the number of participants is low, an oral examination will be held instead.

### Prerequisites

None

### Recommendations

It is recommended that students have substantive knowledge of the course “Financial Econometrics.”

### Additional Information

The course will be held in English.

### Workload

135 hours

## T

**6.136 Module component: Financial Intermediation [T-WIWI-102623]****Coordinators:** Prof. Dr. Martin Ruckes**Organisation:** KIT Department of Business and Economics

**Part of:** [M-WIWI-101453 - Applied Strategic Decisions](#)  
[M-WIWI-101480 - Finance 3](#)  
[M-WIWI-101483 - Finance 2](#)  
[M-WIWI-101502 - Economic Theory and its Application in Finance](#)

| Type                | Credits | Grading | Term offered     | Version |
|---------------------|---------|---------|------------------|---------|
| Written examination | 4,5 CP  | Graded  | Each winter term | 1       |

| Courses  |         |                                               |       |                                                                                               |              |
|----------|---------|-----------------------------------------------|-------|-----------------------------------------------------------------------------------------------|--------------|
| WT 25/26 | 2530232 | <a href="#">Financial Intermediation</a>      | 2 SWS | Lecture /  | Ruckes       |
| WT 25/26 | 2530233 | <a href="#">Übung zu Finanzintermediation</a> | 1 SWS | Practice                                                                                      | Ruckes, Benz |
| Exams    |         |                                               |       |                                                                                               |              |
| WT 25/26 | 7900063 | <a href="#">Financial Intermediation</a>      |       |                                                                                               | Ruckes       |
| ST 2026  | 7900078 | <a href="#">Financial Intermediation</a>      |       |                                                                                               | Ruckes       |

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

**Assessment**

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

**Recommendations**

None

*Below you will find excerpts from courses related to this module component:*

## V

**Financial Intermediation**

2530232, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)

Lecture (V)  
On-Site

**Organizational issues**

Terminankündigungen des Instituts beachten

**Literature****Weiterführende Literatur:**

- Hartmann-Wendels/Pfingsten/Weber (2014): Bankbetriebslehre, 6. Auflage, Springer Verlag.
- Freixas/Rochet (2008): Microeconomics of Banking, 2. Auflage, MIT Press.

## T

**6.137 Module component: Formal Systems [T-INFO-101336]**

**Coordinators:** Prof. Dr. Bernhard Beckert  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-100799 - Formal Systems](#)

**Type**  
Written examination

**Credits**  
6 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
1

| Courses  |         |                                 |         |                    |                         |
|----------|---------|---------------------------------|---------|--------------------|-------------------------|
| WT 25/26 | 2424086 | <a href="#">Formale Systeme</a> | 4 SWS   | Lecture / Practice | Beckert, Ulbrich, Weigl |
| Exams    |         |                                 |         |                    |                         |
| WT 25/26 | 7500036 | <a href="#">Formal Systems</a>  | Beckert |                    |                         |
| ST 2026  | 7500009 | <a href="#">Formal Systems</a>  | Beckert |                    |                         |



**T****6.138 Module component: Formal Systems II: Application [T-INFO-101281]****Coordinators:** Prof. Dr. Bernhard Beckert**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-100744 - Formal Systems II: Application](#)**Type**  
Oral examination**Credits**  
5 CP**Grading**  
graded**Term offered**  
Each summer term**Version**  
1

| Exams    |         |                                               |                  |
|----------|---------|-----------------------------------------------|------------------|
| WT 25/26 | 7500200 | <a href="#">Formale Systeme II: Anwendung</a> | Beckert, Ulbrich |

T

6.139 Module component: Formal Systems II: Theory [T-INFO-101378]

Coordinators: Prof. Dr. Bernhard Beckert

Organisation: KIT Department of Informatics

Part of: [M-INFO-100841 - Formal Systems II: Theory](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 5 CP    | graded  | Each summer term | 1       |

| Courses |         |                                              |       |                                                                                               |                  |
|---------|---------|----------------------------------------------|-------|-----------------------------------------------------------------------------------------------|------------------|
| ST 2026 | 24608   | <a href="#">Formale Systeme II - Theorie</a> | 3 SWS | Lecture /  | Beckert, Ulbrich |
| Exams   |         |                                              |       |                                                                                               |                  |
| ST 2026 | 7500129 | <a href="#">Formal Systems II: Theory</a>    |       |                                                                                               | Beckert          |

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

## T

**6.140 Module component: Fundamentals for Financial -Quant and -Machine Learning Research [T-WIWI-111846]****Coordinators:** Prof. Dr. Maxim Ulrich**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-105894 - Foundations for Advanced Financial -Quant and -Machine Learning Research](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 9 CP    | graded  | Irregular    | 1       |

**Assessment**

The 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.

**Recommendations**

- 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).

**Additional Information**

Teaching and learning format: Lecture and exercise.

**Workload**

270 hours

**T****6.141 Module component: Fundamentals of National and International Group Taxation [T-WIWI-111304]**

**Coordinators:** Prof. Dr. Berthold Wigger  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101511 - Advanced Topics in Public Finance](#)

**Type**  
Written examination

**Credits**  
4,5 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
1

| Courses  |         |                                                                           |       |                                                                                               |                   |
|----------|---------|---------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|-------------------|
| ST 2026  | 2560133 | <a href="#">Fundamentals of National and International Group Taxation</a> | 3 SWS | Lecture /  | Wigger, Gutekunst |
| Exams    |         |                                                                           |       |                                                                                               |                   |
| WT 25/26 | 790kobe | <a href="#">Fundamentals of National and International Group Taxation</a> |       |                                                                                               | Wigger            |
| ST 2026  | 790kobe | <a href="#">Fundamentals of National and International Group Taxation</a> |       |                                                                                               | Wigger            |

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

**Assessment**

Success is assessed in the form of a written (90 min.) examination (in accordance with §4(2), 1 SPO). The examination is offered every semester and can be repeated at any regular examination date.

**Prerequisites**

None

**Recommendations**

It is recommended to attend the course “Basics of German Company Tax Law and Tax Planning” beforehand.

**Workload**

135 hours

## T

**6.142 Module component: Global Manufacturing [T-WIWI-112103]**

**Coordinators:** Dr. Henning Sasse  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101412 - Industrial Production III](#)  
[M-WIWI-101471 - Industrial Production II](#)

| Type                | Credits | Grading | Term offered     | Version |
|---------------------|---------|---------|------------------|---------|
| Written examination | 3,5 CP  | Graded  | Each winter term | 1       |

| Courses  |         |                                      |            |                                                                                               |       |
|----------|---------|--------------------------------------|------------|-----------------------------------------------------------------------------------------------|-------|
| WT 25/26 | 2581956 | <a href="#">Global Manufacturing</a> | 2 SWS      | Lecture /  | Sasse |
| Exams    |         |                                      |            |                                                                                               |       |
| WT 25/26 | 7981956 | <a href="#">Global Manufacturing</a> | Schultmann |                                                                                               |       |
| ST 2026  | 7981956 | <a href="#">Global Manufacturing</a> | Schultmann |                                                                                               |       |

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

**Assessment**

The assessment consists of an oral (30 minutes) or 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.

**Prerequisites**

None

**Recommendations**

None

**Workload**

105 hours

Below you will find excerpts from courses related to this module component:

## V

**Global Manufacturing**

2581956, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
Blended (On-Site/Online)

**Content**

- Fundamentals of international business
- Forms of international cooperation and value creation
- Site selection
- Cost driven internationalization and site selection
- Sales and customer driven internationalization and site selection
- Challenges, risks and risk mitigation
- Management of international production sites
- Types and case studies of international production

**Organizational issues**

Blockveranstaltung, siehe Homepage

**Literature**

Wird in der Veranstaltung bekannt gegeben.

## T

## 6.143 Module component: Global Optimization I [T-WIWI-102726]

**Coordinators:** Prof. Dr. Oliver Stein

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

**Part of:** [M-WIWI-101473 - Mathematical Programming](#)

**Type**  
Written examination

**Credits**  
4,5 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
1

| Courses  |                   |                                       |       |                                                                                               |       |
|----------|-------------------|---------------------------------------|-------|-----------------------------------------------------------------------------------------------|-------|
| ST 2026  | 2550134           | <a href="#">Global Optimization I</a> | 2 SWS | Lecture /  | Stein |
| Exams    |                   |                                       |       |                                                                                               |       |
| WT 25/26 | 7900004_WS2526_NK | <a href="#">Global Optimization I</a> |       |                                                                                               | Stein |
| ST 2026  | 7900205_SS2026_HK | <a href="#">Global Optimization I</a> |       |                                                                                               | Stein |

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

### Assessment

Success is in the form of a written examination in English (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

### Recommendations

None

### Additional Information

Part I and II of the lecture are held consecutively in the **same** semester.

Below you will find excerpts from courses related to this module component:

## V

### Global Optimization I

2550134, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
On-Site

**Content**

In many optimization problems from economics, engineering and natural sciences, solution algorithms are only able to efficiently identify *local* optimizers, while it is much harder to find *globally* optimal points. This corresponds to the fact that by local search it is easy to find the summit of the closest mountain, but that the search for the summit of Mount Everest is rather elaborate.

The lecture treats methods for global optimization of convex functions under convex constraints. It is structured as follows:

- Introduction, examples, and terminology
- Existence results for optimal points
- Optimality in convex optimization
- Duality, bounds, and constraint qualifications
- Algorithms (Kelley's cutting plane method, Frank-Wolfe method, primal-dual interior point methods)

The lecture is accompanied by exercises which, amongst others, offers the opportunity to implement and to test some of the methods on practically relevant examples.

**Remark:**

The treatment of *nonconvex* optimization problems forms the contents of the lecture "Global Optimization II". The lectures "Global Optimization I" and "Global Optimization II" are held consecutively *in the same semester*.

**Learning objectives:**

The student

- knows and understands the fundamentals of deterministic global optimization in the convex case,
- is able to choose, design and apply modern techniques of deterministic global optimization in the convex case in practice.

**Literature**

O. Stein, Basic Concepts of Global Optimization, Springer, 2024

**Weiterführende Literatur:**

- W. Alt, Numerische Verfahren der konvexen, nichtglatten Optimierung, Teubner, 2004
- C.A. Floudas, Deterministic Global Optimization, Kluwer, 2000
- R. Horst, H. Tuy, Global Optimization, Springer, 1996
- A. Neumaier, Interval Methods for Systems of Equations, Cambridge University Press, 1990

## T

**6.144 Module component: Global Optimization I and II [T-WIWI-103638]****Coordinators:** Prof. Dr. Oliver Stein**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-101473 - Mathematical Programming](#)**Type**  
Written examination**Credits**  
9 CP**Grading**  
graded**Term offered**  
Each summer term**Version**  
1

| Courses  |                   |                                                   |       |                                                                                                |             |
|----------|-------------------|---------------------------------------------------|-------|------------------------------------------------------------------------------------------------|-------------|
| ST 2026  | 2550134           | <a href="#">Global Optimization I</a>             | 2 SWS | Lecture /   | Stein       |
| ST 2026  | 2550135           | <a href="#">Exercise to Global Optimization I</a> | 1 SWS | Practice /  | Stein, Beck |
| ST 2026  | 2550136           | <a href="#">Global Optimization II</a>            | 2 SWS | Lecture /   | Stein       |
| Exams    |                   |                                                   |       |                                                                                                |             |
| WT 25/26 | 7900006_WS2526_NK | <a href="#">Global Optimization I and II</a>      |       |                                                                                                | Stein       |
| ST 2026  | 7900207_SS2026_HK | <a href="#">Global Optimization I and II</a>      |       |                                                                                                | Stein       |

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

The assessment of the lecture is a written examination in English (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

**Recommendations**

None

**Additional Information**

Part I and II of the lecture are held consecutively in the **same** semester.

Below you will find excerpts from courses related to this module component:

## V

**Global Optimization I**2550134, SS 2026, 2 SWS, Language: English, [Open in study portal](#)**Lecture (V)**  
On-Site



**Content**

In many optimization problems from economics, engineering and natural sciences, solution algorithms are only able to efficiently identify *local* optimizers, while it is much harder to find *globally* optimal points. This corresponds to the fact that by local search it is easy to find the summit of the closest mountain, but that the search for the summit of Mount Everest is rather elaborate.

The lecture treats methods for global optimization of convex functions under convex constraints. It is structured as follows:

- Introduction, examples, and terminology
- Existence results for optimal points
- Optimality in convex optimization
- Duality, bounds, and constraint qualifications
- Algorithms (Kelley's cutting plane method, Frank-Wolfe method, primal-dual interior point methods)

The lecture is accompanied by exercises which, amongst others, offers the opportunity to implement and to test some of the methods on practically relevant examples.

**Remark:**

The treatment of *nonconvex* optimization problems forms the contents of the lecture "Global Optimization II". The lectures "Global Optimization I" and "Global Optimization II" are held consecutively *in the same semester*.

**Learning objectives:**

The student

- knows and understands the fundamentals of deterministic global optimization in the convex case,
- is able to choose, design and apply modern techniques of deterministic global optimization in the convex case in practice.

**Literature**

O. Stein, Basic Concepts of Global Optimization, Springer, 2024

**Weiterführende Literatur:**

- W. Alt, Numerische Verfahren der konvexen, nichtglatten Optimierung, Teubner, 2004
- C.A. Floudas, Deterministic Global Optimization, Kluwer, 2000
- R. Horst, H. Tuy, Global Optimization, Springer, 1996
- A. Neumaier, Interval Methods for Systems of Equations, Cambridge University Press, 1990

**Global Optimization II**

2550136, SS 2026, 2 SWS, Language: English, [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**

O. Stein, Basic Concepts of Global Optimization, Springer, 2024

**Weiterführende Literatur:**

- W. Alt, Numerische Verfahren der konvexen, nichtglatten Optimierung, Teubner, 2004
- C.A. Floudas, Deterministic Global Optimization, Kluwer, 2000
- R. Horst, H. Tuy, Global Optimization, Springer, 1996
- A. Neumaier, Interval Methods for Systems of Equations, Cambridge University Press, 1990

## T

## 6.145 Module component: Global Optimization II [T-WIWI-102727]

**Coordinators:** Prof. Dr. Oliver Stein

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

**Part of:** [M-WIWI-101473 - Mathematical Programming](#)

**Type**  
Written examination

**Credits**  
4,5 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
2

| Courses  |                   |                                                    |       |                                                                                                |             |
|----------|-------------------|----------------------------------------------------|-------|------------------------------------------------------------------------------------------------|-------------|
| ST 2026  | 2550136           | <a href="#">Global Optimization II</a>             | 2 SWS | Lecture /   | Stein       |
| ST 2026  | 2550137           | <a href="#">Exercise to Global Optimization II</a> | 1 SWS | Practice /  | Stein, Beck |
| Exams    |                   |                                                    |       |                                                                                                |             |
| WT 25/26 | 7900005_WS2526_NK | <a href="#">Global Optimization II</a>             |       |                                                                                                | Stein       |
| ST 2026  | 7900206_SS2026_HK | <a href="#">Global Optimization II</a>             |       |                                                                                                | Stein       |

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

### Assessment

The assessment of the lecture is a written examination in English (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

### Additional Information

Part I and II of the lecture are held consecutively in the **same** semester.

*Below you will find excerpts from courses related to this module component:*

## V

## Global Optimization II

2550136, SS 2026, 2 SWS, Language: English, [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**

O. Stein, Basic Concepts of Global Optimization, Springer, 2024

**Weiterführende Literatur:**

- W. Alt, Numerische Verfahren der konvexen, nichtglatten Optimierung, Teubner, 2004
- C.A. Floudas, Deterministic Global Optimization, Kluwer, 2000
- R. Horst, H. Tuy, Global Optimization, Springer, 1996
- A. Neumaier, Interval Methods for Systems of Equations, Cambridge University Press, 1990

**T****6.146 Module component: Graph Partitioning and Graph Clustering in Theory and Practice [T-INFO-114232]**

**Coordinators:** Prof. Dr. Peter Sanders  
Dr. rer. nat. Torsten Ueckerdt

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-107211 - Graph Partitioning and Graph Clustering in Theory and Practice](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 4 CP    | graded  | Each summer term | 1       |

**Assessment**

The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting 20 minutes.

The module grade is made up of the graded and weighted performance assessments (usually 80% of the oral examination and 20% of the other performance).

**Prerequisites**

None.

**Recommendations**

Knowledge of graph theory and algorithm technology is helpful.

**T****6.147 Module component: Graph Partitioning and Graph Clustering in Theory and Practice - Practical [T-INFO-114233]**

**Coordinators:** Prof. Dr. Peter Sanders  
Dr. rer. nat. Torsten Ueckerdt

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-107211 - Graph Partitioning and Graph Clustering in Theory and Practice](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 1 CP    | Graded  | Each summer term | 1       |

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO). (seminar paper/presentation/programming task or similar).

The module grade is made up of the graded and weighted performance assessments (usually 80% of the oral examination and 20% of the other performance). An overall grade is awarded.

**Prerequisites**

None.

**Recommendations**

Knowledge of graph theory and algorithm technology is helpful.

## T

**6.148 Module component: Graph Theory and Advanced Location Models [T-WIWI-102723]****Coordinators:** Prof. Dr. Stefan Nickel**Organisation:** KIT Department of Business and Economics

**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 CP

**Grading**  
graded

**Term offered**  
Irregular

**Version**  
2

| Courses |         |                                                                         |         |                                                                                                |          |
|---------|---------|-------------------------------------------------------------------------|---------|------------------------------------------------------------------------------------------------|----------|
| ST 2026 | 2500033 | <a href="#">Exercises for Graph Theory and Advanced Location Models</a> | 1.5 SWS | Practice /  | Hoffmann |
| ST 2026 | 2500050 | <a href="#">Graph Theory and Advanced Location Models</a>               | 3 SWS   | Lecture /   | Nickel   |
| Exams   |         |                                                                         |         |                                                                                                |          |
| ST 2026 | 7900209 | <a href="#">Graph Theory and Advanced Location Models</a>               | Nickel  |                                                                                                |          |

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

**Assessment**

The assessment of the course (lecture and exercise) is a 60-minute 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

**Recommendations**

It is recommended that students have knowledge of Operations Research, such as that taught in the course "Introduction to Operations Research".

**Additional Information**

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>.

## T

## 6.149 Module component: Growth and Development [T-WIWI-112816]

**Coordinators:** Prof. Dr. Ingrid Ott

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

**Part of:** [M-WIWI-107010 - Economics in a Connected World](#)  
[M-WIWI-107011 - Economics of Innovation and Growth](#)

| Type                | Credits | Grading | Term offered     | Version |
|---------------------|---------|---------|------------------|---------|
| Written examination | 4,5 CP  | Graded  | Each winter term | 1       |

| Courses  |         |                                                     |       |                                                                                                |              |
|----------|---------|-----------------------------------------------------|-------|------------------------------------------------------------------------------------------------|--------------|
| WT 25/26 | 2561503 | <a href="#">Growth and Development</a>              | 2 SWS | Lecture /   | Ott          |
| WT 25/26 | 2561504 | <a href="#">Exercise for Growth and Development</a> | 1 SWS | Practice /  | Ott, Ghoniem |
| Exams    |         |                                                     |       |                                                                                                |              |
| WT 25/26 | 7900078 | <a href="#">Growth and Development</a>              |       |                                                                                                | Ott          |
| ST 2026  | 7900105 | <a href="#">Growth and Development</a>              |       |                                                                                                | Ott          |

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

### Assessment

Success is assessed in the form of a written examination (60 minutes). The examination is offered every semester and can be repeated at any regular examination date.

### Prerequisites

None

### Recommendations

It is recommended that students have basic micro- and macro-economic knowledge, as taught for example in the courses **Economics I** and **Economics II**. In addition, it is recommended that they have an interest in quantitative-mathematical modelling.

### Workload

135 hours

Below you will find excerpts from courses related to this module component:

## V

### Growth and Development

2561503, WS 25/26, 2 SWS, Language: 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:**

- Acemoglu, D. (2009): Introduction to modern economic growth. Princeton University Press, New Jersey.
- Aghion, P., Howitt, P. (2009): Economics of growth, MIT-Press, Cambridge/MA.
- Barro, R.J., Sala-i-Martin, X. (2003): Economic Growth. MIT-Press, Cambridge/MA.
- Sydsaeter, K., Hammond, P. (2008): Essential mathematics for economic analysis. Prentice Hall International, Harlow.
- Sydsæter, K., Hammond, P., Seierstad, A., Strom, A., (2008): Further Mathematics for Economic Analysis, Second Edition, Pearson Education Limited, Essex.

## T

**6.150 Module component: Hands-on Bioinformatics Practical [T-INFO-103009]**

**Coordinators:** Prof. Dr. Alexandros Stamatakis  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-101573 - Hands-on Bioinformatics Practical](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 3 CP    | graded  | Irregular    | 3       |

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

Practical tasks in the field of bioinformatics must be completed. The results must be presented in writing or orally.

**Prerequisites**

The exam in Introduction to Bioinformatics for Computer Scientists must have been passed in one of the preceding semesters.

## T

## 6.151 Module component: Heat Economy [T-WIWI-102695]

**Coordinators:** Prof. Dr. Wolf Fichtner

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

**Part of:** [M-WIWI-101452 - Energy Economics and Technology](#)

**Type**  
Written examination

**Credits**  
3,5 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
2

| Courses  |         |                              |       |                                                                                               |          |
|----------|---------|------------------------------|-------|-----------------------------------------------------------------------------------------------|----------|
| ST 2026  | 2581001 | <a href="#">Heat Economy</a> | 2 SWS | Lecture /  | Fichtner |
| Exams    |         |                              |       |                                                                                               |          |
| WT 25/26 | 7981001 | <a href="#">Heat Economy</a> |       |                                                                                               | Fichtner |
| ST 2026  | 7981001 | <a href="#">Heat Economy</a> |       |                                                                                               | Fichtner |

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

### Assessment

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.

### Recommendations

None

### Additional Information

See German version.

Below you will find excerpts from courses related to this module component:

## V

## Heat Economy

2581001, SS 2026, 2 SWS, Language: German, [Open in study portal](#)

Lecture (V)  
On-Site

### Organizational issues

Block, Seminarraum Standort West - siehe Institutsaushang

**T****6.152 Module component: Heterogeneous Parallel Computing Systems [T-INFO-101359]****Coordinators:** Prof. Dr. Wolfgang Karl**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-100822 - Heterogeneous Parallel Computing Systems](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 3 CP    | graded  | Each winter term | 1       |

| Courses  |         |                                                              |       |                                                                                               |      |
|----------|---------|--------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|------|
| WT 25/26 | 2424117 | <a href="#">Heterogene parallele Rechensysteme</a>           | 2 SWS | Lecture /  | Karl |
| Exams    |         |                                                              |       |                                                                                               |      |
| WT 25/26 | 7500209 | <a href="#">VL: Heterogeneous Parallel Computing Systems</a> |       |                                                                                               | Karl |

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

## T

**6.153 Module component: HRI and Social Robotics [T-INFO-113396]**

**Coordinators:** TT-Prof. Dr. Barbara Bruno  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-106650 - HRI and Social Robotics](#)

**Type**  
Written examination

**Credits**  
4 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
1

| Courses  |         |                                                     |       |                                                                                                         |              |
|----------|---------|-----------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------|--------------|
| ST 2026  | 2400159 | <a href="#">HRI and Social Robotics</a>             | 4 SWS | Lecture / Practice /  | Bruno, Maure |
| Exams    |         |                                                     |       |                                                                                                         |              |
| WT 25/26 | 7500390 | <a href="#">HRI and Social Robotics - Post Exam</a> |       |                                                                                                         | Bruno        |

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

**Assessment**

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 120 minutes.

**Prerequisites**

None.

**Recommendations**

Knowledge of the content of modules Robotics I - Introduction to Robotics is helpful.

*Below you will find excerpts from courses related to this module component:*

## V

**HRI and Social Robotics**

2400159, SS 2026, 4 SWS, Language: English, [Open in study portal](#)

Lecture / Practice (VÜ)  
On-Site

**Content****Competency Goals:**

Students know the foundations of Human-Robot Interaction (HRI) and Social Robotics, including: design principles and methodologies, human factors influencing HRI (anthropomorphization), sensors, actuators and software architecture for social robotics, challenges and solutions for key abilities of social robots (spatial interaction, engagement detection, non-verbal interaction, verbal interaction, emotion generation and detection), research methods (study design principles, statistical tools for analyses) and have seen state-of-the-art research topics in the field including social learning, theory of mind, trust and ethical considerations in HRI.

Thanks to the exercise sessions and assignments, students gain first-hand knowledge and can independently apply techniques related to the above theory items, including for collecting stakeholders' feedback for a robot design, programming the robot's social behaviour along multiple modalities, extracting relevant user information from available sensors, designing and analysing HRI experiments.

**Content**

Subject-specific, methodological, practical and interdisciplinary content

**Workload**

- 1) Attendance of the course: 22.5h (15x90min slots)
- 2) Attendance of the exercise sessions: 22.5h (15x90min slots)
- 3) Self-study of course material and work on homework assignments: 60h (4h/week)
- 4) Preparation for the exam: 80h

**Competency certificate**

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 120 minutes (counting for 60% of the grade)

**PLUS**

The assessment is carried out in form of course work (German Studienleistung, § 4 Abs. 3 SPO) (collectively counting for 40% of the grade). Students must regularly submit exercise sheets. The number of exercise sheets and the scale for passing will be announced at the beginning of the course. The assessment can only be repeated once.

## T

**6.154 Module component: HRI and Social Robotics - Pass [T-INFO-113397]**

**Coordinators:** TT-Prof. Dr. Barbara Bruno  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-106650 - HRI and Social Robotics](#)

**Type**  
Examination of another type

**Credits**  
2 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
1

| Courses  |         |                                                            |       |                                                                                                         |              |
|----------|---------|------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------|--------------|
| ST 2026  | 2400159 | <a href="#">HRI and Social Robotics</a>                    | 4 SWS | Lecture / Practice /  | Bruno, Maure |
| Exams    |         |                                                            |       |                                                                                                         |              |
| WT 25/26 | 7500399 | <a href="#">HRI and Social Robotics - Pass (Post-Exam)</a> |       |                                                                                                         | Bruno        |

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

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

Students must regularly submit exercise sheets. The number of exercise sheets and the scale for passing will be announced at the beginning of the course. The assessment can only be repeated once.

**Recommendations**

Knowledge of the content of modules Robotics I - Introduction to Robotics is helpful.

*Below you will find excerpts from courses related to this module component:*

## V

**HRI and Social Robotics**

2400159, SS 2026, 4 SWS, Language: English, [Open in study portal](#)

Lecture / Practice (VÜ)  
On-Site

**Content****Competency Goals:**

Students know the foundations of Human-Robot Interaction (HRI) and Social Robotics, including: design principles and methodologies, human factors influencing HRI (anthropomorphization), sensors, actuators and software architecture for social robotics, challenges and solutions for key abilities of social robots (spatial interaction, engagement detection, non-verbal interaction, verbal interaction, emotion generation and detection), research methods (study design principles, statistical tools for analyses) and have seen state-of-the-art research topics in the field including social learning, theory of mind, trust and ethical considerations in HRI.

Thanks to the exercise sessions and assignments, students gain first-hand knowledge and can independently apply techniques related to the above theory items, including for collecting stakeholders' feedback for a robot design, programming the robot's social behaviour along multiple modalities, extracting relevant user information from available sensors, designing and analysing HRI experiments.

**Content**

Subject-specific, methodological, practical and interdisciplinary content

**Workload**

- 1) Attendance of the course: 22.5h (15x90min slots)
- 2) Attendance of the exercise sessions: 22.5h (15x90min slots)
- 3) Self-study of course material and work on homework assignments: 60h (4h/week)
- 4) Preparation for the exam: 80h

**Competency certificate**

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 120 minutes (counting for 60% of the grade)

PLUS

The assessment is carried out in form of course work (German Studienleistung, § 4 Abs. 3 SPO) (collectively counting for 40% of the grade). Students must regularly submit exercise sheets. The number of exercise sheets and the scale for passing will be announced at the beginning of the course. The assessment can only be repeated once.

**T****6.155 Module component: Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy [T-INFO-101262]****Coordinators:** Prof. Dr.-Ing. Tamim Asfour  
Hon.-Prof. Dr. Uwe Spetzger**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-100725 - Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy](#)**Type**  
Written examination**Credits**  
3 CP**Grading**  
graded**Term offered**  
Each term**Version**  
2

| Courses  |         |                                                                                                                                       |       |                                                                                               |          |
|----------|---------|---------------------------------------------------------------------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|----------|
| WT 25/26 | 2424139 | <a href="#">Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy</a> | 2 SWS | Lecture /  | Spetzger |
| ST 2026  | 24678   | <a href="#">Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy</a> | 2 SWS | Lecture /  | Spetzger |
| Exams    |         |                                                                                                                                       |       |                                                                                               |          |
| WT 25/26 | 7500118 | <a href="#">Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy</a> |       |                                                                                               | Spetzger |
| ST 2026  | 7500145 | <a href="#">Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy</a> |       |                                                                                               | Spetzger |

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

Success is assessed in the form of a written examination (usually lasting 45 minutes) in accordance with Section 4 (2) No. 1 SPO.

**Prerequisites**

None.

**Recommendations**

Attending the internships and seminars in the field of medical technology at the institute is recommended, as initial practical and theoretical experience in the many different areas is imparted and deepened.

Below you will find excerpts from courses related to this module component:

**V****Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy**24678, SS 2026, 2 SWS, Language: German, [Open in study portal](#)Lecture (V)  
On-Site



**Content**

The course provides an overview of modern neuro-medicine and provides a basic understanding of neuroanatomy, sensory and neurophysiology, which represents an important interface to the innovative research areas of neuroprosthetics (optical, acoustic prostheses). There is also a close connection to motor systems in robotics. There are further links to the fields of imaging and image processing and intraoperative support systems. Practical relevance is established and specific application examples in medical diagnostics and therapy are presented.

**Goals:**

After successfully completing the course, students will have a basic understanding and basic information about the structure and complex functioning of the brain and the central nervous system (CNS). They will learn the basics of neurophysiology and sensory functions and, in particular, the technically complex modern diagnostics of the brain and CNS. In addition, students learn the basics of modern treatment modalities for various neurological and neurosurgical diseases and are able to understand the application and use of different medical equipment and devices. The overview of modern neuro-medicine allows interdisciplinary recognition and analysis of problems and allows the implementation of theoretical models in a concrete practical context.

## T

**6.156 Module component: Human Factors in Autonomous Driving [T-WIWI-113059]****Coordinators:** Prof. Dr. Alexey Vinel**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-106631 - Cooperative Autonomous Vehicles](#)**Type**  
Written examination**Credits**  
4,5 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
1

| Courses  |                  |                                                                                              |       |                                                                                                |                       |
|----------|------------------|----------------------------------------------------------------------------------------------|-------|------------------------------------------------------------------------------------------------|-----------------------|
| WT 25/26 | 2511452          | <a href="#">Human Factors in Autonomous Driving</a>                                          | 2 SWS | Lecture /   | Vinel, Bied, Schrapel |
| WT 25/26 | 2511453          | <a href="#">Exercises Human Factors in Autonomous Driving</a>                                | 1 SWS | Practice /  | Vinel, Bied, Schrapel |
| Exams    |                  |                                                                                              |       |                                                                                                |                       |
| WT 25/26 | 79AIFB_HFAD_C6   | <a href="#">Human Factors in Autonomous Driving (Registration extended until 16.02.2026)</a> | Vinel |                                                                                                |                       |
| ST 2026  | 791-AIFB-HFAD-NK | <a href="#">Human Factors in Autonomous Driving (registration until 20.07.2026)</a>          | Vinel |                                                                                                |                       |

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

The assessment of this course is a written examination (60 min) or an oral exam (approx. 20 min).

The exam takes place every semester and can be repeated at every regular examination date.

**Workload**

135 hours

## T

**6.157 Module component: Human Factors in Security and Privacy [T-WIWI-109270]**

**Coordinators:** Prof. Dr. Melanie Volkamer

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

**Part of:** [M-WIWI-104520 - Human Factors in Security and Privacy](#)  
[M-WIWI-107529 - Information Systems: Software & Systems Engineering](#)

| Type                | Credits | Grading | Term offered | Version |
|---------------------|---------|---------|--------------|---------|
| Written examination | 4,5 CP  | graded  | Irregular    | 3       |

**Assessment**

The assessment of this course (lecture and exercise) 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.

**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

**Recommendations**

The prior attendance of the lecture "Information Security" is strongly recommended.

**Additional Information**

**Please note:** This course is only offered irregularly.

The lecture units are held partly in German and partly in English.

**Workload**

135 hours

## T

**6.158 Module component: Human-Computer-Interaction [T-INFO-114192]****Coordinators:** Prof. Dr.-Ing. Michael Beigl**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107166 - Human Computer Interaction](#)  
[M-WIWI-107531 - Information Systems: Interactive Systems](#)**Type**  
Written examination**Credits**  
6 CP**Grading**  
graded**Term offered**  
Each summer term**Version**  
1

| Courses  |         |                                            |       |                                                                                               |       |
|----------|---------|--------------------------------------------|-------|-----------------------------------------------------------------------------------------------|-------|
| ST 2026  | 24659   | <a href="#">Human-Computer-Interaction</a> | 2 SWS | Lecture /  | Beigl |
| Exams    |         |                                            |       |                                                                                               |       |
| WT 25/26 | 7500076 | <a href="#">Human-Computer-Interaction</a> |       |                                                                                               | Beigl |
| ST 2026  | 7500048 | <a href="#">Human-Computer-Interaction</a> |       |                                                                                               | Beigl |

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

The assessment is carried out as a written exam (of approx. 60 minutes) as a digital exam according to §2 (3) of the Statute for the implementation of online examinations. The exam takes place ON SITE at KIT!

**Prerequisites**

Participation in the exercise is compulsory and the contents of the exercise are relevant for the examination.

Below you will find excerpts from courses related to this module component:

## V

**Human-Computer-Interaction**24659, SS 2026, 2 SWS, Language: English, [Open in study portal](#)**Lecture (V)**  
**Blended (On-Site/Online)**

**Content****Description:**

The lecture introduces the fundamentals of human-computer communication. Upon completion of the module, students will have acquired basic knowledge of the field of human-computer interaction. They will have mastered the basic techniques for evaluating user interfaces, will be familiar with the basic rules and techniques for designing user interfaces, and will have knowledge of existing user interfaces and their functions. They will be able to apply these basic techniques, for example, to analyze user interfaces of computer systems and synthesize existing designs into alternative, better solutions.

**Course content:**

Topics covered include:

1. Human perception (physiological basics, human senses, Gestalt)
2. Human information processing (HIP models, psychological basics, action processes)
3. Design basics and design methods, principles, guidelines, and standards for designing user interfaces
4. Design analysis of human-computer interaction
5. Fundamentals and examples for the design of user interfaces and methods for modeling user interfaces
6. Studies: Evaluation of human-computer interaction systems (tools, evaluation methods, performance measurement, study design and implementation)
7. Practical application of the above fundamentals using practical examples and development of independent, new, and alternative user interfaces.

**Workload**

The total workload for this learning unit is approximately 180 hours (6.0 credits).

**Activity****Workload****Attendance time: Attendance at lectures**

15 x 90 min

22 h 30 min

**Attendance time: Attendance at exercises**

8 x 90 min

12 h 00 min

**Preparation/follow-up for lectures**

15 x 150 min

37 h 30 min

**Preparation/follow-up for exercises**

8 x 360 min

48 h 00 min

**Reviewing the slide set/script 2 times**

2 x 12 hours

24 hours

**Preparing for the exam**

36 hours

**TOTAL**

**180 hours**

Workload for the learning unit "Human-Machine Interaction"

**Learning objectives**

The lecture introduces the basics of human-machine communication. After completing the course, students will be able to

- demonstrate basic knowledge of the field of human-machine interaction
- name and apply basic techniques for analyzing user interfaces
- apply basic rules and techniques for designing user interfaces
- analyze and evaluate existing user interfaces and their functions

**Organizational issues**

The lecture is a core module and is assessed in writing (written exam).

**Literature**

David Benyon: Designing Interactive Systems: A Comprehensive Guide to HCI and Interaction Design. Addison-Wesley Educational Publishers Inc; 2nd Revised edition; ISBN-13: 978-0321435330

Steven Heim: The Resonant Interface: HCI Foundations for Interaction Design. Addison Wesley; ISBN-13: 978-0321375964

## T

**6.159 Module component: Human-Computer-Interaction Pass [T-INFO-114193]****Coordinators:** Prof. Dr.-Ing. Michael Beigl**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107166 - Human Computer Interaction](#)  
[M-WIWI-107531 - Information Systems: Interactive Systems](#)

| Type       | Credits | Grading   | Term offered     | Version |
|------------|---------|-----------|------------------|---------|
| Coursework | 0 CP    | pass/fail | Each summer term | 1       |

| Courses |         |                                                 |       |                                                                                                |       |
|---------|---------|-------------------------------------------------|-------|------------------------------------------------------------------------------------------------|-------|
| ST 2026 | 2400095 | <a href="#">Human-Computer-Interaction</a>      | 1 SWS | Practice /  | Beigl |
| Exams   |         |                                                 |       |                                                                                                |       |
| ST 2026 | 7500121 | <a href="#">Human-Computer-Interaction Pass</a> |       |                                                                                                | Beigl |

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

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

Exercise sheets must be handed in regularly to pass the course. The specific details will be announced in the lecture.

**Prerequisites**

None.

**Additional Information**

Participation in the exercise is compulsory and the contents of the exercise are relevant for the examination.

**T****6.160 Module component: Human-Machine-Interaction in Anthropomatics: Basics [T-INFO-101361]**

**Coordinators:** Prof. Dr.-Ing. Jürgen Beyerer  
Dr.-Ing. Florian van de Camp

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-100824 - Human-Machine-Interaction in Anthropomatics: Basics](#)

**Type**  
Written examination

**Credits**  
3 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
4

| Courses  |         |                                                                     |       |                                                                                               |                      |
|----------|---------|---------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|----------------------|
| WT 25/26 | 2424100 | <a href="#">Human-Machine-Interaction in Anthropomatics: Basics</a> | 2 SWS | Lecture /  | van de Camp          |
| Exams    |         |                                                                     |       |                                                                                               |                      |
| WT 25/26 | 7500017 | <a href="#">Human-Machine-Interaction in Anthropomatics: Basics</a> |       |                                                                                               | Beyerer, van de Camp |
| WT 25/26 | 7500402 | <a href="#">Human-Machine-Interaction in Anthropomatics: Basics</a> |       |                                                                                               | Beyerer, van de Camp |

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

**Assessment**

Success is assessed in the form of a written examination (lasting 60 minutes) in accordance with Section 4 (2) No. 1 SPO.

**Prerequisites**

None.

## T

**6.161 Module component: Humanoid Robotics Laboratory [T-INFO-111590]**

**Coordinators:** Prof. Dr.-Ing. Tamim Asfour  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-105792 - Humanoid Robotics Laboratory](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 6 CP    | graded  | Each winter term | 3       |

| Courses  |         |                                              |       |                                                                                                        |        |
|----------|---------|----------------------------------------------|-------|--------------------------------------------------------------------------------------------------------|--------|
| WT 25/26 | 2424890 | <a href="#">Humanoid Robotics Laboratory</a> | 4 SWS | Practical course /  | Asfour |
| Exams    |         |                                              |       |                                                                                                        |        |
| WT 25/26 | 7500149 | <a href="#">Humanoid Robotics Laboratory</a> |       |                                                                                                        | Asfour |

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

**Recommendations**

- Very good programming skills in at least one high-level programming language are strongly recommended.
- Attendance of the lectures Robotics 1, Robotics 2, Robotics 3, as well as the robotics practical course are recommended.
- Project-specific recommendations (knowledge of C++, Python, ...) will be announced in the individual project descriptions

**Additional Information**

- Internship dates are always by arrangement with the supervising staff member.
- An extension work of the topic as a master thesis is possible in principle.
- The number of participants in this practical course is generally **limited** and varies with the number of available research projects at the institute.

Below you will find excerpts from courses related to this module component:

|                                                                                     |                                                                                                                                 |                                               |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
|  | <b>Humanoid Robotics Laboratory</b><br>2424890, WS 25/26, 4 SWS, Language: German/English, <a href="#">Open in study portal</a> | <b>Practical course (P)</b><br><b>On-Site</b> |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|

**Content**

In this practical course, a topic is worked on alone or in small teams with up to 3 students. Questions of humanoid robotics are dealt with, such as semantic scene interpretation, active perception, planning of grasping and manipulation tasks, action representation with motion primitives, and programming by demonstration.

The project work (alone or in groups) is performed largely independently but supported by scientific staff of the H2T. At the end of the practical course, the work has to be documented and presented in a scientific talk.

**Learning Objectives:**

- Students will be able to independently understand, structure, analyze, and solve a complex humanoid robotics problem using existing programming skills, alone or in a small team.
- Students can convey complex technical content in a presentation.

**Recommendation:**

- Very good programming skills in at least one high-level programming language are strongly recommended.
- Attendance of the lectures Robotics 1, Robotics 2, Robotics 3, as well as the robotics practical course are recommended.
- Project-specific recommendations (knowledge of C++, Python, ...) will be announced in the individual project descriptions



**Organizational issues**

Die Erfolgskontrolle erfolgt in Form einer mündlichen Prüfung nach § 4 Abs. 2 Nr. 2 SPO.

Die Modulnote ist die Note der mündlichen Prüfung.

Zielgruppe: Das Praktikum richtet sich an Studierende der Informatik, Elektrotechnik, Maschinenbau, Mechatronik im Masterstudium sowie alle Interessenten an der Robotik.

**Arbeitsaufwand:**

6 LP entspricht ca. 180h, davon

1. 10h Präsenzzeit in Praktikumsbesprechungen
2. 10h Vor- und Nachbereitung derselben
3. 150h Selbststudium zur Bearbeitung des Themas

ca. 10h Vorbereitung und Halten eines wissenschaftlichen Vortrags

**T****6.162 Module component: Humanoid Robots - Locomotion and Whole-Body Control [T-INFO-113395]****Coordinators:** Prof. Dr. Katja Mombaur**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106649 - Humanoid Robots - Locomotion and Whole-Body Control](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 6 CP    | graded  | Each term    | 1       |

| Courses |         |                                                                     |       |                                                                                               |                        |
|---------|---------|---------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|------------------------|
| ST 2026 | 2400135 | <a href="#">Humanoid Robots – Locomotion and Whole-Body Control</a> | 4 SWS | Lecture /  | Mombaur, Große Sundrup |

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

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

The grade of the course is given based on the performance in an individual programming project on the topic of humanoid robots, which consists of the definition and solution of the project itself as well as a subsequent oral presentation in a block event and the submission of a written report. Project work starts in the exercise slots during the second half of the term and ends during the lecture free time.

As a prerequisite for the enrollment in the project, the students must regularly and successfully participate in the exercises and present their results for the exercise sheets during the first part of the term, according to the modalities announced at the beginning of the course.

Both components can be completed in the same group of two students. Withdrawal is possible until 2 weeks after enrollment in the project.

Active participation in the class is expected from all students and is a necessary requirement for the course.

**Prerequisites**

- Completion of module Robotics 1 or corresponding knowledge required.
- Programming skills

**Recommendations**

Attendance of the lectures Robotics I - Introduction to Robotics and Mechano-Informatics in Robotics is required.

**Additional Information**

Limitation to 30 participants

**T****6.163 Module component: Humanoid Robots - Locomotion and Whole-Body Control -Pass [T-INFO-114282]****Coordinators:** Prof. Dr. Katja Mombaur**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106649 - Humanoid Robots - Locomotion and Whole-Body Control](#)

| Type              | Credits | Grading   | Term offered | Version |
|-------------------|---------|-----------|--------------|---------|
| Coursework (oral) | 0 CP    | pass/fail | Each term    | 1       |

| Courses |         |                                                                     |       |                                                                                               |                        |
|---------|---------|---------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|------------------------|
| ST 2026 | 2400135 | <a href="#">Humanoid Robots – Locomotion and Whole-Body Control</a> | 4 SWS | Lecture /  | Mombaur, Große Sundrup |

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

The assessment is carried out in form of course work (German Studienleistung, § 4 Abs. 3 SPO).

The grade of the course is given based on the performance in an individual programming project on the topic of humanoid robots, which consists of the definition and solution of the project itself as well as a subsequent oral presentation in a block event and the submission of a written report. Project work starts in the exercise slots during the second half of the term and ends during the lecture free time.

As a prerequisite for the enrollment in the project, the students must regularly and successfully participate in the exercises and present their results for the exercise sheets during the first part of the term, according to the modalities announced at the beginning of the course.

Both components can be completed in the same group of two students. Withdrawal is possible until 2 weeks after enrollment in the project.

Active participation in the class is expected from all students and is a necessary requirement for the course.

**Prerequisites**

- Completion of module Robotics 1 or corresponding knowledge required.
- Programming skills

**Recommendations**

Attendance of the lectures Robotics I - Introduction to Robotics and Mechano-Informatics in Robotics is required.

**Additional Information**

Limitation to 30 participants

## T

**6.164 Module component: Humanoid Robots - Seminar [T-INFO-114170]**

**Coordinators:** Prof. Dr.-Ing. Tamim Asfour  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-107152 - Humanoid Robots - Seminar](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 3 CP    | graded  | Each winter term | 1       |

| Courses  |         |                                           |       |                                                                                               |        |
|----------|---------|-------------------------------------------|-------|-----------------------------------------------------------------------------------------------|--------|
| WT 25/26 | 2400048 | <a href="#">Humanoid Robots - Seminar</a> | 2 SWS | Seminar /  | Asfour |
| Exams    |         |                                           |       |                                                                                               |        |
| WT 25/26 | 7500119 | <a href="#">Humanoid Robots - Seminar</a> |       |                                                                                               | Asfour |

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

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO). It includes a presentation at the end of the term and a term paper.

**Prerequisites**

None.

**Recommendations**

Attending the lectures Robotics I – Introduction to Robotics, Robotics II: Humanoid Robotics, Robotics III – Sensors and Perception in Robotics, Mechano-Informatics and Robotics and Wearable Robotic Technologies is recommended.

*Below you will find excerpts from courses related to this module component:*

## V

**Humanoid Robots - Seminar**

2400048, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

**Seminar (S)**  
On-Site

**Content**

The students choose a topic from the field of humanoid robotics, e.g. robot design, motion, perception, learning and conduct a mostly independent literature research on that topic with the support of an experienced supervisor. At the end of the semester they present their results and write a paper in English in the style of a scientific publication.

**Learning Objectives:**

The students have gained experience in doing independent literature research on a topic of ongoing research. They have studied, understood and compared different approaches tackling the selected scientific problem. The students are able to write a survey of the different approaches in English and in the style of a scientific publication, and to give a talk on the chosen topic.

**Examination: Oral presentation at the end of the semester, and a written paper.**

**Registration ILIAS**

Contact: [humanoid-robotics-seminar@lists.kit.edu](mailto:humanoid-robotics-seminar@lists.kit.edu)

Distribution of topics at the beginning of the lecture time

**Organizational issues****Zugehörige Veranstaltungen:**

Empfehlungen:

- Vorlesung Anthropomatik: Humanoide Roboter
- Praktikum Humanoide Roboter
- Robotik 1, Robotik 2, Robotik 3
- Maschinelles Lernen
- Visuelle Perzeption für Mensch-Maschine-Schnittstellen

**Arbeitsaufwand:** 90 h

## T

## 6.165 Module component: Incentives in Organizations [T-WIWI-105781]

**Coordinators:** Prof. Dr. Petra Nieken

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

**Part of:** [M-WIWI-101453 - Applied Strategic Decisions](#)  
[M-WIWI-101500 - Microeconomic Theory](#)  
[M-WIWI-101505 - Experimental Economics](#)  
[M-WIWI-101510 - Cross-Functional Management Accounting](#)  
[M-WIWI-105923 - Incentives, Interactivity & Decisions in Organizations](#)

**Type**  
Written examination

**Credits**  
4,5 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
1

| Courses  |         |                                                      |       |                                                                                                |                            |
|----------|---------|------------------------------------------------------|-------|------------------------------------------------------------------------------------------------|----------------------------|
| ST 2026  | 2573003 | <a href="#">Incentives in Organizations</a>          | 2 SWS | Lecture /   | Nieken                     |
| ST 2026  | 2573004 | <a href="#">Übung zu Incentives in Organizations</a> | 2 SWS | Practice /  | Nieken, Mitarbeiter, Gorny |
| Exams    |         |                                                      |       |                                                                                                |                            |
| WT 25/26 | 7900201 | <a href="#">Incentives in Organizations</a>          |       |                                                                                                | Nieken                     |
| ST 2026  | 7900132 | <a href="#">Incentives in Organizations</a>          |       |                                                                                                | Nieken                     |

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

### Assessment

The assessment of this course is a written examination (60 min). The exam takesplace in every semester. Re-examinations are offered at every ordinaryexamination date. In case of a small number of registrations, we might offer an oral exam instead of a written exam.

### Prerequisites

None

### Recommendations

It is recommended that students have knowledge in microeconomics, game theory, and statistics.

Below you will find excerpts from courses related to this module component:

## V

### Incentives in Organizations

2573003, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
On-Site

**Content**

The students acquire profound knowledge about the design and the impact of different incentive and compensation systems. Topics covered are, for instance, performance based compensation, team work, intrinsic motivation, multitasking, and subjective performance evaluations. We will use microeconomic or behavioral models as well as empirical data to analyze incentive systems. We will investigate several widely used compensation schemes and their relationship with corporate strategy. Students will learn to develop practical implications which are based on the acquired knowledge of this course.

**Aim**

The student

- develops a strategic understanding about incentives systems and how they work.
- analyzes models from personnel economics.
- understands how econometric methods can be used to analyze performance and compensation data.
- knows incentive schemes that are used in companies and is able to evaluate them critically.
- can develop practical implications which are based on theoretical models and empirical data from companies.
- understands the challenges of managing incentive and compensation systems and their relationship with corporate strategy.

**Workload**

The total workload for this course is: approximately 135 hours.

Lecture: 32 hours

Preparation of lecture: 52 hours

Exam preparation: 51 hours

**Literature**

Slides, Additional case studies and research papers will be announced in the lecture.

Literature (complementary):

Managerial Economics and Organizational Architecture, Brickley / Smith / Zimmerman, McGraw-Hill Education, 2015

Behavioral Game Theory, Camerer, Russell Sage Foundation, 2003

Personnel Economics in Practice, Lazear / Gibbs, Wiley, 2014

Introduction to Econometrics, Wooldridge, Andover, 2014

Econometric Analysis of Cross Section and Panel Data, Wooldridge, MIT Press, 2010

**T****6.166 Module component: Innovation Management: Concepts, Strategies and Methods [T-WIWI-102893]**

**Coordinators:** Prof. Dr. Marion Weissenberger-Eibl  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101488 - Entrepreneurship \(EnTechnon\)](#)  
[M-WIWI-101507 - Innovation Management](#)

| Type                | Credits | Grading        | Term offered     | Version |
|---------------------|---------|----------------|------------------|---------|
| Written examination | 3 CP    | Grading graded | Each summer term | 1       |

| Courses  |         |                                                                         |       |                                                                                               |                    |
|----------|---------|-------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|--------------------|
| ST 2026  | 2545100 | <a href="#">Innovation Management: Concepts, Strategies and Methods</a> | 2 SWS | Lecture /  | Weissenberger-Eibl |
| Exams    |         |                                                                         |       |                                                                                               |                    |
| WT 25/26 | 7900145 | <a href="#">Innovation Management: Concepts, Strategies and Methods</a> |       |                                                                                               | Weissenberger-Eibl |
| ST 2026  | 7900144 | <a href="#">Innovation Management: Concepts, Strategies and Methods</a> |       |                                                                                               | Weissenberger-Eibl |

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

**Assessment**

The assessment consists of a written exam (60 minutes). The exam takes place in every summer semester. Re-examinations are offered at every ordinary examination date.

**Prerequisites**

None

**Recommendations**

None

*Below you will find excerpts from courses related to this module component:*

**V****Innovation Management: Concepts, Strategies and Methods**

2545100, SS 2026, 2 SWS, Language: German, [Open in study portal](#)

Lecture (V)  
Blended (On-Site/Online)

**Content**

The course 'Innovation Management: Concepts, Strategies and Methods' offers scientific concepts which facilitate the understanding of the different phases of the innovation process and resulting strategies and appropriate methodologies suitable for application. The concepts refer to the entire innovation process so that an integrated perspective is made possible. This is the basis for the teaching of strategies and methods which fulfil the diverse demands of the complex innovation process. The course focuses particularly on the creation of interfaces between departments and between various actors in a company's environment and the organisation of a company's internal procedures. In this context a basic understanding of knowledge and communication is taught in addition to the specific characteristics of the respective actors. Subsequently methods are shown which are suitable for the profitable and innovation-led implementation of integrated knowledge.

**Aim:** Students develop a differentiated understanding of the different phases and concepts of the innovation process, different strategies and methods in innovation management.

**Organizational issues**

**Wichtig!** Bitte treten Sie dem **ILIAS-Kurs zur Vorlesung** bei, damit wir Ihnen weitere Informationen mitteilen können.

**Literature**

Eine ausführliche Literaturliste wird mit den Vorlesungsunterlagen zur Verfügung gestellt.

Eine Einführung bei: Vahs,D./Brem,A. (2013): Innovationsmanagement. Von der Idee zur erfolgreichen Vermarktung, 4. Auflage, Stuttgart 2013.

## T

**6.167 Module component: Innovation2Business – Innovation Strategy in the Industrial Corporate Practice [T-MACH-112882]****Coordinators:** Prof. Dr.-Ing. Albert Albers**Organisation:** KIT Department of Mechanical Engineering**Part of:** [M-WIWI-101488 - Entrepreneurship \(EnTechnon\)](#)

| Type                | Credits | Grading | Term offered     | Expansion   | Version |
|---------------------|---------|---------|------------------|-------------|---------|
| Written examination | 4 CP    | graded  | Each winter term | 1 semesters | 1       |

| Courses  |                  |                                                                                                |       |                                                                                               |        |
|----------|------------------|------------------------------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|--------|
| WT 25/26 | 2145182          | <a href="#">Innovation2Business – Innovation Strategy in the Industrial Corporate Practice</a> | 2 SWS | Lecture /  | Albers |
| Exams    |                  |                                                                                                |       |                                                                                               |        |
| WT 25/26 | 76-T-MACH-112882 | <a href="#">Innovation2Business – innovation strategy in the industrial corporate practice</a> |       |                                                                                               | Albers |

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

Written exam based on the lecture handout and materials, duration 90 minutes

**Prerequisites**

none

**Recommendations**

None

**Additional Information**

The course is offered in German.

**Workload**

120 hours

*Below you will find excerpts from courses related to this module component:*

## V

**Innovation2Business – Innovation Strategy in the Industrial Corporate Practice**2145182, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)**Lecture (V)  
On-Site****Content**

lecture block at the Bühl &amp; Herzogenaurach locations with plant tours &amp; fireside evenings + exam-preparatory Q&amp;A.

Exam: written, limited to 30 seats (recommended for: Master's degree; mechanical engineering, industrial engineering, electrical engineering, computer science) → see module manual for details.

In this lecture series, use Schaeffler as an example to learn how global companies continuously transform themselves to grow sustainably and become

maintain a leading position in the global market in the long term through business-oriented innovation.

Together we will go through the most important elements of the innovation and development process and learn about the successes and learnings based on

vivid examples from practice.

Join the fireside evenings with the speakers to discuss the lecture content and beyond in a relaxed atmosphere.

The event is limited to 30 students and is free for you (meals, bus transfers &amp; accommodations).

**Organizational issues**

Vorlesung findet an Schaeffler-Standorten (Herzogenaurach und Bühl) statt.

Sprache: Unterlagen Englisch, Vortragssprache Englisch



**T****6.168 Module component: Innovative Concepts for Programming Industrial Robots [T-INFO-101328]****Coordinators:** Prof. Dr.-Ing. Björn Hein**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-100791 - Innovative Concepts for Programming Industrial Robots](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 4 CP    | Graded  | Each summer term | 2       |

| Courses |         |                                                                       |       |                                                                                               |      |
|---------|---------|-----------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|------|
| ST 2026 | 2424179 | <a href="#">Innovative Concepts for Programming Industrial Robots</a> | 2 SWS | Lecture /  | Hein |

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

**Assessment**

Success is assessed in the form of a different type of examination in accordance with Section 4 (2) No. 3 SPO. A project paper with presentation and report must be prepared.

Withdrawal is possible within two weeks of the topic being assigned. A total of two repetitions are possible.

**Prerequisites**

None

**Recommendations**

General knowledge of the basics of robotics is helpful.

## T

**6.169 Module component: Intelligent Agent Architectures [T-WIWI-111267]****Coordinators:** Prof. Dr. Andreas Geyer-Schulz**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-105661 - Data Science: Intelligent, Adaptive, and Learning Information Services](#)**Type**  
Written examination**Credits**  
4,5 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
1

| Courses  |          |                                                                            |       |                                                                                                |              |
|----------|----------|----------------------------------------------------------------------------|-------|------------------------------------------------------------------------------------------------|--------------|
| WT 25/26 | 2540525  | <a href="#">Intelligent Agent Architectures</a>                            | 2 SWS | Lecture /   | Geyer-Schulz |
| WT 25/26 | 2540526  | <a href="#">Übung zu Intelligent Agent Architectures</a>                   | 1 SWS | Practice /  | Geyer-Schulz |
| Exams    |          |                                                                            |       |                                                                                                |              |
| WT 25/26 | 79011480 | <a href="#">Intelligent Agent Architectures (WS 2025/2026)</a>             |       |                                                                                                | Geyer-Schulz |
| ST 2026  | 7900069  | <a href="#">Intelligent Agent Architectures (Nachklausur WS 2025/2026)</a> |       |                                                                                                | Geyer-Schulz |

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

Written examination (60 minutes) according to §4(2), 1 SPO. The exam is considered passed if at least 50 out of a maximum of 100 possible points are achieved. The grades are graded in five steps (best grade 1.0 from 95 points). Details of the grade formation and scale will be announced in the course.

A bonus can be acquired through successful participation in the practice. If the grade of the written examination is between 4.0 and 1.3, the bonus improves the grade by one grade level (0.3 or 0.4). The exact criteria for awarding a bonus will be announced at the beginning of the course.

**Please note: this exam will no longer be offered after August 2026.**

**Prerequisites**

None

**Recommendations**

It is recommended to additionally review the Bachelor-level lecture "Customer Relationship Management" from the module "CRM and Servicemanagement".

**Workload**

135 hours

*Below you will find excerpts from courses related to this module component:*

## V

**Intelligent Agent Architectures**2540525, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)**Lecture (V)**  
On-Site

**Content****Course content:**

The lecture is structured in three parts:

In the first part the methods used for architecture design are introduced (system analysis, UML, formal specification of interfaces, software and analysis patterns, and the separation in conceptual and IT-architectures. The second part is dedicated to learning architectures and machine learning methods. The third part presents examples of learning CRM-Architectures.

**Workload:**

The total workload for this course is approximately 135 hours (4.5 credits):

**Time of attendance**

- Attending the lecture: 15 x 90min = 22h 30m
- Attending the exercise classes: 7 x 90min = 10h 30m
- Examination: 1h 00m

**Self-study**

- Preparation and wrap-up of the lecture: 15 x 180min = 45h 00m
- Preparing the exercises: 25h 00m
- Preparation of the examination: 31h 00m

**Sum: 135h 00m**

**Learning Goals:**

Students have special knowledge of software architectures and of the methods which are used in their development (Systems analysis, formal methods for the specification of interfaces and algebraic semantic, UML, and, last but not least, the mapping of conceptual architectures to IT architectures.

Students know important architectural patterns and they can – based on their CRM knowledge – combine these patterns for innovative CRM applications.

**Assessment:**

The assessment consists of a written exam of 1-hour length following §4 (2), 1 of the examination regulation and by submitting written papers as part of the exercise following §4 (2), 3 of the examination regulation.

The course is considered successfully taken if at least 50 out of 100 points are acquired in the written exam. In this case, all additional points (up to 10) from exercise work will be added.

**Grade: Minimum points**

- 1,0: 95
- 1,3: 90
- 1,7: 85
- 2,0: 80
- 2,3: 75
- 2,7: 70
- 3,0: 65
- 3,3: 60
- 3,7: 55
- 4,0: 50
- 5,0: 0

**Literature**

- P. Clements u. a., *Documenting Software Architectures. Views and Beyond*. Upper Saddle River: Addison-Wesley, 2011.
- Fowler, *Patterns of Enterprise Application Architecture*. Amsterdam: Addison-Wesley Longman, 2002.
- S. Russell und P. Norvig, *Artificial Intelligence: A Modern Approach*, 3. Aufl. Harlow Essex England: Pearson New International Edition, 2014.
- V. N. Vapnik, *The Nature of Statistical Learning Theory*. New York: Springer, 1995.

## T

**6.170 Module component: Intelligent Agents and Decision Theory [T-WIWI-110915]****Coordinators:** Prof. Dr. Andreas Geyer-Schulz**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-105661 - Data Science: Intelligent, Adaptive, and Learning Information Services](#)**Type**  
Written examination**Credits**  
4,5 CP**Grading**  
graded**Term offered**  
Each summer term**Version**  
1

| Courses  |         |                                                                                |       |          |              |
|----------|---------|--------------------------------------------------------------------------------|-------|----------|--------------|
| ST 2026  | 2540537 | <a href="#">Intelligent Agents and Decision Theory</a>                         | 2 SWS | Lecture  | Geyer-Schulz |
| ST 2026  | 2540538 | <a href="#">Übung zu Intelligent Agents and Decision Theory</a>                | 1 SWS | Practice | Bell         |
| Exams    |         |                                                                                |       |          |              |
| WT 25/26 | 7900294 | <a href="#">Intelligent Agents and Decision Theory (Nachklausur SoSe 2025)</a> |       |          | Geyer-Schulz |
| ST 2026  | 7900268 | <a href="#">Intelligent Agents and Decision Theory (Nachklausur SoSe 2026)</a> |       |          | Geyer-Schulz |
| ST 2026  | 7900306 | <a href="#">Intelligent Agents and Decision Theory</a>                         |       |          | Geyer-Schulz |

**Assessment**

Written examination (60 minutes). The exam is held in each semester and can be repeated at any regular examination date. Details of the grading system and any exam bonus that may be achieved from the practice are announced in the course.

**Please note: this course, exercises and exam will be not longer be offered after August 2026.**

**Prerequisites**

None

**Recommendations**

We assume knowledge in statistics, operations research and microeconomics as taught in the Bachelor program (VWL I, Operations Research I + II, Statistics I + II) and a familiarity with preferably the Python programming language.

**Additional Information**

Please note: this course, exercises and exam will be not longer be offered after August 2026.

**Workload**

135 hours

*Below you will find excerpts from courses related to this module component:*

## V

**Intelligent Agents and Decision Theory**

2540537, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)

### Content

The key assumption of this lecture is that the concept of artificial intelligence is inseparably linked to the economic concept of rationality of agents. We consider different classes of decision problems - decisions under certainty, risk and uncertainty - from an economic, managerial and AI-engineering perspective:

From an economic point of view, we analyze how to act rationally in these situations based on classic utility theory. In this regard, the course also introduces the relevant parts of decision theory for dealing with

- multiple conflicting objectives,
- incomplete, risky and uncertain information about the world,
- assessing utility functions, and
- quantifying the value of information ...

From an engineering perspective, we discuss how to develop practical solutions for these decision problems, using appropriate AI components. We introduce

- a general, agent-based design framework for AI systems,

as well as AI methods from the fields of

- search (for decisions under certainty),
- inference (for decisions under risk) and
- learning (for decisions under uncertainty).

Where applicable, the course highlights the theoretical ties of these methods with decision theory.

We conclude with a discussion of ethical and philosophical issues concerning the development and use of AI.

### Learning objectives

Students are able to design, analyze, implement, and evaluate intelligent agents.

### Lecture Outline

1. Introduction: Artificial intelligence and the economic concept of rationality
2. Intelligent Agents: A general, agent-based design framework for AI systems
3. Decision under certainty: Assessing utility functions for decisions with multiple objectives
4. Search: Linear programming for decisions under certainty
5. Decisions under risk: The expected utility principle
6. Information systems: Improving economic decisions under risk
7. Inference: Bayesian networks for decisions under risk
8. Learning: Bayesian Networks (Basics)
9. Learning: Bayesian Networks (Algorithms I)
10. Learning: Bayesian Networks (Algorithms II)

Note: This rough outline may be subject to change.

### Literature

Bamberg, Coenenberg & Krapp (2019). Betriebswirtschaftliche Entscheidungslehre (16th ed.). Verlag Franz Vahlen GmbH.

Fishburn (1988). Nonlinear preference and utility theory. Baltimore: Johns Hopkins University Press.

Keeney & Raiffa (1993). Decisions with multiple objectives: preferences and value trade-offs. Cambridge University Press.

Nickel, S., Stein, O., & Waldmann, K.-H. (2014). Operations Research (2nd ed.). Springer Berlin Heidelberg.

**Russell & Norvig (2016). Artificial Intelligence: A Modern Approach (3rd Global Edition). Pearson.**

**Koller, D., & Friedman, N. (2009). Probabilistic graphical models: principles and techniques. MIT Press.**

Sutton & Barto (2018). Reinforcement learning: An introduction. Cambridge: MIT press.

## T

## 6.171 Module component: Interactive Computer Graphics [T-INFO-101269]

**Coordinators:** Prof. Dr.-Ing. Carsten Dachsbacher

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-100732 - Interactive Computer Graphics](#)

**Type**  
Oral examination

**Credits**  
5 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
1

| Courses  |         |                                               |       |                                                                                               |                            |
|----------|---------|-----------------------------------------------|-------|-----------------------------------------------------------------------------------------------|----------------------------|
| ST 2026  | 24679   | <a href="#">Interaktive Computergrafik</a>    | 2 SWS | Lecture /  | Schudeiske,<br>Dachsbacher |
| Exams    |         |                                               |       |                                                                                               |                            |
| WT 25/26 | 7500202 | <a href="#">Interactive Computer Graphics</a> |       |                                                                                               | Dachsbacher                |
| ST 2026  | 7500123 | <a href="#">Interactive Computer Graphics</a> |       |                                                                                               | Dachsbacher                |

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

## T

**6.172 Module component: International Entrepreneurship and Brand Development [T-WIWI-114893]**

**Coordinators:** Prof. Dr. Ann-Kristin Kupfer  
Prof. Dr. Orestis Terzidis

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

**Part of:** [M-WIWI-101488 - Entrepreneurship \(EnTechnon\)](#)  
[M-WIWI-105312 - Marketing and Sales Management](#)  
[M-WIWI-106258 - Digital Marketing](#)

**Type**  
Examination of another type

**Credits**  
6 CP

**Grading**  
graded

**Term offered**  
see Annotations

**Version**  
1

| Courses  |         |                                                                      |                  |                                                                                             |                  |
|----------|---------|----------------------------------------------------------------------|------------------|---------------------------------------------------------------------------------------------|------------------|
| WT 25/26 | 2572189 | <a href="#">International Entrepreneurship and Brand Development</a> | 4 SWS            | Block /  | Terzidis, Kupfer |
| Exams    |         |                                                                      |                  |                                                                                             |                  |
| WT 25/26 | 7900156 | <a href="#">International Entrepreneurship and Brand Development</a> | Kupfer, Terzidis |                                                                                             |                  |

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

**Assessment**

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

**Additional Information**

Please contact the Marketing and Sales Research Group for further information.

**Workload**

180 hours

*Below you will find excerpts from courses related to this module component:*

## V

**International Entrepreneurship and Brand Development**

2572189, WS 25/26, 4 SWS, Language: English, [Open in study portal](#)

**Block (B)**  
**On-Site**

**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 Institute for Entrepreneurship and Technology and the Institute for Customer Insights (CIN) shortly before the start of the lecture period.

Total workload for 6 ECTS: about 180 hours.

## T

**6.173 Module component: International Finance [T-WIWI-102646]**

**Coordinators:** Prof. Dr. Marliese Uhrig-Homburg  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101480 - Finance 3](#)  
[M-WIWI-101483 - Finance 2](#)

| Type                | Credits | Grading | Term offered    | Version |
|---------------------|---------|---------|-----------------|---------|
| Written examination | 3 CP    | Graded  | see Annotations | 1       |

| Courses  |         |                                       |       |                                                                                               |                       |
|----------|---------|---------------------------------------|-------|-----------------------------------------------------------------------------------------------|-----------------------|
| ST 2026  | 2530570 | <a href="#">International Finance</a> | 2 SWS | Lecture /  | Walter, Uhrig-Homburg |
| Exams    |         |                                       |       |                                                                                               |                       |
| WT 25/26 | 7900052 | <a href="#">International Finance</a> |       |                                                                                               | Uhrig-Homburg         |
| ST 2026  | 7900097 | <a href="#">International Finance</a> |       |                                                                                               | Uhrig-Homburg         |

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

**Assessment**

The success control takes place in form of a written examination (60 min). 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.

**Prerequisites**

None

**Recommendations**

None

**Additional Information**

The course is offered as a 14-day or block course.

*Below you will find excerpts from courses related to this module component:*

## V

**International Finance**

2530570, SS 2026, 2 SWS, Language: German, [Open in study portal](#)

**Lecture (V)**  
On-Site

**Organizational issues**

Kickoff am Mittwoch, 29.04.26, 16:00 - 19:15 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:**

- Eiteman, D. et al., Multinational Business Finance, 13. Auflage, 2012.
- Solnik, B. und D. McLeavey, Global Investments, 6. Auflage, 2008.



**T****6.174 Module component: Internet Law [T-INFO-101307]****Coordinators:** N.N.**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-101215 - Intellectual Property Law](#)**Type**  
Written examination**Credits**  
3 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
2

| Courses  |         |                              |       |                                                                                               |            |
|----------|---------|------------------------------|-------|-----------------------------------------------------------------------------------------------|------------|
| WT 25/26 | 2424354 | <a href="#">Internet Law</a> | 2 SWS | Lecture /  | Idelberger |
| Exams    |         |                              |       |                                                                                               |            |
| WT 25/26 | 7500060 | <a href="#">Internet Law</a> |       |                                                                                               | Matz       |
| ST 2026  | 7500057 | <a href="#">Internet Law</a> |       |                                                                                               | Sattler    |

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

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 120 minutes.

**Prerequisites**The course **Ausgewählte Rechtsfragen des Internetrechts T-INFO-108462** may not have started.**Recommendations**

None.

**Additional Information**Lecture (with written exam) **Internet Law T-INFO-101307** is offered in the winter semester.Colloquium (other type of examination) **Selected Legal Issues in Internet Law T-INFO-108462** is offered in the summer semester.

## T

**6.175 Module component: Internet of Everything [T-INFO-101337]****Coordinators:** Prof. Dr. Martina Zitterbart**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-100800 - Internet of Everything](#)[M-WIWI-107529 - Information Systems: Software & Systems Engineering](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 4 CP    | graded  | Each winter term | 1       |

| Courses  |         |                                        |       |                                                                                               |                                                  |
|----------|---------|----------------------------------------|-------|-----------------------------------------------------------------------------------------------|--------------------------------------------------|
| WT 25/26 | 2424104 | <a href="#">Internet of Everything</a> | 2 SWS | Lecture /  | Zitterbart,<br>Hildenbrand, Mahrt,<br>Neumeister |
| Exams    |         |                                        |       |                                                                                               |                                                  |
| WT 25/26 | 7500009 | <a href="#">Internet of Everything</a> |       |                                                                                               | Zitterbart                                       |
| ST 2026  | 7500071 | <a href="#">Internet of Everything</a> |       |                                                                                               | Zitterbart                                       |

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

**Assessment**

The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting 20 minutes.

Depending on the number of participants, it will be announced six weeks before the examination (Section 6 (3) SPO) whether the assessment will take the form of an oral examination of approx.

- in the form of an oral examination of approx. 30 minutes in accordance with § 4 Para. 2 No. 2 SPO or

- in the form of a written examination in accordance with § 4 Para. 2 No. 1 SPO

takes place.

**Prerequisites**

None.

**Recommendations**

The contents of the lecture Introduction to Computer Networks are assumed to be known. Attendance of the lecture Telematics is strongly recommended, as the contents are an important basis for understanding and classifying the material.

**T****6.176 Module component: Introduction to Bioinformatics for Computer Scientists [T-INFO-101286]****Coordinators:** Prof. Dr. Alexandros Stamatakis**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-100749 - Introduction to Bioinformatics for Computer Scientists](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 3 CP    | Graded  | Each winter term | 1       |

| Courses  |         |                                                                        |       |                                                                                               |            |
|----------|---------|------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|------------|
| WT 25/26 | 2400055 | <a href="#">Introduction to Bioinformatics for Computer Scientists</a> | 2 SWS | Lecture /  | Stamatakis |
| Exams    |         |                                                                        |       |                                                                                               |            |
| WT 25/26 | 7500057 | <a href="#">Introduction to Bioinformatics for Computer Scientists</a> |       |                                                                                               | Stamatakis |

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

The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting 20 minutes.

**Prerequisites**

None.

**Recommendations**

Basic knowledge in the areas of theoretical computer science (algorithms, data structures) and technical computer science (sequential optimisation in C or C++, computer architectures, parallel programming, vector processors) will be beneficial.

## T

**6.177 Module component: Introduction to Econometrics [T-WIWI-114622]**

**Coordinators:** Prof. Dr. Melanie Schienle  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-105414 - Statistics and Econometrics II](#)

**Type**  
Written examination

**Credits**  
5 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
1

| Courses  |         |                                                          |       |                                                                                               |                                       |
|----------|---------|----------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|---------------------------------------|
| ST 2026  | 2520016 | <a href="#">Introduction to Econometrics</a>             | 2 SWS | Lecture /  | Schienle, Bracher                     |
| ST 2026  | 2520017 | <a href="#">Übungen zu Einführung in die Ökonometrie</a> | 2 SWS | Practice                                                                                      | Schienle, Rüter, Bracher, Leimenstoll |
| Exams    |         |                                                          |       |                                                                                               |                                       |
| WT 25/26 | 7900002 | <a href="#">Introduction in Econometrics</a>             |       |                                                                                               | Schienle                              |

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

**Assessment**

Success is assessed in the form of a written examination lasting 1 hour.

**Grade Bonus through Bonus Exercises:** By achieving qualified participation in at least 80% of the bonus exercises accompanying the lectures, students can earn a grade bonus for the examinations directly following the semester. This bonus of three points (out of a maximum of 90 points for the exam) will only be credited if the examination is considered passed without the application of this bonus. The grade bonus can thus result in an improvement of up to one grade increment.

**Prerequisites**

None

Below you will find excerpts from courses related to this module component:

## V

**Introduction to Econometrics**

2520016, SS 2026, 2 SWS, Language: German, [Open in study portal](#)

**Lecture (V)**  
On-Site

**Content****Learning objectives:**

- Familiarity with the basic concepts and methods of econometrics
- Preparation of simple econometric surveys

**Content:**

- Simple and multiple linear regression (estimating parameters, confidence interval, testing, prognosis, testing assumptions)
- Model assessment

**Requirements:**

Knowledge of the lectures Statistics I + II is required.

**Workload:**

Total workload for 5 CP: approx. 150 hours

Attendance: 30 hours

Preparation and follow-up: 120 hours

**Literature**

Von Auer: Ökonometrie ISBN 3-540-00593-5

Goldberger: A course in Econometrics ISBN 0-674-17544-1

Gujarati. Basic Econometrics ISBN 0-07-113964-8

Schneeweiß: Ökonometrie ISBN 3-7908-0008-2

**T****6.178 Module component: Introduction to Quantum Computing (IQC) [T-INFO-112344]**

**Coordinators:** Prof. Dr. Bernhard Beckert  
Prof. Dr.-Ing. Ina Schaefer

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-106101 - Introduction to Quantum Computing \(IQC\)](#)

| Type                | Credits | Grading | Term offered     | Version |
|---------------------|---------|---------|------------------|---------|
| Written examination | 3 CP    | Graded  | Each winter term | 1       |

| Courses  |         |                                                         |       |                                                                                               |          |
|----------|---------|---------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|----------|
| WT 25/26 | 2400073 | <a href="#">Introduction to Quantum Computing</a>       | 2 SWS | Lecture /  | Schaefer |
| Exams    |         |                                                         |       |                                                                                               |          |
| WT 25/26 | 7500107 | <a href="#">Introduction to Quantum Computing (IQC)</a> |       |                                                                                               | Schaefer |

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

## T

**6.179 Module component: Introduction to Stochastic Optimization [T-WIWI-106546]****Coordinators:** Prof. Dr. Steffen Rebennack**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-102832 - Operations Research in Supply Chain Management](#)  
[M-WIWI-103289 - Stochastic Optimization](#)**Type**  
Written examination**Credits**  
4,5 CP**Grading**  
graded**Term offered**  
Each summer term**Version**  
3

| Courses  |         |                                                                              |           |                                                                                                |                    |
|----------|---------|------------------------------------------------------------------------------|-----------|------------------------------------------------------------------------------------------------|--------------------|
| ST 2026  | 2550470 | <a href="#">Introduction to Stochastic Optimization</a>                      | 2 SWS     | Lecture /   | Rebennack          |
| ST 2026  | 2550471 | <a href="#">Übung zur Einführung in die Stochastische Optimierung</a>        | 1 SWS     | Practice /  | Rebennack, Kandora |
| ST 2026  | 2550474 | <a href="#">Rechnerübung zur Einführung in die Stochastische Optimierung</a> | 2 SWS     | Others                                                                                         | Rebennack, Kandora |
| Exams    |         |                                                                              |           |                                                                                                |                    |
| WT 25/26 | 7900242 | <a href="#">Introduction to Stochastic Optimization</a>                      | Rebennack |                                                                                                |                    |
| ST 2026  | 7900311 | <a href="#">Introduction to Stochastic Optimization</a>                      | Rebennack |                                                                                                |                    |

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

The assessment consists of a written exam (60 minutes). The exam takes place in every semester.

**Prerequisites**

None.

**Workload**

135 hours

## T

**6.180 Module component: Introduction to Video Analysis [T-INFO-101273]**

**Coordinators:** Prof. Dr.-Ing. Jürgen Beyerer  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-100736 - Introduction to Video Analysis](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 3 CP    | graded  | Each summer term | 1       |

| Courses  |         |                                                |                |                                                                                               |       |
|----------|---------|------------------------------------------------|----------------|-----------------------------------------------------------------------------------------------|-------|
| ST 2026  | 24684   | <a href="#">Introduction to Video Analysis</a> | 2 SWS          | Lecture /  | Arens |
| Exams    |         |                                                |                |                                                                                               |       |
| WT 25/26 | 7500099 | <a href="#">Introduction to Video Analysis</a> | Beyerer, Arens |                                                                                               |       |

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

**Assessment**

Success is assessed in the form of an oral examination (usually lasting 30 minutes) in accordance with Section 4 (2) No. 2 SPO.

**Prerequisites**

None.

## T

## 6.181 Module component: IT Security [T-INFO-113960]

**Coordinators:** Prof. Dr. Jörn Müller-Quade  
Prof. Dr. Christian Wressnegger

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-106998 - IT Security](#)

| Type                | Credits | Grading           | Term offered     | Version |
|---------------------|---------|-------------------|------------------|---------|
| Written examination | 6 CP    | Grading<br>graded | Each winter term | 3       |

| Courses  |         |                             |       |                                                                                                         |                                   |
|----------|---------|-----------------------------|-------|---------------------------------------------------------------------------------------------------------|-----------------------------------|
| WT 25/26 | 2400010 | <a href="#">IT Security</a> | 4 SWS | Lecture / Practice /  | Müller-Quade, Wressnegger, Martin |
| Exams    |         |                             |       |                                                                                                         |                                   |
| WT 25/26 | 7500038 | <a href="#">IT Security</a> |       |                                                                                                         | Müller-Quade, Strufe, Wressnegger |

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

### Assessment

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 90 minutes.

### Prerequisites

None.

### Recommendations

Students should be familiar with the content of the compulsory lecture "Informationssicherheit".



**T****6.182 Module component: IT-Security Management for Networked Systems [T-INFO-101323]****Coordinators:** Prof. Dr. Hannes Hartenstein**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-100786 - IT-Security Management for Networked Systems](#)  
[M-WIWI-107529 - Information Systems: Software & Systems Engineering](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 5 CP    | graded  | Each winter term | 1       |

## T

**6.183 Module component: Joint Entrepreneurship Summer School [T-WIWI-109064]**

**Coordinators:** Prof. Dr. Orestis Terzidis  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101488 - Entrepreneurship \(EnTechnon\)](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 6 CP    | graded  | Irregular    | 1       |

| Courses |         |                                                              |       |                                                                                               |                  |
|---------|---------|--------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|------------------|
| ST 2026 | 2545021 | <a href="#">Joint Entrepreneurship School China</a>          | 4 SWS | Seminar /  | Kleinn, Terzidis |
| Exams   |         |                                                              |       |                                                                                               |                  |
| ST 2026 | 7900346 | <a href="#">Joint Entrepreneurship Summer School (China)</a> |       |                                                                                               | Terzidis         |

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

**Assessment**

The learning control of the program (Summer School) consists of two parts:

**A) Investor Pitch:**

Based on a presentation (investor pitch) in front of a jury, the insights gained and developed during the course of the event are presented and the business idea presented. Among other things, the presentation performance of the team, the structured content and the logical consistency of the business idea are evaluated. The exact evaluation criteria will be announced in the course.

**B) Written elaboration:**

The second part of the assessment is a written report. The iterative knowledge gain of the entire event is systematically logged and can be further supplemented by the contents of the presentation. The report documents key action steps, applied methods, findings, market analyzes and interviews and prepares them in writing. The exact structure and requirements will be announced in the course.

The grade consists of 50% presentation performance and 50% written preparation. The points system for the assessment is determined by the lecturer of the course. It will be announced at the beginning of the course.

**Prerequisites**

The Summer School is aimed at master students of KIT. Prerequisite is the participation in the selection process.

**Recommendations**

We recommend basic business knowledge, the lecture Entrepreneurship as well as openness and interest in intercultural exchange. Solid knowledge of the English language is an advantage.

**Additional Information**

The working language during the Summer School is English. A one-week stay in China is part of the Summer School.

*Below you will find excerpts from courses related to this module component:*

## V

**Joint Entrepreneurship School China**

2545021, SS 2026, 4 SWS, Language: English, [Open in study portal](#)

**Seminar (S)**  
On-Site

**Content**

During the Summer School in Shanghai and Karlsruhe, students develop a business model of technologies and patents developed at KIT in workshops in German-Chinese tandems over the period of two weeks.

Click on our website for detailed information and a video: <https://etm.entechnon.kit.edu/english/1095.php>

**Organizational issues**

Dates:

- Briefing: April / May
- Karlsruhe: Presumably: July / August 2026
- Shanghai: Presumably: September 2026
- Deliverables: November 2026

## T

**6.184 Module component: KD<sup>2</sup>Lab Hands-On Research Course: New Ways and Tools in Experimental Economics [T-WIWI-111109]****Coordinators:** Prof. Dr. Christof Weinhardt**Organisation:** KIT Department of Business and Economics

**Part of:** [M-WIWI-101446 - Market Engineering](#)  
[M-WIWI-103118 - Data Science: Data-Driven User Modeling](#)  
[M-WIWI-104080 - Designing Interactive Information Systems](#)  
[M-WIWI-105714 - Consumer Research](#)  
[M-WIWI-105923 - Incentives, Interactivity & Decisions in Organizations](#)

| Type                        | Credits | Grading | Term offered | Expansion   | Version |
|-----------------------------|---------|---------|--------------|-------------|---------|
| Examination of another type | 4,5 CP  | graded  | Irregular    | 1 semesters | 1       |

**Assessment**

The assessment of the success of the lecture is carried out as a non-exam assessment. Grading will be based on a continuous basis throughout the semester. The assessment consists of:

- A written paper, and
- a group presentation with subsequent discussion and question and answer session of 30 minutes.

For particularly active and constructive participation in the discussions of other papers during the final presentation, a bonus of one grade level (0.3 or 0.4) can be achieved on the passed exam. Details on the grading will be announced at the beginning of the event.

**Additional Information**

The number of participants is limited due to laboratory capacity and to ensure optimal supervision of the project groups. Places are allocated on the basis of preferences and suitability for the topics. Previous knowledge in the field of experimental economic research is particularly important.

The course cannot be offered in the summer semester 2024.

**Workload**

135 hours

## T

**6.185 Module component: Knowledge Discovery [T-WIWI-102666]****Coordinators:** Dr.-Ing. Tobias Käfer**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-101456 - Intelligent Systems and Services](#)[M-WIWI-105366 - Artificial Intelligence](#)[M-WIWI-106804 - Advanced Topics in AI: Graph Neural Networks and Language Models](#)**Type**  
Written examination**Credits**  
4,5 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
4

| Courses  |                |                                                                                 |       |                                                                                                         |                               |
|----------|----------------|---------------------------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------|-------------------------------|
| WT 25/26 | 2511303        | <a href="#">Knowledge Discovery, Graph Neural Networks, and Language Models</a> | 3 SWS | Lecture / Practice /  | Käfer, Shao, Noullet, Kubelka |
| Exams    |                |                                                                                 |       |                                                                                                         |                               |
| WT 25/26 | 79AIFB_KD_D1   | <a href="#">Knowledge Discovery (Registration extended until 16.02.2026)</a>    |       |                                                                                                         | Käfer                         |
| ST 2026  | 791-AIFB-KD-NK | <a href="#">Knowledge Discovery (Registration until 20.07.2026)</a>             |       |                                                                                                         | Käfer                         |

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

The Knowledge Discovery course is assessed through a written examination with a duration of 60 minutes. Depending on the number of participants, the examiner may replace the written exam with an oral examination lasting approximately 30 minutes

**Prerequisites**

None

**Workload**

135 hours

Below you will find excerpts from courses related to this module component:

## V

**Knowledge Discovery, Graph Neural Networks, and Language Models**2511303, WS 25/26, 3 SWS, Language: English, [Open in study portal](#)Lecture / Practice (VÜ)  
Blended (On-Site/Online)**Content**

This course represents an advanced, methodologically oriented course in the field of Artificial Intelligence. The course offers an in-depth examination of modern methods for knowledge extraction and processing at the interface of graph-based machine learning and natural language processing.

In the area of text-based methods, the lecture focuses on large language models (LLMs) such as ChatGPT, LLAMA, and DeepSeek, examining their underlying principles, training methods, and applications. Additional language processing techniques from text mining are also covered extensively.

In the area of graph-based methods, the lecture is dedicated to graph representation learning, which focuses on forming useful representations of graph data. The mathematical foundations of graph and geometric deep learning are covered, and applications in areas such as explainable artificial intelligence are highlighted.

**Learning objectives:**

Students

- Explain the core concepts of text mining, large language models (LLMs), and graph neural networks (GNNs).
- Compare and select different neural architectures and graph models in terms of structure, performance, and interpretability.
- Implement corresponding systems in practice, including data preprocessing, model selection, and evaluation.

**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**

- T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning: Data Mining, Inference, and Prediction (<http://www-stat.stanford.edu/~tibs/ElemStatLearn/>)
- T. Mitchell. Machine Learning. 1997
- M. Berhold, D. Hand (eds). Intelligent Data Analysis - An Introduction. 2003
- P. Tan, M. Steinbach, V. Kumar: Introduction to Data Mining, 2005, Addison Wesley

## T

**6.186 Module component: Knowledge-Driven Artificial Intelligence [T-WIWI-114863]****Coordinators:** Prof. Dr. Harald Sack**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-101456 - Intelligent Systems and Services](#)**Type**  
Written examination**Credits**  
4,5 CP**Grading**  
graded**Term offered**  
Each summer term**Version**  
1

| Courses |                  |                                                                                          |       |                                                                                                |                                                           |
|---------|------------------|------------------------------------------------------------------------------------------|-------|------------------------------------------------------------------------------------------------|-----------------------------------------------------------|
| ST 2026 | 2511606          | <a href="#">Knowledge-driven Artificial Intelligence</a>                                 | 2 SWS | Lecture /   | Sack, Malakzadeh Mahani, Patronilo, Nahani, Yargan, Gader |
| ST 2026 | 2511607          | <a href="#">Exercises to Knowledge-driven Artificial Intelligence</a>                    | 1 SWS | Practice /  | Sack, Tietz, Malekzadeh Mahani, Ondraszek                 |
| Exams   |                  |                                                                                          |       |                                                                                                |                                                           |
| ST 2026 | 791-AIFB-KDAI-HK | <a href="#">Knowledge-Driven Artificial Intelligence (Registration until 20.07.2026)</a> |       |                                                                                                | Sack                                                      |

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

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

**Workload**

150 hours

Below you will find excerpts from courses related to this module component:

## V

**Knowledge-driven Artificial Intelligence**2511606, SS 2026, 2 SWS, Language: English, [Open in study portal](#)**Lecture (V)**  
On-Site

**Content****- The Art of Understanding**

- From Numbers to Insights
- Data, Information, and Knowledge
- Natural Language and Successful Communication
- The Art of Understanding
- The Principles of Learning

**- Basic Machine Learning**

- Machine Learning Fundamentals
- How to evaluate a Machine Learning Experiment?
- Evaluation and Generalisation Problems
- Supervised and Unsupervised ML
- Basic ML Algorithms
- Linear Regression
- Decision Trees
- k-means Clustering
- Neural Networks and Deep Learning

**- Natural Language Processing**

- NLP and Basic Linguistic Knowledge
- NLP Applications, Techniques and Challenges
- Regular Expressions, Tokenisation and Word Normalisation
- Statistical Language Models (N-Gram Model)
- Naive Bayes Text Classification
- Distributional Semantics and Neural Language Models
- Word Embeddings

**- Knowledge Graphs**

- Knowledge Representations and Ontologies
- Resource Description Framework (RDF)
- Modeling with RDFS
- Querying RDF(S) with SPARQL
- Popular Knowledge Graphs - Wikidata and DBpedia
- Ontologies with the Web Ontology Language (OWL)
- Linked Data Quality Assurance with SHACL
- The Graph in Knowledge Graphs

**- Neurosymbolic AI**

- Symbolic and Subsymbolic AI
- Knowledge Graph Embeddings and KG Completion
- The Limits of AI
- KDAI Master Thesis Topics

**Learning objectives:**

- The students know the fundamentals and measures of information theory and are able to apply those in the context of Knowledge-driven AI.
- 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 know the fundamentals of basic machine learning technologies. The students are able to apply these skills for simple prediction and classification tasks.
- The students know the basic principles of neurosymbolic AI.

**Literature**

- Machine Learning:  
G. Rebal, A. Ravi, S. Churiwala, An Introduction to Machine Learning, Springer, 2019. (available via KIT network)
- Natural Language Processing:  
D. Jurafsky, J.H. Martin, Speech and Language Processing, 3rd ed. Draft, 2023.
- Knowledge Graphs:  
A. Hogan, The Web of Data, Springer, 2020. (available via KIT network)

## T

**6.187 Module component: Lab Project: Speech Translation [T-INFO-114205]**

**Coordinators:** Prof. Dr. Jan Niehues  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-107176 - Lab Project: Speech Translation](#)

**Type**  
Examination of another type

**Credits**  
6 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
1

| Courses  |         |                                                 |         |                                                                                                        |               |
|----------|---------|-------------------------------------------------|---------|--------------------------------------------------------------------------------------------------------|---------------|
| WT 25/26 | 2400150 | <a href="#">Lab Project: Speech Translation</a> | 4 SWS   | Practical course /  | Niehues, Dinh |
| Exams    |         |                                                 |         |                                                                                                        |               |
| WT 25/26 | 7500350 | <a href="#">Lab Project: Speech Translation</a> | Niehues |                                                                                                        |               |

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

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

**Prerequisites**

None.

**Recommendations**

Students should have understood the theoretical principles as introduced in the lectures Deep Learning or Machine Translation.

*Below you will find excerpts from courses related to this module component:*

## V

**Lab Project: Speech Translation**

2400150, WS 25/26, 4 SWS, Language: German/English, [Open in study portal](#)

**Practical course (P)**  
**On-Site**

**Content**

Through the use of deep learning technologies, the quality of machine translation of text and speech has improved significantly in recent years. In this internship, the students develop a language translation system for a new language pair using state-of-the-art methods.

In the first part of the internship, the students are introduced step-by-step to the development of a translation system and its evaluation. For this, the different subtasks have to be solved. In the second part of the internship, the students should investigate different improvements of the system independently.

**Organizational issues**

Findet im Raum 223 an unserem Institut statt:

Mittwochs, 11:30 - 13:00 Uhr



**T****6.188 Module component: Lab: Graph Visualization in Practice [T-INFO-106580]**

**Coordinators:** Dr. rer. nat. Torsten Ueckerdt  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-103302 - Lab: Graph Visualization in Practice](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 5 CP    | graded  | Irregular    | 1       |

**T****6.189 Module component: Laboratory in Cryptanalysis [T-INFO-102990]****Coordinators:** Prof. Dr. Jörn Müller-Quade**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-101559 - Laboratory in Cryptanalysis](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 3 CP    | graded  | Each term    | 1       |

| Courses |       |                                           |       |                                                                                                        |                                               |
|---------|-------|-------------------------------------------|-------|--------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| ST 2026 | 24881 | <a href="#">Laboratory: Cryptanalysis</a> | 4 SWS | Practical course /  | Müller-Quade,<br>Bayreuther, Berger,<br>Brede |

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

## T

**6.190 Module component: Laboratory in Cryptography [T-INFO-102989]**

**Coordinators:** Prof. Dr. Jörn Müller-Quade  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-101558 - Laboratory in Cryptography](#)

**Type**  
Examination of another type

**Credits**  
3 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
1

| Courses  |         |                                                      |       |                                                                                                        |                                  |
|----------|---------|------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------|----------------------------------|
| WT 25/26 | 2424301 | <a href="#">Laboratory Cryptography and Security</a> | 4 SWS | Practical course /  | Bayreuther, Berger, Müller-Quade |
| Exams    |         |                                                      |       |                                                                                                        |                                  |
| WT 25/26 | 7500164 | <a href="#">Laboratory in Cryptography</a>           |       |                                                                                                        | Müller-Quade                     |

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

Below you will find excerpts from courses related to this module component:

## V

**Laboratory Cryptography and Security**

2424301, WS 25/26, 4 SWS, [Open in study portal](#)

**Practical course (P)**  
On-Site

**Content**

The lab covers different areas of computer security and cryptography. The topics are presented theoretically and are implemented afterwards. Covered topics are:

- Historical encryption
- EC-card PINs
- Block ciphers
- Efficient long number arithmetic
- ElGamal encryption / signature

**T****6.191 Module component: Large-scale Optimization [T-WIWI-106549]****Coordinators:** Prof. Dr. Steffen Rebennack**Organisation:** KIT Department of Business and Economics

**Part of:** [M-WIWI-101473 - Mathematical Programming](#)  
[M-WIWI-102832 - Operations Research in Supply Chain Management](#)  
[M-WIWI-103289 - Stochastic Optimization](#)

| Type                | Credits | Grading | Term offered     | Version |
|---------------------|---------|---------|------------------|---------|
| Written examination | 4,5 CP  | graded  | Each summer term | 3       |

| Exams    |         |                                          |           |
|----------|---------|------------------------------------------|-----------|
| WT 25/26 | 7900244 | <a href="#">Large-scale Optimization</a> | Rebennack |

**Assessment**

The assessment consists of a written exam (60 minutes). The exam takes place in every semester.

**Prerequisites**

None.

**Workload**

135 hours

## T

## 6.192 Module component: Liberalised Power Markets [T-WIWI-107043]

**Coordinators:** Prof. Dr. Wolf Fichtner

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

**Part of:** [M-WIWI-101451 - Energy Economics and Energy Markets](#)  
[M-WIWI-102808 - Digital Service Systems in Industry](#)

**Type**  
Written examination

**Credits**  
5,5 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
3

| Courses  |         |                                                      |       |                                                                                                |                           |
|----------|---------|------------------------------------------------------|-------|------------------------------------------------------------------------------------------------|---------------------------|
| WT 25/26 | 2581998 | <a href="#">Liberalised Power Markets</a>            | 2 SWS | Lecture /   | Fichtner                  |
| WT 25/26 | 2581999 | <a href="#">Übungen zu Liberalised Power Markets</a> | 2 SWS | Practice /  | Signer, Fichtner, Beranek |
| Exams    |         |                                                      |       |                                                                                                |                           |
| WT 25/26 | 7900160 | <a href="#">Liberalised Power Markets NEW</a>        |       |                                                                                                | Fichtner                  |
| ST 2026  | 7900205 | <a href="#">Liberalised Power Markets NEW</a>        |       |                                                                                                | Fichtner                  |

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

### Assessment

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.

### Recommendations

None

### Workload

165 hours

Below you will find excerpts from courses related to this module component:

## V

### Liberalised Power Markets

2581998, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
On-Site

**Content****1. Power markets in the past, now and in future****2. Designing liberalised power markets**

- 2.1. Unbundling Dimensions of liberalised power markets
- 2.2. Central dispatch versus markets without central dispatch
- 2.3. The short-term market model
- 2.4. The long-term market model
- 2.5. Market flaws and market failure
- 2.6. Regulation in liberalised markets

**3. The power (sub)markets**

- 3.1 Day-ahead market
- 3.2 Intraday market
- 3.3 (Long-term) Forwards and futures markets
- 3.4 Emission rights market
- 3.5 Market for ancillary services
- 3.6 The “market” for renewable energies
- 3.7 Future market segments

**4. Grid operation and congestion management**

- 4.1. Grid operation
- 4.2. Congestion management

**5. Market power**

- 5.1. Defining market power
- 5.2. Indicators of market power
- 5.3. Reducing market power

**6. Future market structures in the electricity value chain****1. Power markets in the past, now and in future****2. Designing liberalised power markets**

- 2.2. Unbundling Dimensions of liberalised power markets
- 2.3. Central dispatch versus markets without central dispatch
- 2.4. The short-term market model
- 2.5. The long-term market model
- 2.6. Market flaws and market failure
- 2.7. Regulation in liberalised markets

**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:**

Power System Economics; Steven Stoft, IEEE Press/Wiley-Interscience Press, 0-471-15040-1

**T****6.193 Module component: Life Cycle Assessment – Basics and Application Possibilities in an Industrial Context [T-WIWI-113107]**

**Coordinators:** Prof. Dr. Frank Schultmann  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101412 - Industrial Production III](#)  
[M-WIWI-101471 - Industrial Production II](#)

| Type                | Credits | Grading | Term offered     | Version |
|---------------------|---------|---------|------------------|---------|
| Written examination | 3,5 CP  | Graded  | Each winter term | 1       |

| Courses  |         |                                                                                                       |       |                                                                                               |                              |
|----------|---------|-------------------------------------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|------------------------------|
| WT 25/26 | 2581995 | <a href="#">Life Cycle Assessment - Basics and Application Possibilities in an Industrial Context</a> | 2 SWS | Lecture /  | Treml, Schultmann, Schneider |
| Exams    |         |                                                                                                       |       |                                                                                               |                              |
| WT 25/26 | 7981995 | <a href="#">Life Cycle Assessment - Basics and Application Possibilities in an Industrial Context</a> |       |                                                                                               | Schultmann                   |
| ST 2026  | 7981995 | <a href="#">Life Cycle Assessment - Basics and Application Possibilities in an Industrial Context</a> |       |                                                                                               | Schultmann                   |

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

**Assessment**

The assessment consists of an oral (approx. 30 minutes) or 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.

**Prerequisites**

None.

**Recommendations**

None

Below you will find excerpts from courses related to this module component:

**V****Life Cycle Assessment - Basics and Application Possibilities in an Industrial Context**

2581995, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)

Lecture (V)  
On-Site

**Content**

The lecture focuses on the analysis of the environmental impacts of products and processes using Life Cycle Assessment (short: LCA). Structure and steps are conveyed in detail and selected further developments are shown. In order to record the methodology and classify potential environmental impacts, the practical development of what has been learned is also focused on using LCA software and interactive formats.

Topics include:

- Significance and areas of application
- Calculation models
- Attributional/Consequential LCA
- Life Cycle Sustainability Assessment, Social LCA and Life Cycle Costing
- Limitations
- Development of a Case Study

**Literature**

werden in der Veranstaltung bekannt gegeben



## T

**6.194 Module component: Introduction to Quantum Machine Learning [T-INFO-113556]**

**Coordinators:** Dr. Eileen Kühn  
Dr. Max Kühn

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-106742 - Introduction to Quantum Machine Learning](#)

**Type**  
Written examination

**Credits**  
3 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
2

| Courses |         |                                                          |       |                                                                                               |      |
|---------|---------|----------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|------|
| ST 2026 | 2400158 | <a href="#">Introduction to Quantum Machine Learning</a> | 2 SWS | Lecture /  | Kühn |

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

**Assessment**

The assessment takes the form of a written examination (usually 60 minutes) in accordance with Section 4 (2) No. 1 SPO.

Depending on the number of participants, it will be announced six weeks before the examination (§ 6 Para. 3 SPO) whether the assessment will take place

- in the form of an oral examination in accordance with § 4 Para. 2 No. 2 SPO **or**
- in the form of a written examination in accordance with § 4 Para. 2 No. 1 SPO.

**Prerequisites**

None.

*Below you will find excerpts from courses related to this module component:*

## V

**Introduction to Quantum Machine Learning**

2400158, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

**Lecture (V)**  
**Blended (On-Site/Online)**

**Content**

This module aims to introduce students to the theoretical and practical aspects of using quantum computers for machine learning. In the first part of the lecture, the necessary mathematical foundations of quantum systems and their representation through qubits and quantum circuits will be summarized. Based on well-known quantum algorithms, the advantages and possibilities of quantum computing will be demonstrated. Finally, an overview of current hybrid approaches in the field of Quantum Machine Learning and their applications and limitations will be provided:

- Fundamentals and basic concepts
  - Theoretical and practical foundations of quantum computing
  - Taxonomy of Quantum Machine Learning
- Overview of QML algorithms, e.g.
  - Variational Quantum Eigensolver
  - Quantum Approximate Optimization Algorithm
  - Quantum Autoencoder
  - Quantum Convolutional Neural Networks
  - Quantum Generative Adversarial Neural Networks
  - Quantum Kernels
- Current challenges, e.g.
  - Noise
  - Barren Plateaus

In particular, the module will examine the applicability of today's quantum computers and the scalability of the presented approaches.

## T

**6.195 Module component: Localization of Mobile Agents [T-INFO-115014]**

**Coordinators:** Prof. Dr.-Ing. Uwe Hanebeck  
**Organisation:** KIT Department of Humanities and Social Sciences  
 KIT Department of Informatics  
**Part of:** [M-INFO-107663 - Localization of Mobile Agents](#)

| Type             | Credits | Grading | Term offered     | Expansion   | Version |
|------------------|---------|---------|------------------|-------------|---------|
| Oral examination | 6 CP    | graded  | Each summer term | 1 semesters | 2       |

**Assessment**

The assessment is carried out as an oral examination, lasting 15-30 minutes in accordance with Section 4 (2) No. 2 SPO. Participants can contact the chair at any time to arrange an appointment for the oral examination. (§ 4 Abs. 2 Nr. 2 SPO)

**Prerequisites**

T-INFO-115015 Digital exercise must be successfully completed before exam.

**Recommendations**

Knowledge of a higher-level programming language with mature libraries for scientific and numerical computing (e.g., Julia, Matlab, Python) is an advantage.

**T****6.196 Module component: Localization of Mobile Agents - Pass [T-INFO-115015]**

**Coordinators:** Prof. Dr.-Ing. Uwe Hanebeck  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-107663 - Localization of Mobile Agents](#)

| Type       | Credits | Grading   | Term offered     | Expansion   | Version |
|------------|---------|-----------|------------------|-------------|---------|
| Coursework | 0 CP    | pass/fail | Each summer term | 1 semesters | 1       |

**Assessment**

The assessment is carried out in form of course work (German Studienleistung, § 4 Abs. 3 SPO). Students must complete a digital exercise in Ilias which is ungraded. The digital exercise can be repeated as often as desired.

**Prerequisites**

None.

**Recommendations**

Knowledge of a higher-level programming language with mature libraries for scientific and numerical computing (e.g., Julia, Matlab, Python) is an advantage.

## T

**6.197 Module component: Logical Foundations of Cyber-Physical Systems [T-INFO-112360]****Coordinators:** Prof. Dr. André Platzer**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106102 - Logical Foundations of Cyber-Physical Systems](#)**Type**  
Written examination**Credits**  
6 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
3

| Courses  |         |                                                               |       |                                                                                               |         |
|----------|---------|---------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|---------|
| WT 25/26 | 2400161 | <a href="#">Logical Foundations of Cyber-Physical Systems</a> | 4 SWS | Lecture /  | Platzer |
| Exams    |         |                                                               |       |                                                                                               |         |
| WT 25/26 | 7500252 | <a href="#">Logical Foundations of Cyber-Physical Systems</a> |       |                                                                                               | Platzer |

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

The assessment is usually carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 120 minutes.

Depending on the number of participants, it will be announced six weeks before the examination (Section 6 (3) SPO) whether the assessment will take the form of an oral examination of approx.

- in the form of an oral examination of approx. 30 minutes in accordance with § 4 Para. 2 No. 2 SPO or

- in the form of a written examination in accordance with § 4 Para. 2 No. 1 SPO

takes place.

*In order to receive a bonus, you must earn at least 50% of the points for solving the exercises. 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.

**Recommendations**

The course assumes prior exposure to basic computer programming and mathematical reasoning. This course covers the basic required mathematical and logical background of cyber-physical systems. You will be expected to follow the textbook as needed: André Platzer. Logical Foundations of Cyber-Physical Systems. Springer 2018. DOI:10.1007/978-3-319-63588-0

**Additional Information**

Course web page: <https://lfcps.org/course/lfcps.html>

## T

**6.198 Module component: Low Power Design [T-INFO-101344]**

**Coordinators:** Prof. Dr.-Ing. Jörg Henkel  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-100807 - Low Power Design](#)

**Type**  
Oral examination

**Credits**  
3 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
1

**Courses**

|         |         |                                  |       |                                                                                               |                      |
|---------|---------|----------------------------------|-------|-----------------------------------------------------------------------------------------------|----------------------|
| ST 2026 | 2424672 | <a href="#">Low Power Design</a> | 2 SWS | Lecture /  | Henkel, Nassar, Khdr |
|---------|---------|----------------------------------|-------|-----------------------------------------------------------------------------------------------|----------------------|

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

**Assessment**

The assessment is carried out as an oral examination lasting 25-30 minutes, in accordance with Section 4 (2) No. 2 SPO.

**Prerequisites**

None.

**Recommendations**

- Basic knowledge from the modules "Design and Architectures of Embedded Systems (ESII)" and "Optimization and Synthesis of Embedded Systems (ESI)" are helpful but not essential for understanding of this lecture.
- The lecture is equally suitable for students from both computer science as well as electrical engineering department.
- The Lab of "Low Power Design and Embedded Systems" enables students to apply some of the theoretical knowledge gained from the lecture in practice.

Below you will find excerpts from courses related to this module component:

## V

**Low Power Design**

2424672, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

**Lecture (V)**  
On-Site

**Content**

Smart embedded devices driven by advances in fields as diverse as automotive smart home, to high-tech like lithography or battery technology for IoT devices are now omnipresent in our lives. Today's consumers have very high expectations from the embedded devices they own. Many emerging technologies such as virtual reality, robotics and artificial intelligence are limited in scope only by the performance of the underlying embedded devices. Unfortunately, performance of embedded devices is inherently constrained both by their limited cost, size as well as heat dissipating capacity and their limited on-board battery. The fact that all contemporary smartphones have multi-core chips running at low frequencies instead of single-core chips running at high frequencies can be attributed directly to the power consumption constraints imposed on them.

The constraints mandate highly optimized hardware-software co-design techniques for embedded devices that allows extraction of maximum performance with minimal power consumption. A good low power design requires all three building blocks of an embedded device – hardware, software and operating system – to work together synergistically. The lectures cover all the three aspects alongside their interactions from a low power design perspective in depth.

The lecture provides an overview of design methods, synthesis tools, estimation models, software techniques, operating system strategies, scheduling algorithms, etc., with the aim of minimizing the power consumption of embedded devices without compromising their performance. Both the research-relevant and industry-prevalent topics at different level of abstractions (from circuit to system) are discussed in this lecture.

Recommendations: Module "Entwurf und Architekturen für eingebettete Systeme". Basic knowledge from the module "Optimierung und Synthese Eingebetteter Systeme" is helpful but not essential for understanding of this lecture. The lecture is equally suitable for students from both computer science as well as electrical engineering department.

Students are made aware of various low power design optimizations employed in state-of-the-art embedded devices. At the end of the lecture, the students will be able to recognize the challenges involved in crafting efficient low power designs and how to tackle them.

## T

**6.199 Module component: Machine Learning - Foundations and Algorithms [T-INFO-114197]****Coordinators:** Prof. Dr. Gerhard Neumann**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107169 - Machine Learning - Foundations and Algorithms](#)**Type**  
Written examination**Credits**  
6 CP**Grading**  
graded**Term offered**  
Each summer term**Version**  
1

| Courses  |         |                                                               |       |                                                                                                         |         |
|----------|---------|---------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------|---------|
| ST 2026  | 2400018 | <a href="#">Machine Learning – Foundations and Algorithms</a> | 4 SWS | Lecture / Practice /  | Neumann |
| Exams    |         |                                                               |       |                                                                                                         |         |
| WT 25/26 | 7500292 | <a href="#">Machine Learning - Foundations and Algorithms</a> |       |                                                                                                         | Neumann |
| ST 2026  | 7500215 | <a href="#">Machine Learning - Foundations and Algorithms</a> |       |                                                                                                         | Neumann |

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

The success control takes place in the form of a written exam, usually 90 minutes in length, according to § 4 Abs. 2 Nr. 1 SPO.

A bonus can be acquired through successful participation in the exercise as a success control of a different kind (§4(2), 3 SPO 2008) or study performance (§4(3) SPO 2015). The exact criteria for awarding a bonus will be announced at the beginning of the lecture. 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). The bonus is only valid for the main and post exams of the semester in which it was earned. After that, the grade bonus expires.

**Prerequisites**

None.

**Recommendations**

- Attendance of the lecture "Foundations of Artificial Intelligence" ("Grundlagen der Künstlichen Intelligence")
- Knowledge in python
- Mathematics-heavy lecture. The basics will be reviewed, but mathematical proficiency is helpful

## T

## 6.200 Module component: Machine Learning 1 - Basic Methods [T-WIWI-106340]

**Coordinators:** Prof. Dr.-Ing. Johann Marius Zöllner  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-103356 - Machine Learning](#)

**Type**  
Written examination

**Credits**  
4,5 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
4

| Courses  |                    |                                                                                                                                                 |       |               |                          |
|----------|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|-------|---------------|--------------------------|
| WT 25/26 | 2511500            | <a href="#">Machine Learning 1 - Fundamental Methods</a>                                                                                        | 2 SWS | Lecture / 🗣️  | Zöllner                  |
| WT 25/26 | 2511501            | <a href="#">Exercises to Machine Learning 1 - Fundamental Methods</a>                                                                           | 1 SWS | Practice / 🗣️ | Zöllner, Polley, Fechner |
| Exams    |                    |                                                                                                                                                 |       |               |                          |
| WT 25/26 | 79AIFB_ML1_Deutsch | <a href="#">Machine Learning 1 - Basic Methods (Registration extended until Feb 16 – Late registration: Waitlist only, seat not guaranteed)</a> |       |               | Zöllner                  |
| WT 25/26 | 79AIFB_ML1_English | <a href="#">Machine Learning 1 - Basic Methods (written exam in English, Registration extended until 16.02.2026)</a>                            |       |               | Zöllner                  |
| ST 2026  | 791-AIFB-ML1-dt-NK | <a href="#">Machine Learning 1 - Basic Methods (Registration until 20.07.2026)</a>                                                              |       |               | Zöllner                  |
| ST 2026  | 791-AIFB-ML1-en-NK | <a href="#">Machine Learning 1 - Basic Methods (written exam in English, registration until 20.07.2026)</a>                                     |       |               | Zöllner                  |

Legend: 🗣️ Online, 🗣️🗣️ Blended (On-Site/Online), 🗣️ On-Site, ✖ Canceled

### Assessment

Success is assessed in the form of a written examination (60 minutes). The examination is offered every semester and can be repeated at any regular examination date.

A grade bonus can be earned by successfully completing 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.

### Workload

150 hours

Below you will find excerpts from courses related to this module component:

## V

### Machine Learning 1 - Fundamental Methods

2511500, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)

Lecture (V)  
On-Site

**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.

**Literature**

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.



## T

**6.201 Module component: Machine Learning 2 - Advanced Methods [T-WIWI-106341]**

**Coordinators:** Prof. Dr.-Ing. Johann Marius Zöllner  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101637 - Analytics and Statistics](#)  
[M-WIWI-103356 - Machine Learning](#)

**Type**  
Written examination

**Credits**  
4,5 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
5

| Courses  |                    |                                                                                                                 |       |                                                                                                |                                     |
|----------|--------------------|-----------------------------------------------------------------------------------------------------------------|-------|------------------------------------------------------------------------------------------------|-------------------------------------|
| ST 2026  | 2511502            | <a href="#">Machine Learning 2 - Advanced Methods</a>                                                           | 2 SWS | Lecture /   | Zöllner, Fechner, Polley, Stegmaier |
| ST 2026  | 2511503            | <a href="#">Exercises for Machine Learning 2 - Advanced Methods</a>                                             | 1 SWS | Practice /  | Zöllner, Fechner, Polley, Stegmaier |
| Exams    |                    |                                                                                                                 |       |                                                                                                |                                     |
| WT 25/26 | 79AIFB_ML2_Deutsch | <a href="#">Machine Learning 2 – Advanced Methods (exam in German, Registration extended until 16.02.2026)</a>  |       |                                                                                                | Zöllner                             |
| WT 25/26 | 79AIFB_ML2E_B1     | <a href="#">Machine Learning 2 – Advanced Methods (exam in English, Registration extended until 16.02.2026)</a> |       |                                                                                                | Zöllner                             |
| ST 2026  | 791-AIFB-ML2-dt-HK | <a href="#">Machine Learning 2 – Advanced Methods (written exam in German, registration until 20.07.2026)</a>   |       |                                                                                                | Zöllner                             |
| ST 2026  | 791-AIFB-ML2-en_HK | <a href="#">Machine Learning 2 – Advanced Methods (written exam in English, registration until 20.07.2026)</a>  |       |                                                                                                | Zöllner                             |

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

**Assessment**

Success is assessed in the form of a written examination (70 minutes). The examination is offered every semester and can be repeated at any regular examination date.

**Prerequisites**

None.

**Workload**

150 hours

Below you will find excerpts from courses related to this module component:

## V

**Machine Learning 2 - Advanced Methods**

2511502, SS 2026, 2 SWS, Language: German, [Open in study portal](#)

Lecture (V)  
On-Site

**Content**

Machine learning has become a central driver of innovation in science, engineering, and industry. Recent advances in learning algorithms and model architectures have enabled capabilities that were previously out of reach, such as high-quality image, video, and text generation, robust perception in complex environments, and intelligent decision-making under uncertainty. These developments are transforming how intelligent systems interact with the world and are increasingly deployed in large-scale, safety-critical, and autonomous applications.

This lecture provides an in-depth overview of the methods that enable these capabilities. It covers state-of-the-art network architectures, including transformers and graph neural networks, as well as modern generative models such as GANs and diffusion models. In addition, the lecture introduces model-free and model-based reinforcement learning for sequential decision-making and addresses practical aspects such as large-scale training, uncertainty-aware learning, active learning, and advanced computer vision. Through this integrated perspective, students gain a solid understanding of the principles, strengths, and limitations of modern machine learning methods and learn how to apply them in complex real-world systems.

**Learning objectives:**

- **Students have advanced knowledge of state-of-the-art machine learning methods and architectures**, including modern deep learning models, generative approaches, and reinforcement learning, as well as their theoretical foundations, assumptions, and application domains.
- **Students are able to formally describe, classify, and analyze advanced machine learning methods and architectures**, and to apply these methods within complex inference and decision-making systems while accounting for practical constraints such as data availability, scalability, robustness, and uncertainty.
- **Students are capable of critically evaluating advanced machine learning methods and architectures** and of selecting and justifying appropriate models and learning strategies for given problems in machine learning, based on problem characteristics, methodological trade-offs, and application requirements.

**Recommendations:** Attending the lecture Machine Learning 1 or a comparable lecture is very helpful in understanding this lecture.

**Notes:**

- The lecture will be taught in German with English slides. The exam can be taken in either German or English.
- The time of the exam is 70 minutes.

**Literature****Weiterführende Literatur**

- Probabilistic Machine Learning: An Introduction - Kevin P. Murphy
- Probabilistic Machine Learning: Advanced Topics - Kevin P. Murphy
- Deep Learning - Ian Goodfellow, Yoshua Bengio, Aaron Courville
- Reinforcement Learning: An Introduction - Richard S. Sutton and Andrew G. Barto

**Weitere (spezifische) Literatur zu einzelnen Themen wird in der Vorlesung angegeben.**

## T

**6.202 Module component: Machine Learning and Optimization in Energy Systems [T-WIWI-113073]**

**Coordinators:** Prof. Dr. Wolf Fichtner  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101452 - Energy Economics and Technology](#)

| Type                | Credits | Grading | Term offered     | Version |
|---------------------|---------|---------|------------------|---------|
| Written examination | 3,5 CP  | graded  | Each winter term | 4       |

| Courses  |         |                                                                     |       |                                                                                                         |                             |
|----------|---------|---------------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------|-----------------------------|
| WT 25/26 | 2581050 | <a href="#">Machine Learning and Optimization in Energy Systems</a> | 3 SWS | Lecture / Practice /  | Dengiz, Yilmaz, Kleinebrahm |
| Exams    |         |                                                                     |       |                                                                                                         |                             |
| WT 25/26 | 7900179 | <a href="#">Machine Learning and Optimization in Energy Systems</a> |       |                                                                                                         | Fichtner                    |
| ST 2026  | 7900207 | <a href="#">Machine Learning and Optimization in Energy Systems</a> |       |                                                                                                         | Fichtner                    |

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

**Assessment**

The assessment of this course is a written examination (60 min) or an oral exam (30 min) depending on the number of participants.

**Workload**

105 hours

Below you will find excerpts from courses related to this module component:

## V

**Machine Learning and Optimization in Energy Systems**

2581050, WS 25/26, 3 SWS, Language: English, [Open in study portal](#)

Lecture / Practice (VÜ)  
On-Site

**Content****Goals:**

Participants should know about the most common optimization and machine learning approaches for the application in energy systems. They should understand the basic principles of the methods and should be able to apply them for solving important problems of future energy systems with high shares of renewable energy sources.

**Content:**

In the beginning, the essential transition of the energy system into a smart grid and the need for methods from the field of optimization and machine learning are explained. The course can be subdivided into an optimization part and a larger machine learning part. In the optimization part, the basics of optimization approaches that are used in energy systems are shown. Further, heuristic methods and approaches from the field of multiobjective optimization are introduced. In the machine learning part, the most important methods from the field of unsupervised learning, supervised learning and reinforcement learning are introduced and their application in future energy systems are investigated.

Amongst the considered applications are power plant dispatch, intelligent heating with heat pumps, charging strategies for electric vehicles, clustering of energy data for energy system models and electricity demand and renewable generation forecasting.

We also offer a voluntary computer exercise that deepens the understanding of the methods and applications covered in the lecture. The students will have the opportunity to solve problems from the energy domain by using optimization and machine learning approaches implemented in the programming language Python.

The course's general focus is on the application of the methods in the energy field and not on the mathematical details of the different approaches.

The total workload for this course is approximately 105 hours:

- Attendance: 30 hours
- Self-study: 30 hours
- Exam preparation: 45 hours

## T

**6.203 Module component: Machine Learning for Natural Sciences [T-INFO-113916]****Coordinators:** Prof. Dr. Pascal Friederich**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106959 - Machine Learning for Natural Sciences](#)**Type**  
Oral examination**Credits**  
3 CP**Grading**  
graded**Term offered**  
Each summer term**Version**  
1

| Courses  |         |                                                           |       |                                                                                               |            |
|----------|---------|-----------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|------------|
| ST 2026  | 2400008 | <a href="#">Machine Learning for the Natural Sciences</a> | 2 SWS | Lecture /  | Friederich |
| Exams    |         |                                                           |       |                                                                                               |            |
| WT 25/26 | 7500391 | <a href="#">Machine Learning for Natural Sciences</a>     |       |                                                                                               | Friederich |
| ST 2026  | 7500211 | <a href="#">Machine Learning for Natural Sciences</a>     |       |                                                                                               | Friederich |

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

Lecture: The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 90 minutes.

Exercise: The assessment is carried out in form of course work (German Studienleistung, § 4 Abs. 3 SPO). Students must regularly submit exercise sheets. The number of exercise sheets and the scale for passing will be announced at the beginning of the course. The assessment can only be repeated once.

**Prerequisites**

None.

**Recommendations**

- Knowledge of the basics of machine learning is helpful but not required
- Interest in natural science topics is required
- Basic knowledge of python is recommended. It has to be acquired during the semester through self-study

**T****6.204 Module component: Machine Learning for Natural Sciences - Pass [T-INFO-113917]****Coordinators:** Prof. Dr. Pascal Friederich**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106959 - Machine Learning for Natural Sciences](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 3 CP    | Graded  | Each summer term | 1       |

| Courses |         |                                                                        |       |                                                                                                         |                                                                 |
|---------|---------|------------------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|
| ST 2026 | 2400034 | <a href="#">Exercise for Machine Learning for the Natural Sciences</a> | 2 SWS | Lecture / Practice /  | Friederich, Torresi, Neubert, Eberhard, Schlöder, Metni, Teufel |
| Exams   |         |                                                                        |       |                                                                                                         |                                                                 |
| ST 2026 | 7500149 | <a href="#">Exercise for Machine Learning for the Natural Sciences</a> |       |                                                                                                         | Friederich                                                      |

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

Lecture: The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 90 minutes.

Exercise: The assessment is carried out in form of course work (German Studienleistung, § 4 Abs. 3 SPO). Students must regularly submit exercise sheets. The number of exercise sheets and the scale for passing will be announced at the beginning of the course. The assessment can only be repeated once.

**Prerequisites**

None.

**Recommendations**

- Knowledge of the basics of machine learning is helpful but not required
- Interest in natural science topics is required
- Basic knowledge of python is recommended. It has to be acquired during the semester through self-study

## T

## 6.205 Module component: Machine Learning in Climate and Environmental Sciences [T-INFO-113083]

**Coordinators:** TT-Prof. Dr. Peer Nowack

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-106470 - Machine Learning in Climate and Environmental Sciences](#)

**Type**  
Written examination

**Credits**  
6 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
2

| Courses  |         |                                                                        |       |                                                                                                         |        |
|----------|---------|------------------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------|--------|
| ST 2026  | 2400003 | <a href="#">Machine Learning in Climate and Environmental Sciences</a> | 4 SWS | Lecture / Practice /  | Nowack |
| Exams    |         |                                                                        |       |                                                                                                         |        |
| WT 25/26 | 7500322 | <a href="#">Machine Learning in Climate and Environmental Sciences</a> |       |                                                                                                         | Nowack |
| ST 2026  | 7500302 | <a href="#">Machine Learning in Climate and Environmental Sciences</a> |       |                                                                                                         | Nowack |

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

### Assessment

The assessment of the lectures is likely carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 60-120 minutes (exact duration to be confirmed).

Depending on the class size, this might be changed to an oral examination (lasting around 20 minutes, § 4 Abs. 2 No. 2 SPO). The exact type of assessment will be confirmed at least six weeks prior to the assessment.

### Prerequisites

No strict prerequisites but several strong recommendations (see below).

### Recommendations

- Previous programming experience, e.g. in scientific contexts or in computer science, is required.
- Knowledge of fundamentals about machine learning is an advantage.
- Knowledge of the Python programming language is an advantage.
- Good knowledge of mathematical concepts such as linear algebra is an advantage.
- An interest in scientific questions important for the climate- and environmental sciences.

Below you will find excerpts from courses related to this module component:

## V

### Machine Learning in Climate and Environmental Sciences

2400003, SS 2026, 4 SWS, Language: English, [Open in study portal](#)

Lecture / Practice (VÜ)  
On-Site

**Content****Content:**

This module covers key concepts for real-world applications of machine learning, focusing on environmental data science. These include:

- foundations of machine learning (e.g., curse of dimensionality, cross-validation, cost functions, feature engineering)
- several widely applied regression, classification, and unsupervised learning algorithms (e.g., LASSO, random forests, Gaussian processes, neural networks, LSTMs, transformers, self-organizing maps)
- time series forecasting and causal inference.
- explainable AI (e.g., SHAP value analyses, feature permutation methods, intrinsically interpretable methods).

These concepts will be discussed in applied contexts, using current research examples from the climate and environmental sciences, including: climate change modelling, machine learning emulation of numerical models, forecasting air pollution and wildfires, understanding coupled dynamical systems such as global teleconnections in climate science, challenges in modelling non-stationary systems (e.g., predicting extreme weather events under global warming), and anomaly detection in measurement data.

The lectures are accompanied by computer exercises in which students learn how to implement and modify machine learning modelling pipelines first-hand.

**Workload:**

Concerning in-person events, this is a 4 SWS module: 2 SWS for lectures, 2 SWS for exercises

Overall:

(2 SWS lectures + 2 SWS exercises + 1.5 x 4 SWS preparation and homework) x 15 +30 h preparation for the exam = 180 h = 6 ECTS

**Competency/Goals:****Learning objectives:**

Students will be able to effectively address complex data science challenges. They can design and use robust strategies/modelling pipelines for machine learning applications in the climate and environmental sciences, which are transferable to other disciplines.

Their acquired knowledge will include major classes of machine learning techniques, how to choose and differentiate among algorithms in a variety of problem settings, ways of assessing important data properties that could for example help or interfere with modelling goals, and methods to combine data-driven modelling with prior scientific system understanding to increase performance and trustworthiness of machine learning.

Students will learn how to implement these approaches in Python, using major machine learning software packages.

**Credits for the exercise component (T-INFO-113085) will only be awarded once the corresponding lecture component (T-INFO-113083) is successfully completed. The exercises must be taken alongside the lectures; therefore, students will only receive the full 6 LP credits upon passing both the exercise and the final exam for the entire module.**

## T

**6.206 Module component: Machine Learning in Climate and Environmental Sciences - Pass [T-INFO-113085]****Coordinators:** TT-Prof. Dr. Peer Nowack**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106470 - Machine Learning in Climate and Environmental Sciences](#)

| Type       | Credits | Grading   | Term offered     | Version |
|------------|---------|-----------|------------------|---------|
| Coursework | 0 CP    | pass/fail | Each summer term | 2       |

| Courses  |         |                                                                               |       |                                                                                                         |        |
|----------|---------|-------------------------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------|--------|
| ST 2026  | 2400003 | <a href="#">Machine Learning in Climate and Environmental Sciences</a>        | 4 SWS | Lecture / Practice /  | Nowack |
| Exams    |         |                                                                               |       |                                                                                                         |        |
| WT 25/26 | 7500380 | <a href="#">Machine Learning in Climate and Environmental Sciences - Pass</a> |       |                                                                                                         | Nowack |

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

The assessment is carried out in form of course work (German Studienleistung, § 4 Abs. 3 SPO). Students must regularly submit exercise sheets. The number of exercise sheets and the scale for passing will be announced at the beginning of the course. The assessment can only be repeated once.

**Prerequisites**

No strict prerequisites but several strong recommendations (see below).

**Recommendations**

- Previous programming experience, e.g. in scientific contexts or in computer science, is required.
- Knowledge of fundamentals about machine learning is an advantage.
- Knowledge of the Python programming language is an advantage.
- Good knowledge of mathematical concepts such as linear algebra is an advantage.
- An interest in scientific questions important for the climate- and environmental sciences.

Below you will find excerpts from courses related to this module component:

## V

**Machine Learning in Climate and Environmental Sciences**2400003, SS 2026, 4 SWS, Language: English, [Open in study portal](#)Lecture / Practice (VÜ)  
On-Site



**Content****Content:**

This module covers key concepts for real-world applications of machine learning, focusing on environmental data science. These include:

- foundations of machine learning (e.g., curse of dimensionality, cross-validation, cost functions, feature engineering)
- several widely applied regression, classification, and unsupervised learning algorithms (e.g., LASSO, random forests, Gaussian processes, neural networks, LSTMs, transformers, self-organizing maps)
- time series forecasting and causal inference.
- explainable AI (e.g., SHAP value analyses, feature permutation methods, intrinsically interpretable methods).

These concepts will be discussed in applied contexts, using current research examples from the climate and environmental sciences, including: climate change modelling, machine learning emulation of numerical models, forecasting air pollution and wildfires, understanding coupled dynamical systems such as global teleconnections in climate science, challenges in modelling non-stationary systems (e.g., predicting extreme weather events under global warming), and anomaly detection in measurement data.

The lectures are accompanied by computer exercises in which students learn how to implement and modify machine learning modelling pipelines first-hand.

**Workload:**

Concerning in-person events, this is a 4 SWS module: 2 SWS for lectures, 2 SWS for exercises

Overall:

(2 SWS lectures + 2 SWS exercises + 1.5 x 4 SWS preparation and homework) x 15 +30 h preparation for the exam = 180 h = 6 ECTS

**Competency/Goals:****Learning objectives:**

Students will be able to effectively address complex data science challenges. They can design and use robust strategies/modelling pipelines for machine learning applications in the climate and environmental sciences, which are transferable to other disciplines.

Their acquired knowledge will include major classes of machine learning techniques, how to choose and differentiate among algorithms in a variety of problem settings, ways of assessing important data properties that could for example help or interfere with modelling goals, and methods to combine data-driven modelling with prior scientific system understanding to increase performance and trustworthiness of machine learning.

Students will learn how to implement these approaches in Python, using major machine learning software packages.

**Credits for the exercise component (T-INFO-113085) will only be awarded once the corresponding lecture component (T-INFO-113083) is successfully completed. The exercises must be taken alongside the lectures; therefore, students will only receive the full 6 LP credits upon passing both the exercise and the final exam for the entire module.**

**T****6.207 Module component: Machine Translation [T-INFO-101385]**

**Coordinators:** Prof. Dr. Jan Niehues  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-100848 - Machine Translation](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 6 CP    | graded  | Each summer term | 1       |

## T

**6.208 Module component: Management Accounting 1 [T-WIWI-102800]****Coordinators:** Prof. Dr. Marcus Wouters**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-101498 - Management Accounting](#)**Type**  
Written examination**Credits**  
4,5 CP**Grading**  
graded**Term offered**  
see Annotations**Version**  
2

| Courses  |              |                                                                   |         |                                                                                                |           |
|----------|--------------|-------------------------------------------------------------------|---------|------------------------------------------------------------------------------------------------|-----------|
| ST 2026  | 2579900      | <a href="#">Management Accounting 1</a>                           | 2 SWS   | Lecture /   | Wouters   |
| ST 2026  | 2579901      | <a href="#">Tutorial Management Accounting 1 (Bachelor)</a>       | 2 SWS   | Practice /  | Dickemann |
| ST 2026  | 2579902      | <a href="#">Tutorial Management Accounting 1 (Master)</a>         | 2 SWS   | Practice /  | Dickemann |
| Exams    |              |                                                                   |         |                                                                                                |           |
| WT 25/26 | 79-2579900-B | <a href="#">Management Accounting 1 (Bachelor)</a>                | Wouters |                                                                                                |           |
| WT 25/26 | 79-2579900-M | <a href="#">Management Accounting 1 (Mastervorzug und Master)</a> | Wouters |                                                                                                |           |

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

The assessment consists of a written exam (120 min.) according to § 4 paragraph 2 Nr. 1 of the examination regulation.

**Recommendations**

We recommend that you take part in our exercise for the lecture.

**Additional Information**

The course "Management Accounting 1" and the corresponding assessment for first-time examinees will be offered for the last time in the **summer semester 2026**.

The exercise is offered separately for Bachelor's students as well as for students in the Master's transfer and Master's program.

Note for exam registration:

- Bachelor students: 79-2579900-B Management Accounting 1 (Bachelor)
- Students in the Master's transfer and Master's program: 79-2579900-M Management Accounting 1 (Master's transfer and Master)

Below you will find excerpts from courses related to this module component:

## V

**Management Accounting 1**2579900, SS 2026, 2 SWS, Language: English, [Open in study portal](#)**Lecture (V)**  
Online

**Content**

The course covers topics in management accounting in a decision-making framework. Some of these topics in the course MA1 are: short-term planning, investment decisions, budgeting and activity-based costing.

We will use international material written in English.

We will approach these topics primarily from the perspective of the users of financial information (not so much from the controller who prepares the information).

The course builds on an introductory level of understanding of accounting concepts from Business Administration courses in the core program. The course is intended for students in Industrial Engineering.

**Learning objectives:**

- Students have an understanding of theory and applications of management accounting topics.
- They can use financial information for various purposes in organizations.

**Examination:**

- The assessment consists of a written exam (120 minutes) at the end of each semester (following § 4 (2) No. 1 of the examination regulation).

**Workload:**

- The total workload for this course is approximately 135.0 hours. For further information see German version.

**Organizational issues****Bitte beachten Sie:**

- die Vorlesung Management Accounting 1 wird letztmalig im SoS 2026 und
- die Vorlesung Management Accounting 2 wird letztmalig im WS 2026/27 angeboten.

**Literature**

- Marc Wouters, Frank H. Selto, Ronald W. Hilton, Michael W. Maher: Cost Management – Strategies for Business Decisions, 2012, Publisher: McGraw-Hill Higher Education (ISBN-13 9780077132392 / ISBN-10 0077132394)
- In addition, several papers that will be available on ILIAS.

**Tutorial Management Accounting 1 (Bachelor)**

2579901, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

**Practice (Ü)  
On-Site**

**Content**

see Module Handbook

**Organizational issues****Bitte beachten Sie:**

- die Übung Management Accounting 1 wird letztmalig im SoS 2026 und
- die Übung Management Accounting 2 wird letztmalig im WS 2026/27 angeboten.

**Tutorial Management Accounting 1 (Master)**

2579902, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

**Practice (Ü)  
On-Site**

**Content**

see Module Handbook

**Organizational issues****Bitte beachten Sie:**

- die Übung Management Accounting 1 wird letztmalig im SoS 2026 und
- die Übung Management Accounting 2 wird letztmalig im WS 2026/27 angeboten.

## T

**6.209 Module component: Management Accounting 2 [T-WIWI-102801]****Coordinators:** Prof. Dr. Marcus Wouters**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-101498 - Management Accounting](#)**Type**  
Written examination**Credits**  
4,5 CP**Grading**  
graded**Term offered**  
see Annotations**Version**  
2

| Courses  |              |                                                                   |         |                                                                                                |          |
|----------|--------------|-------------------------------------------------------------------|---------|------------------------------------------------------------------------------------------------|----------|
| WT 25/26 | 2579903      | <a href="#">Management Accounting 2</a>                           | 2 SWS   | Lecture /   | Wouters  |
| WT 25/26 | 2579904      | <a href="#">Tutorial Management Accounting 2 (Bachelor)</a>       | 2 SWS   | Practice /  | Letmathe |
| WT 25/26 | 2579905      | <a href="#">Tutorial Management Accounting 2 (Master)</a>         | 2 SWS   | Practice /  | Letmathe |
| Exams    |              |                                                                   |         |                                                                                                |          |
| WT 25/26 | 79-2579903-B | <a href="#">Management Accounting 2 (Bachelor)</a>                | Wouters |                                                                                                |          |
| WT 25/26 | 79-2579903-M | <a href="#">Management Accounting 2 (Mastervorzug und Master)</a> | Wouters |                                                                                                |          |

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

The assessment consists of a written exam (120 min.) according to § 4 paragraph 2 Nr. 1 of the examination regulation.

**Prerequisites**

None

**Recommendations**

It is recommended:

- to take part in the course "Management Accounting 1" before this course
- participation in the exercise for the lecture "Management Accounting 2"

**Additional Information**The course "Management Accounting 2" and the corresponding assessment for first-time examinees will be offered for the last time in the **winter semester 2026/2027**.

The exercise for the lecture is offered separately for Bachelor's students as well as for students in the Master's transfer and Master's program.

Note for exam registration: Bachelor students:

- 79-2579903-B Management Accounting 2 (Bachelor)
- Students in the Master's transfer and Master's program: 79-2579903-M Management Accounting 2 (Master's transfer and Master)

Below you will find excerpts from courses related to this module component:

## V

**Management Accounting 2**2579903, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)**Lecture (V)**  
Online

**Content**

The course covers topics in management accounting in a decision-making framework. Some of these topics in the course MA2 are: cost estimation, product costing and cost allocation, financial performance measures, transfer pricing, strategic performance measurement systems.

We will use international material written in English.

We will approach these topics primarily from the perspective of the users of financial information (not so much from the controller who prepares the information).

The course builds on an introductory level of understanding of accounting concepts from Business Administration courses in the core program. The course is intended for students in Industrial Engineering.

**Learning objectives:**

- Students have an understanding of theory and applications of management accounting topics. They can use financial information for various purposes in organizations.

**Recommendations:**

- It is recommended to take part in the course "Management Accounting 1" before this course.

**Examination:**

- The assessment consists of a written exam (120 min) at the end of each semester (following § 4 (2) No. 1 of the examination regulation).

**Workload:**

- The total workload for this course is approximately 135.0 hours. For further information see German version.

**Literature**

- Marc Wouters, Frank H. Selto, Ronald W. Hilton, Michael W. Maher: Cost Management – Strategies for Business Decisions, 2012, Verlag: McGraw-Hill Higher Education (ISBN-13 9780077132392 / ISBN-10 0077132394)
- Zusätzlich werden Artikel auf ILIAS zur Vergütung gestellt.

**Tutorial Management Accounting 2 (Bachelor)**

2579904, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

**Practice (Ü)  
On-Site**

**Content**

see ILIAS

**Tutorial Management Accounting 2 (Master)**

2579905, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

**Practice (Ü)  
On-Site**

**Content**

see ILIAS

## T

**6.210 Module component: Management of IT-Projects [T-WIWI-113968]****Coordinators:** Prof. Dr.-Ing. Sascha Alpers**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-101477 - Development of Business Information Systems](#)**Type**  
Written examination**Credits**  
4,5 CP**Grading**  
graded**Term offered**  
Each summer term**Version**  
1

| Courses  |                  |                                                                                |       |                                                                                                |          |
|----------|------------------|--------------------------------------------------------------------------------|-------|------------------------------------------------------------------------------------------------|----------|
| ST 2026  | 2511214          | <a href="#">IT Project Management</a>                                          | 2 SWS | Lecture /   | Alpers   |
| ST 2026  | 2511215          | <a href="#">Exercise IT Project Management</a>                                 | 1 SWS | Practice /  | Rybinski |
| Exams    |                  |                                                                                |       |                                                                                                |          |
| WT 25/26 | 79AIFB_ITP_C3    | <a href="#">IT Project Management (Registration extended until 16.02.2026)</a> |       |                                                                                                | Oberweis |
| ST 2026  | 791-AIFB-ITPM-HK | <a href="#">IT Project Management (Registration until 20.07.2026)</a>          |       |                                                                                                | Oberweis |

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

Success is assessed in the form of a written examination (written exam) lasting 60 minutes.

**Workload**

135 hours

*Below you will find excerpts from courses related to this module component:*

## V

**IT Project Management**2511214, SS 2026, 2 SWS, Language: German, [Open in study portal](#)**Lecture (V)**  
**On-Site**

**Content****Contents:**

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 about 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
- Project Management Institute Standards Committee. A Guide to the Project Management Body of Knowledge (PMBOK guide). Project Management Institute. Four Campus Boulevard. Newton Square. PA 190733299. U.S.A.

**Exercise IT Project Management**

2511215, SS 2026, 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.



## T

**6.211 Module component: Market Research [T-WIWI-107720]****Coordinators:** Prof. Dr. Martin Klarmann**Organisation:** KIT Department of Business and Economics

**Part of:** [M-WIWI-101510 - Cross-Functional Management Accounting](#)  
[M-WIWI-101647 - Data Science: Evidence-based Marketing](#)  
[M-WIWI-105312 - Marketing and Sales Management](#)  
[M-WIWI-105714 - Consumer Research](#)  
[M-WIWI-106258 - Digital Marketing](#)

| Type                | Credits | Grading | Term offered     | Version |
|---------------------|---------|---------|------------------|---------|
| Written examination | 4,5 CP  | graded  | Each summer term | 3       |

| Courses  |         |                                          |       |                                                                                                |          |
|----------|---------|------------------------------------------|-------|------------------------------------------------------------------------------------------------|----------|
| ST 2026  | 2571150 | <a href="#">Market Research</a>          | 2 SWS | Lecture /   | Klarmann |
| ST 2026  | 2571151 | <a href="#">Market Research Tutorial</a> | 1 SWS | Practice /  | Klarmann |
| Exams    |         |                                          |       |                                                                                                |          |
| WT 25/26 | 7900053 | <a href="#">Market Research</a>          |       |                                                                                                | Klarmann |
| ST 2026  | 7900015 | <a href="#">Market Research</a>          |       |                                                                                                | Klarmann |

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

**Assessment**

The assessment of success takes place through a written exam (70 minutes) with additional aids in the sense of an open book exam. Further details will be announced during the lecture.

**Prerequisites**

None

**Recommendations**

None

**Additional Information**

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 courses related to this module component:

## V

**Market Research**

2571150, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
On-Site

**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**

Homburg, Christian (2016), Marketingmanagement, 6. Aufl., Wiesbaden.

## T

**6.212 Module component: Marketing Analytics [T-WIWI-103139]****Coordinators:** Prof. Dr. Martin Klarmann**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-101647 - Data Science: Evidence-based Marketing](#)**Type**  
Examination of another type**Credits**  
4,5 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
6

| Courses  |         |                                     |       |                                                                                                |          |
|----------|---------|-------------------------------------|-------|------------------------------------------------------------------------------------------------|----------|
| WT 25/26 | 2572170 | <a href="#">Marketing Analytics</a> | 2 SWS | Lecture /   | Klarmann |
| WT 25/26 | 2572171 |                                     | 1 SWS | Practice /  | Jacob    |
| Exams    |         |                                     |       |                                                                                                |          |
| WT 25/26 | 7900082 | <a href="#">Marketing Analytics</a> |       |                                                                                                | Klarmann |

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

Alternative (according to §4(2), 3 of the examination regulation) exam assessment (working on tasks in groups during the lecture).

**Prerequisites**

None

**Recommendations**

It is strongly recommended to complete the course "Market Research" prior to taking the "Marketing Analytics" course.

**Additional Information**

"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](mailto: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 courses related to this module component:

## V

**Marketing Analytics**2572170, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)**Lecture (V)**  
**On-Site****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](mailto:marketing.iism.kit.edu)).

**Literature**

- Hanssens, Dominique M., Parsons, Leonard J., Schultz, Randall L. (2003), Market response models: Econometric and time series analysis, 2nd ed, Boston.
- Gelman, Andrew, Hill, Jennifer (2006), Data analysis using regression and multilevel/hierarchical models, New York.
- 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.
- Ledolter, Johannes (2013), Data mining and business analytics with R, New York.

V2572171, WS 25/26, 1 SWS, Language: English, [Open in study portal](#)**Practice (Ü)  
On-Site****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

**6.213 Module component: Master's Thesis [T-WIWI-103142]**

**Coordinators:** Studiendekan der KIT-Fakultät für Informatik  
Studiendekan des KIT-Studienganges

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

**Part of:** [M-WIWI-104833 - Master's Thesis](#)

| Type         | Credits | Grading | Language | Version |
|--------------|---------|---------|----------|---------|
| Final Thesis | 30 CP   | graded  | D        | 1       |

**Assessment**

see module description

**Prerequisites**

see module description

**Final Thesis**

This module component represents a final thesis. The following periods have been supplied:

|                                 |          |
|---------------------------------|----------|
| <b>Submission deadline</b>      | 6 months |
| <b>Maximum extension period</b> | 3 months |
| <b>Correction period</b>        | 8 weeks  |

## T

**6.214 Module component: Matching Theory [T-WIWI-113264]**

**Coordinators:** Prof. Dr. Clemens Puppe  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101500 - Microeconomic Theory](#)

**Type**  
Written examination

**Credits**  
4,5 CP

**Grading**  
graded

**Term offered**  
see Annotations

**Version**  
1

| Courses  |         |                                 |       |                                                                                                         |         |
|----------|---------|---------------------------------|-------|---------------------------------------------------------------------------------------------------------|---------|
| WT 25/26 | 2500042 | <a href="#">Matching Theory</a> | 3 SWS | Lecture / Practice /  | Okulicz |
| Exams    |         |                                 |       |                                                                                                         |         |
| WT 25/26 | 7900347 | <a href="#">Matching Theory</a> |       |                                                                                                         | Puppe   |

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

**Assessment**

The examination will be offered for the last time in the summer semester 2026. Success is assessed in the form of a written examination lasting 90 minutes.

**Additional Information**

The course is no longer offered.

**Workload**

135 hours

Below you will find excerpts from courses related to this module component:

## V

**Matching Theory**

2500042, WS 25/26, 3 SWS, Language: English, [Open in study portal](#)

Lecture / Practice (VÜ)  
On-Site

**Content**

How should we organize recruitment of students to schools? Could we improve the placement of doctors to hospitals? Why there always seems to be a better roommate to the one you currently have? Matching Theory answers all these questions and more. During the course we will formally study mathematical systems of allocating goods and people, and see their many real life applications from organizing kidney exchange to improving dating apps. The course will cover three main topics in Matching Theory and Market Design: (1) assignment problems (e.g., allocation of social housing), (2) two-sided matching (e.g., allocation of children to schools), (3) transferable-utility matching (e.g., labor market).

The students are expected to:

1. Understand the mathematical properties of allocations and commonly used mechanism
2. Understand the connection between Matching Theory and real-life allocation systems
3. Be able to use their knowledge to propose solutions for novel real-life problems

**Workload:**

- Attendance time – Lecture (2 SWS × 15 weeks): 30 h
- Attendance time – Tutorial (1 SWS × 15 weeks): 15 h
- Self-study – Lecture: 45 h
- Self-study – Tutorial: 25 h
- Exam preparation: 20 h
- **Total workload: 135 h**

**T****6.215 Module component: Mathematics for High Dimensional Statistics [T-WIWI-111247]**

**Coordinators:** Prof. Dr. Oliver Grothe  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101473 - Mathematical Programming](#)  
[M-WIWI-101637 - Analytics and Statistics](#)  
[M-WIWI-103289 - Stochastic Optimization](#)

| Type             | Credits | Grading | Term offered | Version |
|------------------|---------|---------|--------------|---------|
| Oral examination | 4,5 CP  | graded  | Irregular    | 1       |

**Assessment**

The assessment of the course (lecture and exercise) consists of an oral exam (approx. 30 min.) taking place in the recess period.

**Prerequisites**

None

**Recommendations**

Basic knowledge of mathematics and statistics is assumed.

Knowledge in multivariate statistics is an advantage, but not necessary for the course.

## T

**6.216 Module component: Media Management [T-WIWI-112711]**

**Coordinators:** Prof. Dr. Ann-Kristin Kupfer  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-106258 - Digital Marketing](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 4,5 CP  | Graded  | Each winter term | 1       |

| Courses  |         |                                           |       |               |                              |
|----------|---------|-------------------------------------------|-------|---------------|------------------------------|
| WT 25/26 | 2572192 | <a href="#">Media Management</a>          | 2 SWS | Lecture / 🗣️  | Kupfer                       |
| WT 25/26 | 2572193 | <a href="#">Media Management Exercise</a> | 1 SWS | Practice / 🗣️ | Kupfer, Mitarbeiter, Schmitt |
| Exams    |         |                                           |       |               |                              |
| WT 25/26 | 7900135 | <a href="#">Media Management</a>          |       |               | Kupfer                       |
| ST 2026  | 7900004 | <a href="#">Media Management</a>          |       |               | Kupfer                       |

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

**Assessment**

Success is assessed in the form of an examination of another type. The following aspects are included in the assessment:

- Elaboration and presentation of a group task
- Written exam

Further details on the organization of the performance and the points system for the assessment will be announced in the lecture.

**Prerequisites**

None

**Recommendations**

Students are highly encouraged to actively participate in class.

**Workload**

135 hours

*Below you will find excerpts from courses related to this module component:*

## V

**Media Management**

2572192, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

**Lecture (V)**  
On-Site

**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.

## T

**6.217 Module component: Methods in Economics [T-WIWI-114054]**

**Coordinators:** Prof. Dr. Ingrid Ott  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-107011 - Economics of Innovation and Growth](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 1,5 CP  | graded  | Each summer term | 1       |

| Courses |         |                                      |       |                                                                                               |     |
|---------|---------|--------------------------------------|-------|-----------------------------------------------------------------------------------------------|-----|
| ST 2026 | 2560240 | <a href="#">Methods in Economics</a> | 1 SWS | Lecture /  | Ott |
| Exams   |         |                                      |       |                                                                                               |     |
| ST 2026 | 7900108 | <a href="#">Methods in Economics</a> |       |                                                                                               | Ott |

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

**Assessment**

The assessment of success of the lecture will be in the form of an examination of another type.

**Prerequisites**

None

**Recommendations**

Basic knowledge of micro- and macroeconomics is assumed, as taught in the courses Economics I [2600012] and Economics II [2600014]. Further, it is assumed that students have interest in using quantitative-mathematical methods.

**Additional Information**

Due to Prof. Dr. Ingrid Ott's research semester, the lectures for this course will not be offered in the summer semester 2026.

*Below you will find excerpts from courses related to this module component:*

## V

**Methods in Economics**

2560240, SS 2026, 1 SWS, Language: German/English, [Open in study portal](#)

**Lecture (V)**  
On-Site

**Content**

The economic exploitation of inventions is an important part of innovation economics. Intellectual property rights such as patents or trademarks play a central role. Within this workshop, the recording, processing and analysis of such intellectual property rights will be deepened, e.g. considering specific technologies. Students will learn how to work with relational databases, the econometric evaluation of recorded data, and methods for visualising them.

**Learning objectives:**

The student

- learns to query data sources.
- is able to analyse data with statistical methods.
- visualises and interprets data evaluations (e.g. using dashboards or methods of network analysis).

**Recommendations:**

An interest in working with data, basic knowledge on databases as well as basic knowledge in economics and statistics are advantageous.

**Workload:**

The total workload for this course is approximately 45 hours.

- Classes: ca. 5 h
- Self-study: ca. 40 h

**Assessment:**

Non exam assessment according to § 4 paragraph 3 of the examination regulation (SPO 2015).

**Organizational issues**

The course is structured along three meetings. The first of which is getting an individual assignment, the second meeting to guide/direct the students, whereas the third meeting is assignment as a group project.

**Meeting 1** will take place on **30.04.2026** in **Building 01.87, B5.25**.

**Meeting 2** will take place on **04.06.2026** in **Building 01.87, B5.25**.

**Meeting 3** will take place on **23.07.2026** in **Building 01.87, B5.25**.

The exact time will be announced later.

Students are offered the opportunity to participate in this course jointly with the course "Seminar in Economic Policy", within the module "Economics of Innovation and Growth". The work in both courses will be strongly related to each other, as students will work on the same topic from two different perspectives. Students in the course "Seminar in Economic Policy" will be provided with the opportunity to write a paper that addresses the results found by the students in the course "Methods in Economics". Taking both courses together will enable the students to earn 4.5 ECTS.

**Literature**

Relevante Literatur wird in der Vorlesung bekanntgegeben.  
(Relevant literature will be announced in the lecture.)

## T

**6.218 Module component: Methods in Innovation Management [T-WIWI-110263]**

**Coordinators:** Prof. Dr. Marion Weissenberger-Eibl  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101507 - Innovation Management](#)  
[M-WIWI-101507 - Innovation Management](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 3 CP    | graded  | Irregular    | 1       |

**Assessment**

The assessment is an alternative exam assessment consisting of a presentation (25%) and a written paper (75%). The points system for the assessment is determined by the lecturer of the course. It will be announced at the beginning of the course.

**Prerequisites**

None.

**Recommendations**

Prior attendance of the course "Innovation Management: Concepts, Strategies and Methods" is recommended.

**Additional Information**

Teaching and learning format: Seminar

**Workload**

90 hours

## T

**6.219 Module component: Microeconometrics [T-WIWI-112153]****Coordinators:** Prof. Dr. Fabian Krüger**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-105414 - Statistics and Econometrics II](#)**Type**  
Written examination**Credits**  
4,5 CP**Grading**  
graded**Term offered**  
Irregular**Version**  
1

| Courses |         |                                               |       |                                                                                                |        |
|---------|---------|-----------------------------------------------|-------|------------------------------------------------------------------------------------------------|--------|
| ST 2026 | 2500019 | <a href="#">Tutorial in Microeconometrics</a> | 2 SWS | Practice /  | Krüger |
| ST 2026 | 2500032 | <a href="#">Microeconometrics</a>             | 2 SWS | Lecture /   | Krüger |

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

The assessment consists of 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

**Recommendations**

Students are expected to have a good working knowledge of the linear regression model (e.g. by having attended the course 'Volkswirtschaftslehre III: Einführung in die Ökonometrie', or attending it in the same semester as 'Microeconometrics').

**Workload**

135 hours

Below you will find excerpts from courses related to this module component:

## V

**Microeconometrics**2500032, SS 2026, 2 SWS, Language: English, [Open in study portal](#)**Lecture (V)**  
On-Site**Content**

Microeconometrics is concerned with modeling data from an individual ('micro') unit like a person, household or firm. The response variables of interest are often discrete. For example, a person's type of employment may be coded as a binary variable (e.g. working in IT sector versus not working in IT sector), and a person's choice of transportation mode can be cast as a multinomial variable (e.g. bike, train, car, or other). These dependent variables often require nonlinear regression modeling.

The course first introduces maximum likelihood estimation which is particularly useful in microeconometrics. We then discuss econometric models for various types of response variables, as well as methods for estimation and model evaluation. Throughout the course, implementation via R software plays an important role.

**Prerequisites:** Course participants are expected to have a good working knowledge of the linear regression model (e.g. by having attended the course 'Einführung in die Ökonometrie', or attending it in the same semester as 'Microeconometrics').

**Literature**

Winkelmann, R., Boes, S. (2006): Analysis of Microdata. Springer.

## T

## 6.220 Module component: Mixed Integer Programming I [T-WIWI-102719]

**Coordinators:** Prof. Dr. Oliver Stein

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

**Part of:** [M-WIWI-101473 - Mathematical Programming](#)  
[M-WIWI-102832 - Operations Research in Supply Chain Management](#)  
[M-WIWI-103289 - Stochastic Optimization](#)

| Type                | Credits | Grading | Term offered | Version |
|---------------------|---------|---------|--------------|---------|
| Written examination | 4,5 CP  | graded  | Irregular    | 1       |

| Courses  |                   |                                                       |       |                                                                                                |                      |
|----------|-------------------|-------------------------------------------------------|-------|------------------------------------------------------------------------------------------------|----------------------|
| WT 25/26 | 2550138           | <a href="#">Mixed-integer Programming I</a>           | 2 SWS | Lecture /   | Stein                |
| WT 25/26 | 2550139           | <a href="#">Exercises Mixed Integer Programming I</a> | 2 SWS | Practice /  | Stein, Beck, Neussel |
| ST 2026  | 2550140           | <a href="#">Mixed-integer Programming II</a>          | 2 SWS | Lecture /   | Stein                |
| Exams    |                   |                                                       |       |                                                                                                |                      |
| WT 25/26 | 7900180_WS2526_HK | <a href="#">Mixed Integer Programming I</a>           |       |                                                                                                | Stein                |
| ST 2026  | 7900014_SS2026_NK | <a href="#">Mixed Integer Programming I</a>           |       |                                                                                                | Stein                |

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

### Assessment

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

### Recommendations

It is strongly recommended to visit at least one lecture from the Bachelor program of this chair before attending this course.

### Additional Information

The lecture is offered irregularly. The curriculum of the next three years is available online ([kop.ior.kit.edu](http://kop.ior.kit.edu)).

Below you will find excerpts from courses related to this module component:

## V

### Mixed-integer Programming I

2550138, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)

Lecture (V)  
On-Site

**Content**

Many optimization problems from economics, engineering and natural sciences are modeled with continuous as well as with discrete variables. Examples are the energy minimal design of a chemical process in which several reactors may be switched on or off, 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 focusses on mixed-integer *linear* optimization problems and is structured as follows:

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

The lecture is accompanied by exercises which, amongst others, offers the opportunity to implement and to test some of the methods on practically relevant examples.

**Remark:**

The treatment of mixed-integer *nonlinear* optimization problems forms the contents of the lecture "Mixed-integer Programming II".

**Learning objectives:**

The student

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

**Literature**

- C.A. Floudas, Nonlinear and Mixed-Integer Optimization: Fundamentals and Applications, Oxford University Press, 1995
- J. Kallrath: Gemischt-ganzzahlige Optimierung, Vieweg, 2002
- D. Li, X. Sun: Nonlinear Integer Programming, Springer, 2006
- G.L. Nemhauser, L.A. Wolsey, Integer and Combinatorial Optimization, Wiley, 1988
- M. Tawarmalani, N.V. Sahinidis, Convexification and Global Optimization in Continuous and Mixed-Integer Nonlinear Programming, Kluwer, 2002.

**Mixed-integer Programming II**

2550140, SS 2026, 2 SWS, Language: German, [Open in study portal](#)

**Lecture (V)  
On-Site**

**Content**

Many optimization problems from economics, engineering and natural sciences are modeled with continuous as well as with discrete variables. Examples are the energy minimal design of a chemical process in which several reactors may be switched on or off, portfolio optimization with limitations on the number of securities, the choice of locations to serve customers at minimum cost, and the optimal design of vote allocations in election procedures. For the algorithmic identification of optimal points of such problems an interaction of ideas from discrete as well as continuous optimization is necessary.

The lecture focusses on mixed-integer *nonlinear* optimization problems and is structured as follows:

- Continuous relaxation and error bounds for roundings
- Branch-and-Bound for convex and nonconvex problems
- Generalized Benders decomposition
- Outer approximation methods
- Lagrange relaxation
- Dantzig-Wolfe decomposition
- Heuristics

The lecture is accompanied by exercises which, amongst others, offers the opportunity to implement and to test some of the methods on practically relevant examples.

**Remark:**

The treatment of mixed-integer *linear* optimization problems forms the contents of the lecture "Mixed-integer Programming I".

**Learning objectives:**

The student

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

**Literature**

- C.A. Floudas, Nonlinear and Mixed-Integer Optimization: Fundamentals and Applications, Oxford University Press, 1995
- J. Kallrath: Gemischt-ganzzahlige Optimierung, Vieweg, 2002
- D. Li, X. Sun: Nonlinear Integer Programming, Springer, 2006
- G.L. Nemhauser, L.A. Wolsey, Integer and Combinatorial Optimization, Wiley, 1988
- M. Tawarmalani, N.V. Sahinidis, Convexification and Global Optimization in Continuous and Mixed-Integer Nonlinear Programming, Kluwer, 2002.



## T

## 6.221 Module component: Mixed Integer Programming II [T-WIWI-102720]

**Coordinators:** Prof. Dr. Oliver Stein

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

**Part of:** [M-WIWI-101473 - Mathematical Programming](#)  
[M-WIWI-102832 - Operations Research in Supply Chain Management](#)  
[M-WIWI-103289 - Stochastic Optimization](#)

| Type                | Credits | Grading | Term offered | Version |
|---------------------|---------|---------|--------------|---------|
| Written examination | 4,5 CP  | graded  | Irregular    | 1       |

| Courses |                   |                                                          |       |                                                                                                |                 |
|---------|-------------------|----------------------------------------------------------|-------|------------------------------------------------------------------------------------------------|-----------------|
| ST 2026 | 2550140           | <a href="#">Mixed-integer Programming II</a>             | 2 SWS | Lecture /   | Stein           |
| ST 2026 | 2550141           | <a href="#">Exercise to Mixed-integer Programming II</a> | 1 SWS | Practice /  | Stein, Schwarze |
| Exams   |                   |                                                          |       |                                                                                                |                 |
| ST 2026 | 7900009_SS2026_HK | <a href="#">Mixed Integer Programming II</a>             |       |                                                                                                | Stein           |

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

### Assessment

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

### Recommendations

It is strongly recommended to visit at least one lecture from the Bachelor program of this chair before attending this course.

### Additional Information

The lecture is offered irregularly. The curriculum of the next three years is available online ([kop.ior.kit.edu](http://kop.ior.kit.edu)).

Below you will find excerpts from courses related to this module component:

## V

### Mixed-integer Programming II

2550140, SS 2026, 2 SWS, Language: German, [Open in study portal](#)

Lecture (V)  
On-Site

**Content**

Many optimization problems from economics, engineering and natural sciences are modeled with continuous as well as with discrete variables. Examples are the energy minimal design of a chemical process in which several reactors may be switched on or off, portfolio optimization with limitations on the number of securities, the choice of locations to serve customers at minimum cost, and the optimal design of vote allocations in election procedures. For the algorithmic identification of optimal points of such problems an interaction of ideas from discrete as well as continuous optimization is necessary.

The lecture focusses on mixed-integer *nonlinear* optimization problems and is structured as follows:

- Continuous relaxation and error bounds for roundings
- Branch-and-Bound for convex and nonconvex problems
- Generalized Benders decomposition
- Outer approximation methods
- Lagrange relaxation
- Dantzig-Wolfe decomposition
- Heuristics

The lecture is accompanied by exercises which, amongst others, offers the opportunity to implement and to test some of the methods on practically relevant examples.

**Remark:**

The treatment of mixed-integer *linear* optimization problems forms the contents of the lecture "Mixed-integer Programming I".

**Learning objectives:**

The student

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

**Literature**

- C.A. Floudas, Nonlinear and Mixed-Integer Optimization: Fundamentals and Applications, Oxford University Press, 1995
- J. Kallrath: Gemischt-ganzzahlige Optimierung, Vieweg, 2002
- D. Li, X. Sun: Nonlinear Integer Programming, Springer, 2006
- G.L. Nemhauser, L.A. Wolsey, Integer and Combinatorial Optimization, Wiley, 1988
- M. Tawarmalani, N.V. Sahinidis, Convexification and Global Optimization in Continuous and Mixed-Integer Nonlinear Programming, Kluwer, 2002.

## T

**6.222 Module component: Mobile Communication [T-INFO-114271]**

**Coordinators:** Prof. Dr. Oliver Waldhorst  
Prof. Dr. Martina Zitterbart

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-107245 - Mobile Communication](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 4 CP    | graded  | Each winter term | 1       |

| Courses  |         |                                      |       |         |                       |
|----------|---------|--------------------------------------|-------|---------|-----------------------|
| WT 25/26 | 2400015 | <a href="#">Mobile Communication</a> | 2 SWS | Lecture | Waldhorst, Mahrt      |
| Exams    |         |                                      |       |         |                       |
| WT 25/26 | 7500015 | <a href="#">Mobile Communication</a> |       |         | Waldhorst, Zitterbart |
| ST 2026  | 7500073 | <a href="#">Mobile Communication</a> |       |         | Waldhorst, Zitterbart |

**Assessment**

The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting 20 minutes.

*Depending on the number of participants, it will be announced six weeks before the examination (Section 6 (3) SPO) whether the assessment will take the form of an oral examination of approx.*

*- in the form of an oral examination of approx. 30 minutes in accordance with § 4 Para. 2 No. 2 SPO **or***

*- in the form of a written examination in accordance with § 4 Para. 2 No. 1 SPO*

*takes place.*

**Prerequisites**

None.

**Recommendations**

The contents of the lecture Introduction to Computer Networks are assumed to be known. Attendance of the lecture Telematics is strongly recommended, as the contents are an important basis for understanding and classifying the material.

## T

## 6.223 Module component: Model-Driven Software Development [T-INFO-113896]

**Coordinators:** Dr.-Ing. Erik Burger  
Prof. Dr. Ralf Reussner

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-106931 - Model-Driven Software Development](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 3 CP    | graded  | Each winter term | 2       |

| Courses  |         |                                                   |       |                                                                                               |                  |
|----------|---------|---------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|------------------|
| WT 25/26 | 2424657 | <a href="#">Model-Driven Software Development</a> | 2 SWS | Lecture /  | Burger           |
| Exams    |         |                                                   |       |                                                                                               |                  |
| WT 25/26 | 7500086 | <a href="#">Model Driven Software Development</a> |       |                                                                                               | Reussner, Burger |
| ST 2026  | 7500016 | <a href="#">Model Driven Software Development</a> |       |                                                                                               | Burger, Reussner |

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

**Assessment**

The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting 25 minutes.

**Prerequisites**

None.

**Recommendations**

Basic knowledge from the lecture Software Engineering II is helpful.

## T

**6.224 Module component: Modeling and OR-Software: Advanced Topics [T-WIWI-106200]****Coordinators:** Prof. Dr. Stefan Nickel**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-102808 - Digital Service Systems in Industry](#)  
[M-WIWI-102832 - Operations Research in Supply Chain Management](#)**Type**  
Written examination**Credits**  
4,5 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
4

| Courses  |         |                                                                      |       |                                                                                                        |                       |
|----------|---------|----------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------|-----------------------|
| WT 25/26 | 2550490 | <a href="#">Modellieren und OR-Software: Fortgeschrittene Themen</a> | 3 SWS | Practical course /  | Pomes, Linner, Nickel |
| Exams    |         |                                                                      |       |                                                                                                        |                       |
| WT 25/26 | 7900071 | <a href="#">Modeling and OR-Software: Advanced Topics</a>            |       |                                                                                                        | Nickel                |
| ST 2026  | 7900188 | <a href="#">Modeling and OR-Software: Advanced Topics</a>            |       |                                                                                                        | Nickel                |

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

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.

**Recommendations**

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

Successful completion of the course *Modeling and OR-Software: Introduction*.

**Additional Information**

Due to the limited number of participants, please register in advance. Further information can be found on the website of the course. Registration takes place via the Wiwi-Portal. The course is offered every winter semester. The planned lectures and courses for the next three years are announced online at <https://dol.iwr.kit.edu/Lehrveranstaltungen.php>.

**Workload**

135 hours

Below you will find excerpts from courses related to this module component:

## V

**Modellieren und OR-Software: Fortgeschrittene Themen**

2550490, WS 25/26, 3 SWS, Language: German, [Open in study portal](#)

Practical course (P)  
Blended (On-Site/Online)

**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 language is Python.

Please note that the second exam in the summer semester 26 will only be offered to students in their second try.

## T

**6.225 Module component: Modeling and Simulation [T-WIWI-112685]**

**Coordinators:** Prof. Dr.-Ing. Sanja Lazarova-Molnar  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101456 - Intelligent Systems and Services](#)

**Type**  
Written examination

**Credits**  
4,5 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
1

| Courses  |                 |                                                                                  |       |          |                          |
|----------|-----------------|----------------------------------------------------------------------------------|-------|----------|--------------------------|
| ST 2026  | 2511100         | <a href="#">Modeling and Simulation</a>                                          | 2 SWS | Lecture  | Lazarova-Molnar          |
| ST 2026  | 2511101         | <a href="#">Exercises Modeling and Simulation</a>                                | 1 SWS | Practice | Lazarova-Molnar, Mostafa |
| Exams    |                 |                                                                                  |       |          |                          |
| WT 25/26 | 79AIFB_MaS_A6   | <a href="#">Modeling and Simulation (Registration extended until 16.02.2026)</a> |       |          | Lazarova-Molnar          |
| ST 2026  | 791-AIFB-MaS-HK | <a href="#">Modeling and Simulation (Registration until 20.07.2026)</a>          |       |          | Lazarova-Molnar          |

**Assessment**

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

**Recommendations**

Some experience in programming and knowledge of basic mathematics and statistics.

**Additional Information**

Instruction is in the form of lectures and exercises. A detailed course schedule will be published before the start of the semester.

**Workload**

135 hours

*Below you will find excerpts from courses related to this module component:*

## V

**Modeling and Simulation**

2511100, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

**Lecture (V)**

**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

**T****6.226 Module component: Modeling the Dynamics of Financial Markets [T-WIWI-113414]****Coordinators:** Prof. Dr. Maxim Ulrich**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-106660 - Modeling the Dynamics of Financial Markets](#)

| Type                | Credits | Grading | Term offered     | Version |
|---------------------|---------|---------|------------------|---------|
| Written examination | 9 CP    | graded  | Each summer term | 1       |

**Assessment**

The examination takes the form of a one-hour written comprehensive examination on the courses "Dynamic Capital Market Theory", "Essentials for Dynamic Financial Machine Learning" and "Exercises, Python, Research Frontier in Dynamic Capital Markets".

**Recommendations**

Recommendation: Knowledge in the fields of Advanced Statistics, Deep Learning, Financial Economics, Differential Equations, Optimization.

**Workload**

270 hours



## T

**6.227 Module component: Motion in Human and Machine - Seminar [T-INFO-105140]**

**Coordinators:** Prof. Dr.-Ing. Tamim Asfour  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-102555 - Motion in Human and Machine - Seminar](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 3 CP    | Graded  | Each summer term | 3       |

| Courses |         |                                                     |       |                                                                                               |        |
|---------|---------|-----------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|--------|
| ST 2026 | 2400063 | <a href="#">Motion in Human and Machine</a>         | 3 SWS | Seminar /  | Asfour |
| Exams   |         |                                                     |       |                                                                                               |        |
| ST 2026 | 7500289 | <a href="#">Motion in Man and Machine - Seminar</a> |       |                                                                                               | Asfour |

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

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO). It includes a term paper and a final presentation.

**Prerequisites**

None.

**Recommendations**

Programming skills in C++, Python or Matlab are recommended.

Attendance of the lectures Robotics I – Introduction to Robotics, Robotics II – Humanoid Robotics, Robotics III – Sensors and Perception in Robotics, Mechano-Informatics and Robotics and Wearable Robot Technologies is recommended

**Additional Information**

This interdisciplinary seminar is conducted in cooperation with the University of Stuttgart and the University of Tübingen.

*Below you will find excerpts from courses related to this module component:*

## V

**Motion in Human and Machine**

2400063, SS 2026, 3 SWS, Language: English, [Open in study portal](#)

**Seminar (S)**  
On-Site

**Content**

This interdisciplinary block seminar addresses methods for modeling, generating, and controlling movements in human and robot systems. Students gain insight into this interdisciplinary field, learning fundamentals of capturing biological motion, biomechanical simulation, robotics, and machine learning.

The seminar begins with the generation of human movement as an effect of muscle contraction. It covers how observed movement patterns can be identified and categorized. Methods for learning movement primitives from human demonstrations are presented, including approaches for reproducing these patterns on humanoid robots. The seminar addresses the challenge of mapping human motion to robots with different kinematics and dynamics. Students learn how motion primitives enable transfer of human movements to robotic systems and their application to motion generation in humanoid robots.

Students work in small groups on collaborative projects that apply the learned methods. These projects allow students to deepen their understanding through practical application of the methods.

**Competency Goals:**

Students understand methods for modeling, processing, and analyzing human motions. They can explain approaches for capturing biological motion and biomechanical simulation.

Students can describe methods for learning motion primitives from human demonstrations and understand how human motion is mapped to robots with different kinematics and dynamics. They can apply these methods in new contexts.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

**Organizational issues****Institutions:**

KIT IAR - H<sup>2</sup>T Prof. T. Asfour, University of Stuttgart, University of Tübingen

This interdisciplinary seminar is conducted in cooperation with the University of Stuttgart and the University of Tübingen.

**Competency certificate:**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO) and it includes a term paper and a final presentation.

**Recommendations:**

Programming skills in C++, Python or Matlab are recommended.

Attendance of the lectures *Robotics I – Introduction to Robotics*, *Robotics II – Humanoid Robotics*, *Robotics III – Sensors and Perception in Robotics*, *Mechano-Informatics and Robotics* and *Wearable Robot Technologies* is recommended.

**Workload:**

90 h

- approx. 30 h attendance time
- approx. 15 h group project
- approx. 20 h literature review
- approx. 20 h written paper
- approx. 5 h preparation of video podcast

## T

**6.228 Module component: Multicriteria Optimization [T-WIWI-111587]****Coordinators:** Prof. Dr. Oliver Stein**Organisation:** KIT Department of Business and Economics

**Part of:** [M-WIWI-101473 - Mathematical Programming](#)  
[M-WIWI-102832 - Operations Research in Supply Chain Management](#)  
[M-WIWI-103289 - Stochastic Optimization](#)

| Type                | Credits | Grading | Term offered    | Version |
|---------------------|---------|---------|-----------------|---------|
| Written examination | 4,5 CP  | graded  | see Annotations | 1       |

**Assessment**

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

**Recommendations**

It is strongly recommended to visit at least one lecture from the Bachelor program of this chair before attending this course.

**Additional Information**

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](http://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

**Workload**

135 hours

## T

**6.229 Module component: Multimodal Artificial Intelligence [T-INFO-115041]**

**Coordinators:** Prof. Dr. Jan Niehues  
Prof. Dr.-Ing. Rainer Stiefelhagen

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-107676 - Multimodal Artificial Intelligence](#)

**Type**  
Written examination

**Credits**  
6 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
1

| Courses |         |                                                    |       |                                                                                               |                       |
|---------|---------|----------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|-----------------------|
| ST 2026 | 2400141 | <a href="#">Multimodal Artificial Intelligence</a> | 4 SWS | Lecture /  | Niehues, Stiefelhagen |

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

**Assessment**

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) approx. 60 minutes.

**Prerequisites**

None.

*Below you will find excerpts from courses related to this module component:*

## V

**Multimodal Artificial Intelligence**

2400141, SS 2026, 4 SWS, Language: English, [Open in study portal](#)

**Lecture (V)**  
**On-Site**

**Content**

AI systems are increasingly integrated into our everyday lives. These are, for example, systems that can understand and generate language or analyze images and videos. In addition, AI systems are essential in robotics in order to be able to develop the next generation of intelligent robots.

Based on the knowledge of the lecture "Einführung in der KI", the students learn to understand, develop and evaluate these systems. In order to bring this knowledge closer to the students, the lecture is divided into 4 parts. First, the methods of perception using different modalities are treated. The second part deals with advanced methods of learning that go beyond supervised learning. Then methods are discussed that are required for the representation of knowledge in AI systems. Finally, methods are presented that enable AI systems to generate content.

-

Requirements:

None

Recommendations:

- "Einführung in der KI"
- Good basic knowledge of mathematics

Workload:

approx. 180 hours, of which  
approx. 45 hours lecture attendance  
approx. 15 hours exercise visit  
approx. 90 hours post-processing and processing of the exercise sheets  
approx. 30 hours exam preparation

Learning goals:

- The students know the relevant elements of a technical cognitive system and their tasks.
- The students understand the algorithms and methods of AI to model technically cognitive systems.
- The students are able to understand the different sub-components to develop and analyze a system.
- The students can transfer this knowledge to new applications, as well as analyze and compare different methods.

success control:

See the module manual!

## T

**6.230 Module component: Multivariate Statistical Methods [T-WIWI-103124]****Coordinators:** Prof. Dr. Oliver Grothe**Organisation:** KIT Department of Business and Economics

**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                | Credits | Grading | Term offered | Version |
|---------------------|---------|---------|--------------|---------|
| Written examination | 4,5 CP  | graded  | Irregular    | 1       |

| Courses |         |                                                  |       |                                                                                                |        |
|---------|---------|--------------------------------------------------|-------|------------------------------------------------------------------------------------------------|--------|
| ST 2026 | 2550554 | <a href="#">Analysis of Multivariate Data</a>    | 2 SWS | Lecture /   | Grothe |
| ST 2026 | 2550555 | <a href="#">Übung zu Multivariate Verfahren</a>  | 2 SWS | Practice /  | Vetter |
| Exams   |         |                                                  |       |                                                                                                |        |
| ST 2026 | 7900351 | <a href="#">Multivariate Statistical Methods</a> |       |                                                                                                | Grothe |

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

**Assessment**

Written examination lasting 60 minutes.

The examination is offered during the examination period of the lecture semester. Only repeaters (and not first-time writers) are admitted to the repeat examination in the examination period of the following semester.

**Prerequisites**

None

**Recommendations**

Due to the strong quantitative focus and the treatment of advanced statistical methods, in-depth prior knowledge of statistics (comparable to the content of the 'Advanced Statistics' course) is very advantageous for successful completion of the course. Students without such prior knowledge are advised to prepare intensively before the start of the course, as a significantly higher level of familiarization is to be expected.

In addition, prior attendance of the Bachelor course 'Analysis of multivariate data' is recommended. Alternatively, the lecture notes for this course can be made available to students to help them prepare independently.

**Additional Information**

The course (lecture and exercise) is offered irregularly. Detailed information can be found on the chair's website.

**Workload**

135 hours

Below you will find excerpts from courses related to this module component:

## V

**Analysis of Multivariate Data**

2550554, SS 2026, 2 SWS, Language: German, [Open in study portal](#)

Lecture (V)  
On-Site

**Literature**

Skript zur Vorlesung

## T

**6.231 Module component: Natural Language Processing [T-INFO-114207]****Coordinators:** Prof. Dr. Jan Niehues**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107178 - Natural Language Processing](#)**Type**  
Written examination**Credits**  
6 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
1

| Courses  |         |                                                       |       |                                                                                               |                     |
|----------|---------|-------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|---------------------|
| WT 25/26 | 2400147 | <a href="#">Natural Language Processing</a>           | 4 SWS | Lecture /  | Niehues, Liu, Züfle |
| Exams    |         |                                                       |       |                                                                                               |                     |
| WT 25/26 | 00092   | <a href="#">Natural Language Processing muendlich</a> |       |                                                                                               | Niehues             |
| WT 25/26 | 7500286 | <a href="#">Natural Language Processing</a>           |       |                                                                                               | Niehues             |

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

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 60 minutes.

**Prerequisites**

None.

Below you will find excerpts from courses related to this module component:

## V

**Natural Language Processing**2400147, WS 25/26, 4 SWS, Language: English, [Open in study portal](#)**Lecture (V)**  
On-Site**Content**

This course provides an in-depth exploration of computational approaches to understanding and generating human language. The curriculum progresses from foundational concepts to state-of-the-art techniques, equipping students with both theoretical knowledge and practical implementation skills.

The course begins with fundamental linguistic concepts, including tokenization, morphology, and word representations, before advancing to neural approaches such as word embeddings. Core sequence processing techniques form a substantial portion of the curriculum, covering both traditional methods (e.g., Hidden Markov Models) and modern neural approaches (e.g., attention mechanisms). The course places significant emphasis on Transformer-based models, examining pretrained encoder models like BERT, sequence-to-sequence architectures, and large language models from the GPT family and beyond. Advanced topics include instruction following and model alignment, task adaptation, decoding strategies for text generation, and evaluation methodologies. Students will gain insights into cutting-edge techniques including in-context learning, prompting strategies, and retrieval-augmented generation (RAG) systems that combine neural models with external knowledge bases. The latter portion of the course expands into specialized domains: multilingual NLP for cross-lingual applications, conversational AI and dialogue systems, speech technologies (both recognition and synthesis), and multimodal models that integrate vision, speech, and language.

Five practical sessions provide opportunities to implement and experiment with the techniques discussed in lectures.

**T****6.232 Module component: Natural Language Processing and Software Engineering [T-INFO-114257]****Coordinators:** Prof. Dr.-Ing. Anne Kozirolek**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107233 - Natural Language Processing and Software Engineering](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 3 CP    | graded  | Each winter term | 1       |

| Courses  |         |                                                                      |       |                                                                                               |                      |
|----------|---------|----------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|----------------------|
| WT 25/26 | 2424187 | <a href="#">Natural Language Processing and Software Engineering</a> | 2 SWS | Lecture /  | Hey, Kozirolek, Keim |
| Exams    |         |                                                                      |       |                                                                                               |                      |
| WT 25/26 | 7543231 | <a href="#">Natural Language Processing and Software Engineering</a> |       |                                                                                               | Hey, Keim            |
| ST 2026  | 7543231 | <a href="#">Natural Language Processing and Software Engineering</a> |       |                                                                                               | Hey, Keim            |

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

The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting 25 minutes.

**Prerequisites**

None.



**T****6.233 Module component: Network Security: Architectures and Protocols [T-INFO-114238]****Coordinators:** Prof. Dr. Martina Zitterbart**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107218 - Network Security: Architectures and Protocols](#)**Type**  
Oral examination**Credits**  
4 CP**Grading**  
graded**Term offered**  
Each summer term**Version**  
1

| Courses  |         |                                                               |       |                                                                                               |                             |
|----------|---------|---------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|-----------------------------|
| ST 2026  | 24601   | <a href="#">Network Security: Architectures and Protocols</a> | 2 SWS | Lecture /  | Baumgart, Bless, Zitterbart |
| Exams    |         |                                                               |       |                                                                                               |                             |
| WT 25/26 | 7500014 | <a href="#">Network Security: Architectures and Protocols</a> |       |                                                                                               | Zitterbart, Bless, Baumgart |
| ST 2026  | 7500072 | <a href="#">Network Security: Architectures and Protocols</a> |       |                                                                                               | Zitterbart, Bless, Baumgart |

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

The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting 20 minutes.

Depending on the number of participants, it will be announced six weeks before the examination (Section 6 (3) SPO) whether the assessment will take the form of an oral examination of approx.

- in the form of an oral examination of approx. 30 minutes in accordance with § 4 Para. 2 No. 2 SPO or
- in the form of a written examination in accordance with § 4 Para. 2 No. 1 SPO

takes place.

**Prerequisites**

None.

**Recommendations**

The contents of the lecture Introduction to Computer Networks are assumed to be known. Attendance of the lecture Telematics is strongly recommended, as the contents are an important basis for understanding and classifying the material.

Below you will find excerpts from courses related to this module component:

**V****Network Security: Architectures and Protocols**

24601, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
On-Site

**Content****Content**

The lecture "Network Security: Architectures and Protocols" looks at challenges and techniques in the design of secure communication protocols as well as data protection and privacy issues. Complex systems such as Kerberos are examined in detail and their design decisions with regard to security aspects are highlighted. Special focus is placed on PKI fundamentals, infrastructures and specific PKI formats. Further emphasis is placed on the common security protocols IPSec and TLS/SSL as well as protocols for infrastructure protection.

Contents of the lecture "Einführung in Rechnernetze" are assumed to be known.

Furthermore it is highly recommended to visit the Telematics lecture, because its contents build an important base to understand and categorize the knowledge of the Network Security lecture.

**Learning Objective****Students**

- know basic challenges, protection goals and cryptographic building blocks that are relevant for the design of secure communication systems
- are proficient in security-relevant communication protocols (e.g. Kerberos, TLS, IPSec) and can identify and explain basic security mechanisms
- have the ability to analyze and evaluate communication protocols from a security perspective
- have the ability to assess and evaluate the quality of security mechanisms in relation to the required security objectives

In particular, students are familiar with typical attack techniques such as eavesdropping, interception or replaying and can explain these using examples. In addition, students are familiar with cryptographic primitives such as symmetric and asymmetric encryption, digital signatures, message authentication codes and can apply these in particular for the design of secure communication services.

Students are familiar with the Kerberos distributed authentication service and can explain the protocol flow in their own words and name basic concepts (e.g. tickets). In addition, students are familiar with relevant communication protocols for protecting communication on the Internet (e.g. IPsec, TLS) and can explain these and analyze and evaluate their security properties.

Students know different methods for network access protection and can explain and compare common authentication methods (e.g. CHAP, PAP, EAP). Furthermore, students are proficient in methods for protecting wireless access networks and can analyze and evaluate methods such as WEP, WPA and WPA2.

Students master different trust models and can explain and apply basic technical concepts (e.g. digital certificates, PKI) in their own words. In addition, students develop an understanding of data protection aspects in communication networks and can explain and apply technical procedures to protect privacy.

**Organizational issues**

Netzicherheit: Architekturen und Protokolle

**Literature**

Roland Bless et al. Sichere Netzwerkkommunikation. Springer-Verlag, Heidelberg, Juni 2005.

**Weiterführende Literatur**

- Charlie Kaufman, Radia Perlman und Mike Speciner. Network Security: Private Communication in a Public World. 2nd Edition. Prentice Hall, New Jersey, 2002.
- Carlisle Adams und Steve Lloyd. Understanding PKI. Addison Wesley, 2003
- Rolf Oppliger. Secure Messaging with PGP and S/MIME. Artech House, Norwood, 2001.
- Sheila Frankel. Demystifying the IPsec Puzzle. Artech House, Norwood, 2001.
- Thomas Hardjono und Lakshminath R. Dondeti. Security in Wireless LANs and MANs. Artech House, Norwood, 2005.
- Eric Rescorla. SSL and TLS: Designing and Building Secure Systems. Addison Wesley, Indianapolis, 2000.

## T

**6.234 Module component: Next Generation Internet [T-INFO-101321]**

**Coordinators:** Dr.-Ing. Roland Bless  
Prof. Dr. Martina Zitterbart

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-100784 - Next Generation Internet](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 4 CP    | Graded  | Each summer term | 1       |

| Courses  |         |                                          |       |                                                                                               |                   |
|----------|---------|------------------------------------------|-------|-----------------------------------------------------------------------------------------------|-------------------|
| ST 2026  | 24674   | <a href="#">Next Generation Internet</a> | 2 SWS | Lecture /  | Bless             |
| Exams    |         |                                          |       |                                                                                               |                   |
| WT 25/26 | 7500016 | <a href="#">Next Generation Internet</a> |       |                                                                                               | Bless, Zitterbart |
| ST 2026  | 7500074 | <a href="#">Next Generation Internet</a> |       |                                                                                               | Bless, Zitterbart |

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

**Assessment**

The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting 20 minutes.

Depending on the number of participants, it will be announced six weeks before the examination (Section 6 (3) SPO) whether the assessment will take the form of an oral examination of approx.

- in the form of an oral examination of approx. 30 minutes in accordance with § 4 Para. 2 No. 2 SPO or
- in the form of a written examination in accordance with § 4 Para. 2 No. 1 SPO takes place.

**Prerequisites**

None.

**Recommendations**

The contents of the lecture Introduction to Computer Networks are assumed to be known. Attendance of the lecture Telematics is strongly recommended, as the contents are an important basis for understanding and classifying the material.

*Below you will find excerpts from courses related to this module component:*

## V

**Next Generation Internet**

24674, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

**Lecture (V)**  
**On-Site**

**Content**

The lecture focuses on current developments in Internet-based network technologies. First, architectural principles of today's Internet are presented and discussed, subsequently nowadays and future challenges are motivated. Methods for quality-of-service support and transport of multi-media stream as well as newer transport protocols and group communication support are presented. Deployment of the presented technologies in IP-based networks are discussed. The lecture presents advanced approaches such as programmable networks and network virtualization as well as newer approaches and protocols for routing, satellite networking, and peer-to-peer networks.

**Literature**

James F. Kurose, and Keith W. Ross *Computer Networking* 6th edition, Addison-Wesley/Pearson, 2013, ISBN 978-0-273-76896-8, Chapters 1, 2.6 (P2P), 4 (Network Layer), 7.5 (Scheduling, IntServ, DiffServ, RSVP)

**Weiterführende Literatur**

wird in der Vorlesung bekanntgegeben.

## T

**6.235 Module component: Non- and Semiparametrics [T-WIWI-103126]**

**Coordinators:** Prof. Dr. Melanie Schienle  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101638 - Econometrics and Statistics I](#)  
[M-WIWI-101639 - Econometrics and Statistics II](#)

| Type                | Credits | Grading | Term offered | Version |
|---------------------|---------|---------|--------------|---------|
| Written examination | 4,5 CP  | graded  | Irregular    | 1       |

| Courses  |         |                                          |       |          |          |
|----------|---------|------------------------------------------|-------|----------|----------|
| WT 25/26 | 2521300 | <a href="#">Non- and Semiparametrics</a> | 2 SWS | Lecture  | Schienle |
| WT 25/26 | 2521301 |                                          | 2 SWS | Practice | Rüter    |
| Exams    |         |                                          |       |          |          |
| WT 25/26 | 7900009 | <a href="#">Non- and Semiparametrics</a> |       |          | Schienle |

**Assessment**

The assessment consists of a written exam (90 minutes) (following §4(2), 1 of the examination regulation).

**Prerequisites**

None

**Recommendations**

Knowledge of the contents covered by the course "*Applied Econometrics*" [2520020]

**Additional Information**

The course takes place every second winter semester: 2018/19 then 2020/21

Below you will find excerpts from courses related to this module component:

## V

**Non- and Semiparametrics**

2521300, WS 25/26, 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**

Li, Racine: Nonparametric Econometrics: Theory and Practice. Princeton University Press, 2007.

## T

**6.236 Module component: Nonlinear Optimization I [T-WIWI-102724]****Coordinators:** Prof. Dr. Oliver Stein**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-101473 - Mathematical Programming](#)**Type**  
Written examination**Credits**  
4,5 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
4

| Courses  |                   |                                                    |       |            |                          |
|----------|-------------------|----------------------------------------------------|-------|------------|--------------------------|
| WT 25/26 | 2550111           | <a href="#">Nonlinear Optimization I</a>           | 2 SWS | Lecture /  | Stein                    |
| WT 25/26 | 2550112           | <a href="#">Exercises Nonlinear Optimization I</a> | 1 SWS | Practice / | Stein, Schwarze, Neussel |
| Exams    |                   |                                                    |       |            |                          |
| WT 25/26 | 7900001_WS2526_HK | <a href="#">Nonlinear Optimization I</a>           |       |            | Stein                    |
| ST 2026  | 7900202_SS2026_NK | <a href="#">Nonlinear Optimization I</a>           |       |            | Stein                    |

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

**Assessment**

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.

**Additional Information**

Part I and II of the lecture are held consecutively in the *same* semester.

Below you will find excerpts from courses related to this module component:

## V

**Nonlinear Optimization I**2550111, WS 25/26, 2 SWS, Language: English, [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**

O. Stein, Basic Concepts of Nonlinear Optimization, Springer, Berlin, 2024

**Additional Literature:**

- W. Alt, Nichtlineare Optimierung, Vieweg, 2002
- M.S. Bazaraa, H.D. Sherali, C.M. Shetty, Nonlinear Programming, Wiley, 1993
- O. Güler, Foundations of Optimization, Springer, 2010
- H.Th. Jongen, K. Meer, E. Triesch, Optimization Theory, Kluwer, 2004
- J. Nocedal, S. Wright, Numerical Optimization, Springer, 2000

## T

**6.237 Module component: Nonlinear Optimization I and II [T-WIWI-103637]****Coordinators:** Prof. Dr. Oliver Stein**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-101473 - Mathematical Programming](#)**Type**  
Written examination**Credits**  
9 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
6

| Courses  |                   |                                                    |       |                                                                                                |                          |
|----------|-------------------|----------------------------------------------------|-------|------------------------------------------------------------------------------------------------|--------------------------|
| WT 25/26 | 2550111           | <a href="#">Nonlinear Optimization I</a>           | 2 SWS | Lecture /   | Stein                    |
| WT 25/26 | 2550112           | <a href="#">Exercises Nonlinear Optimization I</a> | 1 SWS | Practice /  | Stein, Schwarze, Neussel |
| WT 25/26 | 2550113           | <a href="#">Nonlinear Optimization II</a>          | 2 SWS | Lecture /   | Stein                    |
| Exams    |                   |                                                    |       |                                                                                                |                          |
| WT 25/26 | 7900003_WS2526_HK | <a href="#">Nonlinear Optimization I and II</a>    |       |                                                                                                | Stein                    |
| ST 2026  | 7900204_SS2026_NK | <a href="#">Nonlinear Optimization I and II</a>    |       |                                                                                                | Stein                    |

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

The assessment consists of a written exam in English (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.

**Additional Information**

Part I and II of the lecture are held consecutively in the **same** semester.

*Below you will find excerpts from courses related to this module component:*

## V

**Nonlinear Optimization I**

2550111, WS 25/26, 2 SWS, Language: English, [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**

O. Stein, Basic Concepts of Nonlinear Optimization, Springer, Berlin, 2024

**Additional Literature:**

- W. Alt, Nichtlineare Optimierung, Vieweg, 2002
- M.S. Bazaraa, H.D. Sherali, C.M. Shetty, Nonlinear Programming, Wiley, 1993
- O. Güler, Foundations of Optimization, Springer, 2010
- H.Th. Jongen, K. Meer, E. Triesch, Optimization Theory, Kluwer, 2004
- J. Nocedal, S. Wright, Numerical Optimization, Springer, 2000

**Nonlinear Optimization II**

2550113, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

**Lecture (V)**  
**On-Site**

**Content**

The lecture treats the minimization of smooth nonlinear functions under nonlinear constraints. For such problems, which occur very often in economics, engineering, and natural sciences, optimality conditions are derived and, based on them, solution algorithms are developed. The lecture is structured as follows:

- Topology and first order approximations of the feasible set
- Theorems of the alternative, first and second order optimality conditions
- Algorithms (penalty method, multiplier method, barrier method, interior point method, SQP method, quadratic optimization)

The lecture is accompanied by exercises which, amongst others, offers the opportunity to implement and to test some of the methods on practically relevant examples.

**Remark:**

The treatment of optimization problems *without* constraints forms the contents of the lecture "Nonlinear Optimization I". The lectures "Nonlinear Optimization I" and "Nonlinear Optimization II" are held consecutively *in the same semester*.

**Learning objectives:**

The student

- knows and understands fundamentals of constrained nonlinear optimization,
- is able to choose, design and apply modern techniques of constrained nonlinear optimization in practice.

**Literature**

O. Stein, Basic Concepts of Nonlinear Optimization, Springer, Berlin, 2024

**Additional Literature:**

- W. Alt, Nichtlineare Optimierung, Vieweg, 2002
- M.S. Bazaraa, H.D. Sherali, C.M. Shetty, Nonlinear Programming, Wiley, 1993
- O. Güler, Foundations of Optimization, Springer, 2010
- H.Th. Jongen, K. Meer, E. Triesch, Optimization Theory, Kluwer, 2004
- J. Nocedal, S. Wright, Numerical Optimization, Springer, 2000



## T

## 6.238 Module component: Nonlinear Optimization II [T-WIWI-102725]

**Coordinators:** Prof. Dr. Oliver Stein

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

**Part of:** [M-WIWI-101473 - Mathematical Programming](#)

**Type**  
Written examination

**Credits**  
4,5 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
3

| Courses  |                   |                                                       |       |                                                                                                |                          |
|----------|-------------------|-------------------------------------------------------|-------|------------------------------------------------------------------------------------------------|--------------------------|
| WT 25/26 | 2550112           | <a href="#">Exercises Nonlinear Optimization I</a>    | 1 SWS | Practice /  | Stein, Schwarze, Neussel |
| WT 25/26 | 2550113           | <a href="#">Nonlinear Optimization II</a>             | 2 SWS | Lecture /   | Stein                    |
| WT 25/26 | 2550114           | <a href="#">Exercise to Nonlinear Optimization II</a> | 1 SWS | Practice /  | Stein, Schwarze, Neussel |
| Exams    |                   |                                                       |       |                                                                                                |                          |
| WT 25/26 | 7900002_WS2526_HK | <a href="#">Nonlinear Optimization II</a>             |       |                                                                                                | Stein                    |
| ST 2026  | 7900203_SS2026_NK | <a href="#">Nonlinear Optimization II</a>             |       |                                                                                                | Stein                    |

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

### Assessment

The assessment consists of a written exam (60 minutes) in English 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.

### Additional Information

Part I and II of the lecture are held consecutively in the same semester.

Below you will find excerpts from courses related to this module component:

## V

### Nonlinear Optimization II

2550113, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
On-Site

**Content**

The lecture treats the minimization of smooth nonlinear functions under nonlinear constraints. For such problems, which occur very often in economics, engineering, and natural sciences, optimality conditions are derived and, based on them, solution algorithms are developed. The lecture is structured as follows:

- Topology and first order approximations of the feasible set
- Theorems of the alternative, first and second order optimality conditions
- Algorithms (penalty method, multiplier method, barrier method, interior point method, SQP method, quadratic optimization)

The lecture is accompanied by exercises which, amongst others, offers the opportunity to implement and to test some of the methods on practically relevant examples.

**Remark:**

The treatment of optimization problems *without* constraints forms the contents of the lecture "Nonlinear Optimization I". The lectures "Nonlinear Optimization I" and "Nonlinear Optimization II" are held consecutively *in the same semester*.

**Learning objectives:**

The student

- knows and understands fundamentals of constrained nonlinear optimization,
- is able to choose, design and apply modern techniques of constrained nonlinear optimization in practice.

**Literature**

O. Stein, Basic Concepts of Nonlinear Optimization, Springer, Berlin, 2024

**Additional Literature:**

- W. Alt, Nichtlineare Optimierung, Vieweg, 2002
- M.S. Bazaraa, H.D. Sherali, C.M. Shetty, Nonlinear Programming, Wiley, 1993
- O. Güler, Foundations of Optimization, Springer, 2010
- H.Th. Jongen, K. Meer, E. Triesch, Optimization Theory, Kluwer, 2004
- J. Nocedal, S. Wright, Numerical Optimization, Springer, 2000

## T

**6.239 Module component: Online Concepts for Karlsruhe City Retailers [T-WIWI-111848]**

**Coordinators:** Prof. Dr. Ann-Kristin Kupfer  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101510 - Cross-Functional Management Accounting](#)  
[M-WIWI-105312 - Marketing and Sales Management](#)  
[M-WIWI-106258 - Digital Marketing](#)

**Type**  
Examination of another type

**Credits**  
3 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
2

| Courses |         |                                                              |       |          |        |
|---------|---------|--------------------------------------------------------------|-------|----------|--------|
| ST 2026 | 2571184 | <a href="#">Online concepts for Karlsruhe city retailers</a> | 2 SWS | Others / | Kupfer |
| Exams   |         |                                                              |       |          |        |
| ST 2026 | 7900221 | <a href="#">Online Concepts for Karlsruhe City Retailers</a> |       |          | Kupfer |

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

**Assessment**

Alternative exam assessment:

- presentations in teams (in each case to the extent of approx. 15 minutes per team with subsequent discussio)
- delivery of a written elaboration per team.

**Additional Information**

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](http://marketing.iism.kit.edu)) shortly before the start of the lecture period in the summer semester.

**Workload**

90 hours

Below you will find excerpts from courses related to this module component:

## V

**Online concepts for Karlsruhe city retailers**

2571184, SS 2026, 2 SWS, Language: German, [Open in study portal](#)

Others (sonst.)  
On-Site

**Content****Content**

As part of a practical project in cooperation with the city marketing department of KME Karlsruhe Marketing und Event GmbH, students will have the opportunity to directly interact with retailers in Karlsruhe. Challenges of the digitalization of brick-and-mortar retailing will be analyzed and solutions will be developed and implemented.

In a theoretical part at the beginning of the event, students will gain an insight into the theoretical foundations of specific online marketing instruments. In cooperation with Karlsruhe City Marketing, students are taught application-oriented skills in online marketing tools, such as content management systems, social media platforms, search engine optimization or Google Ads campaigns.

In the practical part of the course, student teams cooperate with a real retailer in Karlsruhe's city center and learn how to analyze and optimize online presences and digital solutions based on key performance indicators. Possible use cases range from social media communication and website optimization to the introduction of innovative pricing and payment methods. In this way, students are given the tools for developing, maintaining and optimizing individual websites and digital solutions in stationary retailing.

Learning objectives result accordingly as follows:

- Learning of theoretical basics of central, application-oriented tools of online marketing
- Application and practical deep-dive of the acquired knowledge in a real case
- Concise and structured presentation of results

Total time required for 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

**Organizational issues**

Kick off Montag 11.5.26 Gebäude 01.87 Seminarraum 025

## T

**6.240 Module component: Operations Research in Health Care Management [T-WIWI-102884]**

**Coordinators:** Prof. Dr. Stefan Nickel  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-102805 - Service Operations](#)

**Type**  
Written examination

**Credits**  
4,5 CP

**Grading**  
graded

**Term offered**  
Each term

**Version**  
4

| Courses  |         |                                                               |       |              |      |
|----------|---------|---------------------------------------------------------------|-------|--------------|------|
| WT 25/26 | 2550495 | <a href="#">Operations Research in Health Care Management</a> | 2 SWS | Lecture / 🗣️ | Graß |
| WT 25/26 | 2550496 | <a href="#">Übungen zu OR im Health Care Management</a>       | 1 SWS | Practice     | Graß |
| ST 2026  | 2550495 | <a href="#">Operations Research in Health Care Management</a> | 2 SWS | Lecture / 🗣️ | Graß |
| ST 2026  | 2550496 | <a href="#">Übungen zu OR im Health Care Management</a>       | 1 SWS | Practice / 📄 | Graß |
| Exams    |         |                                                               |       |              |      |
| WT 25/26 | 7900010 | <a href="#">Operations Research in Health Care Management</a> |       |              | Graß |
| ST 2026  | 7900229 | <a href="#">Operations Research in Health Care Management</a> |       |              | Graß |

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

**Assessment**

Success is assessed in English in the form of a 60-minute written examination (in accordance with §4(2), 1 SPO).

The examination is offered every semester.

**Prerequisites**

None

**Recommendations**

Basic knowledge as conveyed in the module "Introduction to Operations Research" is assumed.

**Additional Information**

Lectures and examinations are held in English.

**Workload**

135 hours

*Below you will find excerpts from courses related to this module component:*

## V

**Operations Research in Health Care Management**

2550495, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

**Lecture (V)**  
On-Site

**Literature****Elective literature:**

- Fleßa: Grundzüge der Krankenhausbetriebslehre, Oldenbourg, 2007
- Fleßa: Grundzüge der Krankenhaussteuerung, Oldenbourg, 2008
- Hall: Patient flow: reducing delay in healthcare delivery, Springer, 2006

## V

**Operations Research in Health Care Management**

2550495, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

**Lecture (V)**  
On-Site

## **Literature**

### **Weiterführende Literatur:**

- Fleßa: Grundzüge der Krankenhausbetriebslehre, Oldenbourg, 2007
- Fleßa: Grundzüge der Krankenhaussteuerung, Oldenbourg, 2008
- Hall: Patient flow: reducing delay in healthcare delivery, Springer, 2006

## T

**6.241 Module component: Operations Research in Supply Chain Management [T-WIWI-102715]****Coordinators:** Prof. Dr. Stefan Nickel**Organisation:** KIT Department of Business and Economics

**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](#)

| Type                | Credits | Grading | Term offered | Version |
|---------------------|---------|---------|--------------|---------|
| Written examination | 4,5 CP  | graded  | Irregular    | 2       |

| Exams    |         |                                                                |        |
|----------|---------|----------------------------------------------------------------|--------|
| WT 25/26 | 7900028 | <a href="#">Operations Research in Supply Chain Management</a> | Nickel |

**Assessment**

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

**Recommendations**

Basic knowledge as conveyed in the module Introduction to Operations Research and in the lectures Facility Location and Strategic SCM, Tactical and operational SCM is assumed.

**Additional Information**

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>.

## T

**6.242 Module component: Optimization and Synthesis of Embedded Systems (ESI) [T-INFO-114253]****Coordinators:** Prof. Dr.-Ing. Jörg Henkel**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107229 - Optimization and Synthesis of Embedded Systems \(ESI\)](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 3 CP    | Graded  | Each winter term | 1       |

| Courses  |         |                                                                          |       |                                                                                               |                |
|----------|---------|--------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|----------------|
| WT 25/26 | 2424143 | <a href="#">Optimisation and synthesis of embedded systems (ES1)</a>     | 2 SWS | Lecture /  | Henkel, Nassar |
| Exams    |         |                                                                          |       |                                                                                               |                |
| WT 25/26 | 7500085 | <a href="#">VL: Optimization and synthesis of embedded systems (ES1)</a> |       |                                                                                               | Henkel         |

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

The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting approx. 20 minutes.

**Prerequisites**

None.

**Recommendations**

Knowledge of computer structures is helpful.

The prerequisites, if any, are explained in more detail in the module description.

*Below you will find excerpts from courses related to this module component:*

## V

**Optimisation and synthesis of embedded systems (ES1)**2424143, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)**Lecture (V)**  
**On-Site****Content**

An embedded system is an electronic computing system integrated into a surrounding system, such as a driver assistance system in a car or the regulation of a controlled variable (refrigerator temperature, pressure in a power plant, motor of a robot, etc.). The cost-effective and reliable development of embedded systems presents a considerable challenge, increasingly influencing the overall system's value. Particularly in Europe, the design of embedded systems plays an important economic role in many industries, such as the automotive and automation sectors, leading numerous renowned companies to engage in this field.

The lecture comprehensively addresses all aspects of embedded systems development at the hardware, software, and system levels. This includes various areas such as modeling, optimization, and synthesis of embedded systems. In addition to providing an overview of all these relevant aspects and possibilities, the course focuses on different synthesis steps, which automatically generate and optimize hardware circuits from a description language (e.g., VHDL or C). Another emphasis is on introducing the different potential target technologies that can ultimately be used to realize a design. These range from custom-developed chips (e.g., ASICs) to FPGAs and microcontrollers for software components.

**Exams:**

Exam number: 7500085

For exam dates, please fill out the form on our homepage: <https://ces.itec.kit.edu/972.php>**Certificate:** The assessment is conducted as an oral exam lasting typically 25-30 minutes according to § 4 Abs. 2 Nr. 2 SPO.**Course Content:** 1. Introduction 2. Overview of System Design 3. Hardware Description and Simulation 4. High-Level Synthesis 5. Logic Synthesis 6. Target Technologies 7. Layout Synthesis 8. Field Programmable Gate Arrays (FPGAs) 9. Microcontrollers and DSPs**Workload:** 90 hours**Target Audience:** Master's students or Bachelor's students in advanced stage (basic knowledge of Digital Logic Design (TI-1) is assumed).**Learning Objectives:** Students can develop embedded systems and are familiar with the specific constraints of the design process. They understand how to specify, synthesize, and optimize their own hardware using hardware description languages. They are familiar with the possible target technologies for both hardware and software components of the design, along with their respective advantages and disadvantages.



**Organizational issues**

Bitte im ILIAS zur Teilnahme anmelden.

**T****6.243 Module component: Optimization Methods for Machine Learning and Engineering [T-INFO-110809]**

**Coordinators:** Prof. Dr.-Ing. Jürgen Beyerer  
Julius Pfrommer

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-105329 - Optimization Methods for Machine Learning and Engineering](#)

| Type                | Credits | Grading | Term offered     | Version |
|---------------------|---------|---------|------------------|---------|
| Written examination | 5 CP    | Graded  | Each winter term | 2       |

| Courses  |         |                                                                           |         |                                                                                                |                   |
|----------|---------|---------------------------------------------------------------------------|---------|------------------------------------------------------------------------------------------------|-------------------|
| WT 25/26 | 2400280 | <a href="#">Optimization Methods for Machine Learning and Engineering</a> | 2 SWS   | Lecture /   | Pfrommer, Beyerer |
| WT 25/26 | 2400281 | <a href="#">Optimization Methods for Machine Learning and Engineering</a> | 1 SWS   | Practice /  | Pfrommer, Beyerer |
| Exams    |         |                                                                           |         |                                                                                                |                   |
| WT 25/26 | 7500279 | <a href="#">Optimization Methods for Machine Learning and Engineering</a> | Beyerer |                                                                                                |                   |
| ST 2026  | 7500329 | <a href="#">Optimization Methods for Machine Learning and Engineering</a> | Beyerer |                                                                                                |                   |

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

**Assessment**

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 60 minutes.

Depending on the number of participants, it will be announced six weeks before the examination (Section 6 (3) SPO) whether the assessment will take the form of an oral examination of approx.

- in the form of an oral examination of approx. 30 minutes in accordance with § 4 Para. 2 No. 2 SPO or
- in the form of a written examination in accordance with § 4 Para. 2 No. 1 SPO

takes place.

**Prerequisites**

None.

Below you will find excerpts from courses related to this module component:

**V****Optimization Methods for Machine Learning and Engineering**

2400280, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
Blended (On-Site/Online)

**Content**

The term optimization refers to techniques for the identification of the best solution in a complex problem setting. Many applications from machine learning and engineering are based on solving an optimization problem. This lecture introduces the major theoretical and algorithmic tools for solving of convex optimization problems. Practical problems for machine learning, engineering and further application domains are used as illustration. The students apply their knowledge to practical optimization problems in tutorial exercises.

**Literature**

Literatur:

- Boyd, Stephen, and Lieven Vandenberghe. Convex optimization. Cambridge university press, 2004.
  - Luenberger, David G. Optimization by vector space methods. John Wiley & Sons, 1969.
- Sra, Suvrit, Sebastian Nowozin, and Stephen J. Wright, eds. Optimization for machine learning. MIT Press, 2012.

## T

**6.244 Module component: Optimization under Uncertainty [T-WIWI-106545]****Coordinators:** Prof. Dr. Steffen Rebennack**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-103289 - Stochastic Optimization](#)**Type**  
Written examination**Credits**  
4,5 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
3

| Courses  |         |                                                                   |       |                                                                                                |                    |
|----------|---------|-------------------------------------------------------------------|-------|------------------------------------------------------------------------------------------------|--------------------|
| WT 25/26 | 2550464 | <a href="#">Optimization Under Uncertainty</a>                    | 2 SWS | Lecture /   | Rebennack, Kandora |
| WT 25/26 | 2550465 | <a href="#">Übungen zu Optimierungsansätze unter Unsicherheit</a> | 1 SWS | Practice /  | Rebennack          |
| WT 25/26 | 2550466 |                                                                   | 2 SWS | Others                                                                                         | Rebennack          |
| Exams    |         |                                                                   |       |                                                                                                |                    |
| WT 25/26 | 7900240 | <a href="#">Optimization under Uncertainty</a>                    |       |                                                                                                | Rebennack          |
| ST 2026  | 7900309 | <a href="#">Optimization under Uncertainty</a>                    |       |                                                                                                | Rebennack          |

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

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.

**Workload**

135 hours

## T

**6.245 Module component: Panel Data [T-WIWI-103127]****Coordinators:** apl. Prof. Dr. Wolf-Dieter Heller**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-101638 - Econometrics and Statistics I](#)  
[M-WIWI-101639 - Econometrics and Statistics II](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 4,5 CP  | Graded  | Each summer term | 2       |

| Courses |         |                                       |       |          |        |
|---------|---------|---------------------------------------|-------|----------|--------|
| ST 2026 | 2520320 | <a href="#">Panel Data</a>            | 2 SWS | Lecture  | Heller |
| ST 2026 | 2520321 | <a href="#">Übungen zu Paneldaten</a> | 2 SWS | Practice | Heller |
| Exams   |         |                                       |       |          |        |
| ST 2026 | 7900115 | <a href="#">Panel Data</a>            |       |          | Heller |

**Assessment**

The assessment is carried out as an examination of another type in the form of a one-hour exam that includes both a written and an oral part. The exam may be taken as an individual exam or in pairs. The individual components are integrated into a single overall grade that reflects the overall impression of the combined performance

**Prerequisites**

None

**Workload**

135 hours

Below you will find excerpts from courses related to this module component:

## V

**Panel Data**2520320, SS 2026, 2 SWS, Language: German, [Open in study portal](#)**Lecture (V)****Content****Content:**

Fixed-Effects-Models, Random-Effects-Models, Time-Demeaning

**Workload:**

Total workload for 4.5 CP: approx. 135 hours

Attendance: 30 hours

Preparation and follow-up: 65 hours

Exam preparation: 40 hours

Exam preparation: 40 hours

**Literature**Wooldridge, J. M. (2002). *Econometric analysis of cross section and panel data*. Cambridge and London: MIT Press.Wooldridge, J. M. (2009). *Introductory Econometrics: A Modern Approach* (5th ed.). Mason, Ohio: South-Western Cengage Learning.

## T

## 6.246 Module component: Parallel Algorithms [T-INFO-114221]

**Coordinators:** Prof. Dr. Peter Sanders  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-107199 - Parallel Algorithms](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 4 CP    | graded  | Each winter term | 1       |

| Courses  |         |                                     |       |                                                                                               |                          |
|----------|---------|-------------------------------------|-------|-----------------------------------------------------------------------------------------------|--------------------------|
| WT 25/26 | 2400053 | <a href="#">Parallel Algorithms</a> | 3 SWS | Lecture /  | Sanders, Uhl, Laupichler |
| Exams    |         |                                     |       |                                                                                               |                          |
| WT 25/26 | 7575489 | <a href="#">Parallel Algorithms</a> |       |                                                                                               | Sanders                  |

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

**Assessment**

The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting 20 minutes.

**Prerequisites**

T-INFO-114222 - Parallel Algorithms Pass must be started.

**Recommendations**

Knowledge from lectures such as Algorithms I/II is recommended.

## T

**6.247 Module component: Parallel Algorithms Pass [T-INFO-114222]**

**Coordinators:** Prof. Dr. Peter Sanders  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-107199 - Parallel Algorithms](#)

**Type**  
Examination of another type

**Credits**  
1 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
1

| Exams    |         |                                          |         |
|----------|---------|------------------------------------------|---------|
| WT 25/26 | 7500163 | <a href="#">Parallel Algorithms Pass</a> | Sanders |

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

The exercise can be proven via various performance records (usually exercise sheets). This will be determined individually during the lecture.

An overall grade will be awarded.

**Prerequisites**

None.

**Recommendations**

Knowledge from lectures such as Algorithms I/II is recommended.

**T****6.248 Module component: Parallel Computer Systems and Parallel Programming [T-INFO-101345]****Coordinators:** Prof. Dr. Achim Streit**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-100808 - Parallel Computer Systems and Parallel Programming](#)**Type**  
Written examination**Credits**  
4 CP**Grading**  
graded**Term offered**  
Each summer term**Version**  
2

| Courses |       |                                                                    |       |         |                       |
|---------|-------|--------------------------------------------------------------------|-------|---------|-----------------------|
| ST 2026 | 24617 | <a href="#">Parallel computer systems and parallel programming</a> | 2 SWS | Lecture | Streit, Caspart, Baer |

## T

**6.249 Module component: Parameterized Algorithms [T-INFO-114194]**

**Coordinators:** TT-Prof. Dr. Thomas Bläsius  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-107167 - Parameterized Algorithms](#)

| Type             | Credits | Grading | Version |
|------------------|---------|---------|---------|
| Oral examination | 6 CP    | graded  | 1       |

| Courses |         |                                          |       |                                                                                                         |         |
|---------|---------|------------------------------------------|-------|---------------------------------------------------------------------------------------------------------|---------|
| ST 2026 | 2400178 | <a href="#">Parameterized Algorithms</a> | 4 SWS | Lecture / Practice /  | Bläsius |

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

**Assessment**

The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting 20 minutes.

**Prerequisites**

None.

**Recommendations**

Basic knowledge of algorithms and data structures (e.g. from the lectures Algorithms 1 + 2) is helpful.

*Below you will find excerpts from courses related to this module component:*

## V

**Parameterized Algorithms**

2400178, SS 2026, 4 SWS, Language: English, [Open in study portal](#)

Lecture / Practice (VÜ)  
On-Site

**Content**

Parameterized Algorithms

**Qualifikationsziele**

The students achieve systematic understanding of the parameterized perspective on analyzing the running time of algorithms, as well as the corresponding techniques for algorithm design, which build on existing knowledge in theoretical computer science and algorithms. After passing the course successfully, the students are able to \* reproduce and explain fundamental design and analysis techniques from the field of parameterized algorithms, \* execute and rigorously analyze the running time of parameterized algorithms and proof their correctness, \* select, which algorithms or algorithmic techniques are suitable for a given parameterized problem, \* analyze unknown problems in regards to their parameterized complexity.

**Inhalt**

Many algorithmic problems appearing in applications are NP-hard. This means that there are no algorithms that efficiently solve these problems on every input (assuming  $P \neq NP$ ). Nonetheless, one can often solve these problems efficiently if the inputs are in some sense well-behaved. The parameterized complexity provides a way to formalize the concept of well-behaved inputs. This is done by associating with every input a parameter  $k$ , which represents a measure for the complexity of the input. Then the goal is to find an algorithms with running time polynomial in the input size, while allowing it to be exponential (or worse) in the parameter  $k$ . Compared to the coarse classification of problems in to polynomially solvable or NP-hard, this provides a more nuanced perspective on the computational complexity of problems.

**Empfehlung**

Basic knowledge of algorithms and data structures (e.g., from the courses Algorithms 1 + 2) is expected.

**Arbeitsaufwand**

Lecture with exercise, 4 hours per week (SWS), 6 ECTS 6 ECTS corresponds to approximately 180 hours of work, including: ~60 hours attending lectures and exercises ~30 hours preparation and review ~60 hours working on exercise sheets ~30 hours exam preparation



## T

**6.250 Module component: Parameterized Algorithms - Pass [T-INFO-114195]**

**Coordinators:** TT-Prof. Dr. Thomas Bläsius  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-107167 - Parameterized Algorithms](#)

**Type**  
Coursework

**Credits**  
0 CP

**Grading**  
pass/fail

**Version**  
1

| Courses |         |                                          |       |                                                                                                         |         |
|---------|---------|------------------------------------------|-------|---------------------------------------------------------------------------------------------------------|---------|
| ST 2026 | 2400178 | <a href="#">Parameterized Algorithms</a> | 4 SWS | Lecture / Practice /  | Bläsius |

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

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

A total of two repetitions are possible.

**Prerequisites**

None.

**Recommendations**

Basic knowledge of algorithms and data structures (e.g. from the lectures Algorithms 1 + 2) is helpful.

*Below you will find excerpts from courses related to this module component:*

## V

**Parameterized Algorithms**

2400178, SS 2026, 4 SWS, Language: English, [Open in study portal](#)

**Lecture / Practice (VÜ)**  
On-Site

**Content**

Parameterized Algorithms

Qualifikationsziele

The students achieve systematic understanding of the parameterized perspective on analyzing the running time of algorithms, as well as the corresponding techniques for algorithm design, which build on existing knowledge in theoretical computer science and algorithms. After passing the course successfully, the students are able to \* reproduce and explain fundamental design and analysis techniques from the field of parameterized algorithms, \* execute and rigorously analyze the running time of parameterized algorithms and proof their correctness, \* select, which algorithms or algorithmic techniques are suitable for a given parameterized problem, \* analyze unknown problems in regards to their parameterized complexity.

Inhalt

Many algorithmic problems appearing in applications are NP-hard. This means that there are no algorithms that efficiently solve these problems on every input (assuming  $P \neq NP$ ). Nonetheless, one can often solve these problems efficiently if the inputs are in some sense well-behaved. The parameterized complexity provides a way to formalize the concept of well-behaved inputs. This is done by associating with every input a parameter  $k$ , which represents a measure for the complexity of the input. Then the goal is to find an algorithms with running time polynomial in the input size, while allowing it to be exponential (or worse) in the parameter  $k$ . Compared to the coarse classification of problems in to polynomially solvable or NP-hard, this provides a more nuanced perspective on the computational complexity of problems.

Empfehlung

Basic knowledge of algorithms and data structures (e.g., from the courses Algorithms 1 + 2) is expected.

Arbeitsaufwand

Lecture with exercise, 4 hours per week (SWS), 6 ECTS 6 ECTS corresponds to approximately 180 hours of work, including: ~60 hours attending lectures and exercises ~30 hours preparation and review ~60 hours working on exercise sheets ~30 hours exam preparation

## T

**6.251 Module component: Parametric Optimization [T-WIWI-102855]**

**Coordinators:** Prof. Dr. Oliver Stein  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101473 - Mathematical Programming](#)

| Type                | Credits | Grading | Term offered | Version |
|---------------------|---------|---------|--------------|---------|
| Written examination | 4,5 CP  | graded  | Irregular    | 1       |

**Assessment**

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

**Recommendations**

It is strongly recommended to visit at least one lecture from the Bachelor program of this chair before attending this course.

**Additional Information**

The lecture is offered irregularly. The curriculum of the next three years is available online ([www.ior.kit.edu](http://www.ior.kit.edu)).

## T

**6.252 Module component: Participatory Technology Design [T-INFO-114199]**

**Coordinators:** Prof. Dr. Kathrin Gerling  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-107170 - Participatory Technology Design](#)

**Type**  
Written examination

**Credits**  
6 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
1

| Courses  |         |                                                           |       |                    |         |
|----------|---------|-----------------------------------------------------------|-------|--------------------|---------|
| WT 25/26 | 2400189 | <a href="#">Participatory Technology Design (V/Ü)</a>     | 4 SWS | Lecture / Practice | Gerling |
| Exams    |         |                                                           |       |                    |         |
| WT 25/26 | 7500307 | <a href="#">Participatory Technology Design (Exam)</a>    |       |                    | Gerling |
| ST 2026  | 7500375 | <a href="#">Participatory Technology Design (Re-Exam)</a> |       |                    | Gerling |

**Assessment**

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 90 minutes.

**Prerequisites**

None.

**Recommendations**

Knowledge of the basics of human-machine interaction is helpful.

## T

**6.253 Module component: Participatory Technology Design - Pass [T-INFO-114200]**

**Coordinators:** Prof. Dr. Kathrin Gerling  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-107170 - Participatory Technology Design](#)

| Type       | Credits | Grading   | Term offered     | Version |
|------------|---------|-----------|------------------|---------|
| Coursework | 0 CP    | pass/fail | Each winter term | 1       |

| Courses  |         |                                                            |       |                    |         |
|----------|---------|------------------------------------------------------------|-------|--------------------|---------|
| WT 25/26 | 2400189 | <a href="#">Participatory Technology Design (V/Ü)</a>      | 4 SWS | Lecture / Practice | Gerling |
| Exams    |         |                                                            |       |                    |         |
| WT 25/26 | 7500278 | <a href="#">Participatory Technology Design (Exercise)</a> |       |                    | Gerling |

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO). A total of two repetitions are possible.

**Prerequisites**

None.

**Recommendations**

Knowledge of the basics of human-machine interaction is helpful.

## T

## 6.254 Module component: Patent Law [T-INFO-101310]

**Coordinators:** Patric Straßburger

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-101215 - Intellectual Property Law](#)

**Type**  
Written examination

**Credits**  
3 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
3

| Courses  |         |                            |       |                                                                                               |             |
|----------|---------|----------------------------|-------|-----------------------------------------------------------------------------------------------|-------------|
| ST 2026  | 24656   | <a href="#">Patent Law</a> | 2 SWS | Lecture /  | Straßburger |
| Exams    |         |                            |       |                                                                                               |             |
| WT 25/26 | 7500006 | <a href="#">Patent Law</a> |       |                                                                                               | Matz        |
| ST 2026  | 7500109 | <a href="#">Patent Law</a> |       |                                                                                               | Sattler     |

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

### Assessment

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 60 minutes.

### Prerequisites

None.

### Recommendations

None.

## T

**6.255 Module component: Pattern Recognition [T-INFO-101362]**

**Coordinators:** Prof. Dr.-Ing. Jürgen Beyerer  
Dr. Tim Zander

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-100825 - Pattern Recognition](#)

| Type                | Credits | Grading | Term offered     | Version |
|---------------------|---------|---------|------------------|---------|
| Written examination | 6 CP    | Graded  | Each summer term | 2       |

| Courses  |         |                                     |       |                                                                                                         |         |
|----------|---------|-------------------------------------|-------|---------------------------------------------------------------------------------------------------------|---------|
| ST 2026  | 24675   | <a href="#">Pattern Recognition</a> | 4 SWS | Lecture / Practice /  | Beyerer |
| Exams    |         |                                     |       |                                                                                                         |         |
| WT 25/26 | 7500111 | <a href="#">Pattern Recognition</a> |       |                                                                                                         | Beyerer |
| ST 2026  | 7500032 | <a href="#">Pattern Recognition</a> |       |                                                                                                         | Beyerer |

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

**Assessment**

The examination is conducted in the form of a written examination (usually lasting 60 minutes) in accordance with § 4 (2) No. 1 SPO.

Depending on the number of participants, it will be announced six weeks prior to the examination (§ 6 (3) SPO) whether the assessment will take place:

- in the form of an oral examination in accordance with § 4 (2) No. 2 SPO, or
- in the form of a written examination in accordance with § 4 (2) No. 1 SPO.

**Prerequisites**

None.

**Recommendations**

Basic knowledge of probability theory, signal processing, and image processing is helpful.

Below you will find excerpts from courses related to this module component:

## V

**Pattern Recognition**

24675, SS 2026, 4 SWS, Language: German, [Open in study portal](#)

Lecture / Practice (VÜ)  
On-Site

**Organizational issues**

Vorlesung: montags 15:45 bis 16:30 Uhr und mittwochs 14:00 bis 15:30 Uhr

Übung: montags 16:30 bis 17:15 Uhr

**Literature****Weiterführende Literatur**

- Richard O. Duda, Peter E. Hart, Stork G. David. Pattern Classification. Wiley-Interscience, second edition, 2001
- K. Fukunaga. Introduction to Statistical Pattern Recognition. Academic Press, second edition, 1997
- R. Hoffman. Signalanalyse und -erkennung. Springer, 1998
- H. Niemann. Pattern analysis and understanding. Springer, second edition, 1990
- J. Schürmann. Pattern classification. Wiley & Sons, 1996
- S. Theodoridis, K. Koutroumbas. Pattern recognition. London: Academic, 2003
- V. N. Vapnik. The nature of statistical learning theory. Springer, second edition, 2000

## T

## 6.256 Module component: Penetration Testing Lab [T-INFO-109929]

**Coordinators:** Dr.-Ing. Ingmar Baumgart  
Prof. Dr. Jörn Müller-Quade

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-104895 - Penetration Testing Lab](#)

**Type**  
Examination of another type

**Credits**  
4 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
1

| Courses  |         |                                         |                        |                                                                                                        |                         |
|----------|---------|-----------------------------------------|------------------------|--------------------------------------------------------------------------------------------------------|-------------------------|
| WT 25/26 | 2400115 | <a href="#">Penetration Testing Lab</a> | 4 SWS                  | Practical course /  | Baumgart, Dukek, Müller |
| ST 2026  | 2400058 | <a href="#">Penetration Testing Lab</a> | 4 SWS                  | Practical course /  | Baumgart, Müller, Dukek |
| Exams    |         |                                         |                        |                                                                                                        |                         |
| WT 25/26 | 7500330 | <a href="#">Penetration Testing Lab</a> | Baumgart, Müller-Quade |                                                                                                        |                         |

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

## T

**6.257 Module component: Perceiving, Understanding and Communicating Risk and Uncertainty [T-WIWI-114750]**

**Coordinators:** Dr. rer. nat. Nico Gradwohl  
Prof. Dr. Benjamin Scheibehenne

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

**Part of:** [M-WIWI-105714 - Consumer Research](#)

| Type                        | Credits | Grading | Term offered     | Expansion   | Version |
|-----------------------------|---------|---------|------------------|-------------|---------|
| Examination of another type | 4,5 CP  | Graded  | Each winter term | 1 semesters | 1       |

| Courses  |         |                                                                                  |       |                                                                                             |              |
|----------|---------|----------------------------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------|--------------|
| WT 25/26 | 2500007 | <a href="#">Perceiving, Understanding and Communicating Risk and Uncertainty</a> | 2 SWS | Block /  | Gradwohl     |
| Exams    |         |                                                                                  |       |                                                                                             |              |
| WT 25/26 | 7900312 | <a href="#">Perceiving, Understanding and Communicating Risk and Uncertainty</a> |       |                                                                                             | Scheibehenne |

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

**Assessment**

The course will be assessed via an examination of another type, comprising:

- Presentation of a research topic
- Active participation
- Homework assignments
- Designing and presenting an intervention to improve the understanding or communication of risk and uncertainty (e.g., online tool, a visualization for a specific topic, training program)

The overall impression will be assessed. Further details on the assessment's specific design will be provided during the course.

**Prerequisites**

None

**Recommendations**

A strong interest in research on human cognition and consumer behavior, as well as interest to engage with basic mathematical models and probability theory.

**Additional Information**

How do people perceive the risks of natural disasters, new technologies, or medical treatments like vaccines? And how can we communicate such risks clearly and transparently to support informed decision-making among consumers?

This course explores the science behind risk perception and communication. We will examine different types of risk and uncertainty, how individuals interpret them, and how to communicate them effectively. Topics include experimental methods, key research findings, common misconceptions, and the cognitive processes that shape our understanding of risk.

By the end of the course, students will be able to:

- Define key concepts related to risk and uncertainty.
- Describe experimental paradigms used to study risk perception.
- Critically analyze empirical and theoretical research.
- Apply insights to real-world challenges involving public communication of risk.
- Design strategies for improving how risk-related information is conveyed and understood.

This class will be taught in English. The number of participants is limited. The registration will take place via the Campus portal.

**Workload**

135 hours

Below you will find excerpts from courses related to this module component:

## V

**Perceiving, Understanding and Communicating Risk and Uncertainty**

2500007, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

**Block (B)**  
**On-Site**



**Content**

How do people perceive the risks of natural disasters, new technologies, or medical treatments like vaccines? And how can we communicate such risks clearly and transparently to support informed decision-making among consumers?

This course explores the science behind risk perception and communication. We will examine different types of risk and uncertainty, how individuals interpret them, and how to communicate them effectively. Topics include experimental methods, key research findings, common misconceptions, and the cognitive processes that shape our understanding of risk.

By the end of the course, students will be able to:

- Define key concepts related to risk and uncertainty.
- Describe experimental paradigms used to study risk perception, like decisions from description and decision from experience.
- Critically analyze empirical and theoretical research.
- Apply insights to involving public communication of risk.
- Design strategies for improving how risk-related information is conveyed and understood in real-world challenges

**Competence Certificate**

- Presentation of a research topic
- Active participation
- Homework assignments
- Designing and presenting an intervention to improve the understanding or communication of risk and uncertainty (e.g., an online tool, a visualization for a specific topic, or training programme)

**Organizational issues**

This class will be taught in English. The number of participants is limited to 12 participants.

The registration will take place via the WiWi portal. If too many students register, students in higher semesters are selected first. Further selection will take place on a first-come, first served basis.

**Literature**

Dhami, M. K., & Mandel, D. R. (2022). Communicating uncertainty using words and numbers. *Trends in Cognitive Sciences*, 26(6), 514-526. [10.1016/j.tics.2022.03.002](https://doi.org/10.1016/j.tics.2022.03.002)

Slovic, P. (1987). Perception of risk. *Science*, 236(4799), 280-285. <https://doi.org/10.1126/science.3563507>

Tannenbaum, D., Fox, C. R., & Ülkümen, G. (2017). Judgment extremity and accuracy under epistemic vs. aleatory uncertainty. *Management Science*, 63(2), 497-518. <https://doi.org/10.1287/mnsc.2015.2344>

Van Der Bles, A. M., van der Linden, S., Freeman, A. L., & Spiegelhalter, D. J. (2020). The effects of communicating uncertainty on public trust in facts and numbers. *Proceedings of the National Academy of Sciences*, 117(14), 7672-7683. [10.1073/pnas.1913678117](https://doi.org/10.1073/pnas.1913678117)

## T

## 6.258 Module component: Photorealistic Rendering [T-INFO-101268]

**Coordinators:** Prof. Dr.-Ing. Carsten Dachsbacher

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-100731 - Photorealistic Rendering](#)

**Type**  
Oral examination

**Credits**  
5 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
1

| Courses  |         |                                                         |       |                                                                                                |                                 |
|----------|---------|---------------------------------------------------------|-------|------------------------------------------------------------------------------------------------|---------------------------------|
| WT 25/26 | 2400180 | <a href="#">Photorealistic Image Synthesis</a>          | 2 SWS | Lecture /   | Schudeiske, Dachsbacher         |
| WT 25/26 | 2400185 | <a href="#">Exercise Photorealistic Image Synthesis</a> | 2 SWS | Practice /  | Werner, Schudeiske, Dachsbacher |
| Exams    |         |                                                         |       |                                                                                                |                                 |
| WT 25/26 | 7500203 | <a href="#">Photorealistic Rendering</a>                |       |                                                                                                | Dachsbacher                     |
| ST 2026  | 7500124 | <a href="#">Photorealistic Rendering</a>                |       |                                                                                                | Dachsbacher                     |

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

## T

**6.259 Module component: Pioneering Leadership in German SMEs [T-WIWI-114184]**

**Coordinators:** Prof. Dr. Marion Weissenberger-Eibl  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101507 - Innovation Management](#)  
[M-WIWI-101507 - Innovation Management](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 3 CP    | graded  | Irregular    | 1       |

**Assessment**

Non exam assessment consisting of a presentation of the results and a seminar paper (written in the group).

The grade is composed of 70% of the grade for the written work and 30% of the grade for the presentation.

**Prerequisites**

None

**Recommendations**

Prior attendance of the course Innovation Management is recommended.

**Workload**

90 hours

**T****6.260 Module component: Platform & Market Engineering: Commerce, Media, and Digital Democracy [T-WIWI-112823]**

**Coordinators:** Prof. Dr. Christof Weinhardt  
**Organisation:** KIT Department of Business and Economics  
**Part of:** M-WIWI-101409 - Electronic Markets  
M-WIWI-101411 - Information Engineering  
M-WIWI-101446 - Market Engineering  
M-WIWI-101453 - Applied Strategic Decisions  
M-WIWI-102754 - Service Economics and Management  
M-WIWI-107528 - Information Systems: Digital Markets & Services

| Type                | Credits | Grading | Term offered     | Version |
|---------------------|---------|---------|------------------|---------|
| Written examination | 4,5 CP  | graded  | Each summer term | 2       |

| Courses  |         |                                                                                  |       |              |                       |
|----------|---------|----------------------------------------------------------------------------------|-------|--------------|-----------------------|
| ST 2026  | 2540460 | Platform & Market Engineering: Commerce, Media, and Digital Democracy            | 2 SWS | Lecture / 🗎  | Weinhardt, Fegert     |
| ST 2026  | 2540461 | Übungen zu Platform & Market Engineering: Commerce, Media, and Digital Democracy | 1 SWS | Practice / 🗎 | Fegert, Stano, Schick |
| Exams    |         |                                                                                  |       |              |                       |
| WT 25/26 | 7910804 | Platform & Market Engineering: Commerce, Media, and Digital Democracy            |       |              | Weinhardt             |

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

**Assessment**

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) up to 6 bonus points can be obtained. If the grade of the written examination is between 4.0 and 1.3, the bonus improves the grade by max. one grade level (0.3 or 0.4).

**Prerequisites**

None

Below you will find excerpts from courses related to this module component:

**V****Platform & Market Engineering: Commerce, Media, and Digital Democracy**

2540460, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
On-Site

**Content**

This lecture introduces an *innovative learning format* centered around *dynamic, AI-assisted self-study*, complemented by *in-person discussion sessions* to deepen content understanding. Instead of traditional lecture-based teaching (Frontalunterricht), we are piloting a type of flipped-classroom approach. The course is designed to be *co-developed by students and lecturers*—for example, through the creation of podcasts using AI tools like NotebookLM in small groups. This not only reinforces your grasp of the material but also builds your AI literacy.

The course will be graded with 80 points total. 60 of them can be earned in the exam at the end of the semester. The remaining 20 points can be earned in the exercise, where a podcast of a part of the lecture content has to be generated. For outstanding podcast submissions, you can receive up to *10 additional bonus* points.

Digital platforms and markets play an increasingly vital role in modern economies and societies. Understanding how to engineer these systems for efficiency, fairness, and societal benefit is crucial for shaping the digital future. By combining economic theory, engineering principles, and hands-on applications, this course prepares you to address real-world challenges in eCommerce, digital media, and digital democracy.

This lecture provides an in-depth exploration of the theoretical foundations, practical applications, and engineering principles essential for understanding and designing modern markets and digital platforms.

**We aim to:**

- Equip students with the ability to analyze, design, and evaluate digital markets and platforms.
- Provide an understanding of market mechanisms, economic principles, and the role of digital infrastructure in shaping economic and social interactions.
- Explore the influence of digital platforms on media, democracy, and citizen participation.
- Explore ethical implications of digital platforms and online market mechanisms.
- Apply generative AI tools to analyze, structure, and communicate topics from the lecture.
- Develop skills in critical evaluation of AI-generated content.

**Course Structure:**

1. Foundations of Platform & Market Engineering
  1. Market Engineering and Institutional Economics
  2. The "House of Market Engineering"
  3. Key concepts: efficiency, fairness, incentive compatibility, market convergence
2. Applications and Principles of Markets
  1. Market Engineering and Institutional Economics
  2. Economic theories in digital markets and platforms
3. Market Engineering Microstructure and Infrastructure
  1. Game Theory
  2. Mechanism Design
  3. Trust and Enforcement
  4. Auctions (single-item, combinatorial)
  5. IT & Business Infrastructure
  6. Evaluating Market Engineering: Experimental Economics
4. Digital Platforms and the Media
5. Digital Democracy:
  1. Online Polarization and Disinformation
  2. Digital Participation Engineering
  3. Digital Citizen Science Engineering
6. Ethical Implications

**Organizational issues**

ehemals: "Market Engineering: Information in Institutions"

**Literature**

- Roth, A., The Economist as Engineer: Game Theory, Experimental Economics and Computation as Tools for Design Economics. *Econometrica* 70(4): 1341-1378, 2002.
- Weinhardt, C., Holtmann, C., Neumann, D., Market Engineering. *Wirtschaftsinformatik*, 2003.
- Wolfstetter, E., Topics in Microeconomics - Industrial Organization, Auctions, and Incentives. Cambridge, Cambridge University Press, 1999.
- Smith, V. "Theory, Experiments and Economics", *The Journal of Economic Perspectives*, Vol. 3, No. 1, 151-69 1989

## T

**6.261 Module component: Portfolio and Asset Liability Management [T-WIWI-103128]****Coordinators:** Dr. Mher Safarian**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-101639 - Econometrics and Statistics II](#)**Type**  
Written examination**Credits**  
4,5 CP**Grading**  
graded**Term offered**  
Each summer term**Version**  
1

| Courses |         |                                                                     |       |          |          |
|---------|---------|---------------------------------------------------------------------|-------|----------|----------|
| ST 2026 | 2520357 | <a href="#">Portfolio and Asset Liability Management</a>            | 2 SWS | Lecture  | Safarian |
| ST 2026 | 2520358 | <a href="#">Übungen zu Portfolio and Asset Liability Management</a> | 2 SWS | Practice | Safarian |
| Exams   |         |                                                                     |       |          |          |
| ST 2026 | 7900366 | <a href="#">Portfolio and Asset Liability Management</a>            |       |          | Safarian |

**Assessment**

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 courses related to this module component:

## V

**Portfolio and Asset Liability Management**

2520357, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)

**Content****Learning objectives:**

Knowledge of various portfolio management techniques in the financial industry.

**Content:**

Portfolio theory: principles of investment, Markowitz- portfolio analysis, Modigliani-Miller theorems and absence of arbitrage, efficient markets, capital asset pricing model (CAPM), multi factorial CAPM, arbitragepricing theory (APT), arbitrage and hedging, multi factorial models, equity-portfolio management, passive strategies, active investment

Asset liability: statistical portfolio analysis in stock allocation, measures of success, dynamic multi seasonal models, models in building scenarios, stochastic programming in bond and liability management, optimal investment strategies, integrated asset liability management

**Workload:**

Total workload for 4.5 CP: approx. 135 hours

Attendance: 30 hours

Preparation and follow-up: 65 hours

Exam preparation: 40 hours

Exam preparation: 40 hours

**Organizational issues**

Blockveranstaltung, Termine werden über Ilias bekanntgegeben

**Literature**

To be announced in the lecture

**T****6.262 Module component: Post-quantum Cryptography from Lattices [T-INFO-114987]****Coordinators:** Prof. Dr. Jörn Müller-Quade**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107642 - Post-quantum Cryptography from Lattices](#)

| Type             | Credits | Grading | Expansion   | Version |
|------------------|---------|---------|-------------|---------|
| Oral examination | 3 CP    | graded  | 1 semesters | 1       |

**Assessment**

The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) approx. 45 minutes.

**Prerequisites**

None.

**Recommendations**

Basic familiarity with cryptography as introduced in the module “Theoretische Grundlagen der Kryptographie” is recommended, in particular, familiarity with security notions for basic primitives (IND-CPA, EUF-CMA) and security reductions (including hybrid arguments and guessing).

## T

## 6.263 Module component: Power Management [T-INFO-101341]

**Coordinators:** Prof. Dr.-Ing. Frank Bellosa  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-100804 - Power Management](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 3 CP    | Graded  | Each winter term | 1       |

| Courses  |         |                                  |       |                                                                                               |                            |
|----------|---------|----------------------------------|-------|-----------------------------------------------------------------------------------------------|----------------------------|
| WT 25/26 | 2400036 | <a href="#">Power Management</a> | 2 SWS | Lecture /  | Bellosa, Gröninger, Khalil |
| Exams    |         |                                  |       |                                                                                               |                            |
| WT 25/26 | 7500025 | <a href="#">Power Management</a> |       |                                                                                               | Bellosa                    |
| ST 2026  | 7500142 | <a href="#">Power Management</a> |       |                                                                                               | Bellosa                    |

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

Below you will find excerpts from courses related to this module component:

## V

## Power Management

2400036, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)

Lecture (V)  
On-Site



**T****6.264 Module component: Practical Course Computer Vision for Human-Computer Interaction [T-INFO-105943]****Coordinators:** Prof. Dr.-Ing. Rainer Stiefelhagen**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-102966 - Practical Course Computer Vision for Human-Computer Interaction](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 6 CP    | Graded  | Each summer term | 3       |

| Courses |         |                                                                                 |       |                                                                                                        |              |
|---------|---------|---------------------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------|--------------|
| ST 2026 | 2400123 | <a href="#">Practical Course Computer Vision for Human-Computer Interaction</a> | 2 SWS | Practical course /  | Stiefelhagen |
| Exams   |         |                                                                                 |       |                                                                                                        |              |
| ST 2026 | 7500279 | <a href="#">Practical Course Computer Vision for Human-Computer Interaction</a> |       |                                                                                                        | Stiefelhagen |

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

The following conditions have to be fulfilled:

1. The module component [T-INFO-110325 - Practical Course Computer Vision for Human-Computer Interaction incl. Scientific Report](#) must not have been started.

T

6.265 Module component: Practical Course Decentralized Systems and Network Services [T-INFO-106063]

Coordinators:

Prof. Dr. Hannes Hartenstein

Organisation:

KIT Department of Informatics

Part of:

[M-INFO-103047 - Practical Course Decentralized Systems and Network Services](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 4 CP    | graded  | Irregular    | 1       |

**T****6.266 Module component: Practical Course on Network Security Research [T-INFO-114270]**

**Coordinators:** Mario Hock  
Prof. Dr. Martina Zitterbart

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-107244 - Practical Course on Network Security Research](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 3 CP    | graded  | Irregular    | 1       |

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

Among other things, implementation, documentation, presentation in the colloquium and the research report to be prepared are included in the assessment of success.

Withdrawal is possible up to two weeks after the first (online) presentation event.

**Prerequisites**

None.

**Recommendations**

The module Network Security: Architectures and Protocols [M-INFO-100782] should have been started or completed.

## T

**6.267 Module component: Practical Course on Telematics [T-INFO-114894]**

**Coordinators:** Prof. Dr. Martina Zitterbart  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-107597 - Practical Course on Telematics](#)

**Type**  
Examination of another type

**Credits**  
3 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
1

| Courses  |         |                                                |       |                  |                          |
|----------|---------|------------------------------------------------|-------|------------------|--------------------------|
| WT 25/26 | 2400016 | <a href="#">Practical Course on Telematics</a> | 1 SWS | Practical course | Zitterbart, König, Mahrt |
| Exams    |         |                                                |       |                  |                          |
| WT 25/26 | 7500019 | <a href="#">Practical Course on Telematics</a> |       |                  | Zitterbart               |

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

Exercise sheets, presentation and final report are included in the assessment.

**Recommendations**

Previous or parallel attendance of the lecture "Telematics"

## T

**6.268 Module component: Practical Course on Telematics Research [T-INFO-114239]****Coordinators:** Prof. Dr. Martina Zitterbart**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107220 - Practical Course on Telematics Research](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 3 CP    | graded  | Irregular    | 1       |

| Exams    |         |                                                |            |
|----------|---------|------------------------------------------------|------------|
| WT 25/26 | 7500019 | <a href="#">Practical Course on Telematics</a> | Zitterbart |

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

Among other things, implementation, documentation, presentation in the colloquium and the research report to be prepared are included in the assessment of success.

**Prerequisites**

None.

**Recommendations**

A pronounced scientific interest in the topics of network security is a prerequisite: no prefabricated exercises are worked on, instead the internship requires a high degree of personal initiative.

## T

**6.269 Module component: Practical Course Protocol Engineering [T-INFO-104386]****Coordinators:** Prof. Dr. Martina Zitterbart**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-102092 - Practical Course Protocol Engineering](#)**Type**  
Examination of another type**Credits**  
4 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
1

| Courses  |         |                                                       |       |                  |                          |
|----------|---------|-------------------------------------------------------|-------|------------------|--------------------------|
| WT 25/26 | 2400086 | <a href="#">Practical Course Protocol Engineering</a> | 4 SWS | Practical course | Zitterbart, König, Mahrt |
| Exams    |         |                                                       |       |                  |                          |
| WT 25/26 | 7500002 | <a href="#">Practical Course Protocol Engineering</a> |       |                  | Zitterbart               |

## T

**6.270 Module component: Practical Course: Advanced Software Development Tools [T-INFO-112209]****Coordinators:** Prof. Dr.-Ing. Ina Schaefer**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106023 - Practical Course: Advanced Software Development Tools](#)**Type**  
Examination of another type**Credits**  
6 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
1

| Courses  |         |                                                                       |       |                                                                                                        |          |
|----------|---------|-----------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------|----------|
| WT 25/26 | 2400117 | <a href="#">Praktikum: Advanced Software Development Tools</a>        | 4 SWS | Practical course /  | Schaefer |
| ST 2026  | 2400126 | <a href="#">Praktikum: Advanced Software Development Tools</a>        | 4 SWS | Practical course /  | Schaefer |
| Exams    |         |                                                                       |       |                                                                                                        |          |
| WT 25/26 | 7500238 | <a href="#">Practical Course: Advanced Software Development Tools</a> |       |                                                                                                        | Schaefer |
| ST 2026  | 7500062 | <a href="#">Practical Course: Advanced Software Development Tools</a> |       |                                                                                                        | Schaefer |

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

## T

**6.271 Module component: Practical Course: Advanced Topics in High Performance Computing, Data Management and Analytics [T-INFO-111803]****Coordinators:** Prof. Dr. Achim Streit**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-105870 - Practical Course: Advanced Topics in High Performance Computing, Data Management and Analytics](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 6 CP    | Graded  | Each term    | 1       |

| Courses  |         |                                                                                                                |       |                  |                 |
|----------|---------|----------------------------------------------------------------------------------------------------------------|-------|------------------|-----------------|
| WT 25/26 | 2400043 | <a href="#">Advanced Topics in High Performance Computing, Data Management and Analytics</a>                   | 3 SWS | Practical course | Farhadi, Streit |
| Exams    |         |                                                                                                                |       |                  |                 |
| WT 25/26 | 7500345 | <a href="#">Practical Course: Advanced Topics in High Performance Computing, Data Management and Analytics</a> |       |                  | Streit          |

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO). The examination can consist of experiments or projects, each with a concluding presentation. Students may redraw from the assigned topic during the first two weeks after the topic has been communicated.

**Prerequisites**

None.

**Recommendations**

Knowledge in the area of databases, data management, data analytics, parallel computing is helpful.



## T

**6.272 Module component: Practical Course: AI for Climate and Weather Predictions [T-INFO-113659]****Coordinators:** TT-Prof. Dr. Peer Nowack**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106800 - Practical Course: AI for Climate and Weather Predictions](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 6 CP    | Graded  | Irregular    | 1       |

| Courses  |         |                                                                          |       |                                                                                                        |                    |
|----------|---------|--------------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------|--------------------|
| WT 25/26 | 2400064 | <a href="#">AI for climate and weather predictions</a>                   | 2 SWS | Practical course /  | Nowack, Amiramjadi |
| ST 2026  | 2400082 | <a href="#">AI for climate and weather predictions</a>                   | 3 SWS | Practical course /  | Nowack, Amiramjadi |
| Exams    |         |                                                                          |       |                                                                                                        |                    |
| WT 25/26 | 7500010 | <a href="#">Practical Course: AI for Climate and Weather Predictions</a> |       |                                                                                                        | Nowack             |

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

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

A written paper must be prepared and a presentation given. Withdrawal is possible within two weeks of the topic being assigned.

**Prerequisites**

- Previous programming experience, e.g., in scientific contexts or in computer science, is required.
- Students should have previous experience in the theory and implementation of machine learning models.

**Recommendations**

- Knowledge of the Python programming language.
- Good knowledge of mathematical concepts such as linear algebra is an advantage.
- An interest in scientific questions around climate science and weather forecasting.

Below you will find excerpts from courses related to this module component:

## V

**AI for climate and weather predictions**2400064, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)**Practical course (P)**  
**On-Site**

**Content****Content:**

Students will learn how to work with state-of-the-art AI models for climate science and weather forecasting.

For example, typical AI models will include recent releases of

- Foundation models for climate science and weather forecasting.
- Generative AI models for tasks such as ensemble generation of weather forecasts and of climate change simulations for uncertainty quantification.
- Transformer and graph neural network models for weather forecasting.
- Climate model emulators.

Each student will be able to select from a variety of topics to explore in their practical experiments. These could include, but are not limited to:

- The representation of physical concepts in data-driven AI models (e.g., does the model indirectly learn to “understand physics”?).
- Detecting and understanding failure modes of AI models.
- Forecast accuracy and uncertainty quantification for AI-generated ensembles of simulations.
- Effective solutions to post-processing AI results and/or to modifying AI model architectures.
- Assessing if certain AI architectures perform significantly better for specific tasks.

**Workload:**

In-person introductory session, individual and group meetings, final presentation sessions: 30h

Practical tasks – getting started, implementation, experiments, analysis: 100h

Write up results in the style of a scientific paper and preparation of final presentation: 50h

**AI for climate and weather predictions**

2400082, SS 2026, 3 SWS, Language: English, [Open in study portal](#)

**Practical course (P)  
On-Site**

**Content****Content:**

Students will learn how to work with state-of-the-art AI models for climate science and weather forecasting.

For example, typical AI models will include recent releases of

- Foundation models for climate science and weather forecasting.
- Generative AI models for tasks such as ensemble generation of weather forecasts and of climate change simulations for uncertainty quantification.
- Transformer and graph neural network models for weather forecasting.
- Climate model emulators.

Each student will be able to select from a variety of topics to explore in their practical experiments. These could include, but are not limited to:

- The representation of physical concepts in data-driven AI models (e.g., does the model indirectly learn to “understand physics”?).
- Detecting and understanding failure modes of AI models.
- Forecast accuracy and uncertainty quantification for AI-generated ensembles of simulations.
- Effective solutions to post-processing AI results and/or to modifying AI model architectures.
- Assessing if certain AI architectures perform significantly better for specific tasks.

**Workload:**

In-person introductory session, individual and group meetings, final presentation sessions: 30h

Practical tasks – getting started, implementation, experiments, analysis: 100h

Write up results in the style of a scientific paper and preparation of final presentation: 50h

**Organizational issues**

<https://portal.wiwi.kit.edu/ys/9226/manage>

## T

**6.273 Module component: Practical Course: Application Security [T-INFO-113958]****Coordinators:** Prof. Dr. Jörn Müller-Quade**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106996 - Practical Course: Application Security](#)**Type**  
Examination of another type**Credits**  
4 CP**Grading**  
graded**Term offered**  
Each term**Version**  
1

| Courses  |         |                                          |       |                                                                                                        |                                                         |
|----------|---------|------------------------------------------|-------|--------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| WT 25/26 | 2400114 | <a href="#">Application Security Lab</a> | 4 SWS | Practical course /  | Müller-Quade,<br>Mechler, Dörre,<br>Noppel, Wressnegger |
| ST 2026  | 2400117 | <a href="#">Application Security Lab</a> | 4 SWS | Practical course /  | Müller-Quade,<br>Wressnegger, Sperrle,<br>Gharibyar     |
| Exams    |         |                                          |       |                                                                                                        |                                                         |
| WT 25/26 | 7500188 | <a href="#">Application Security Lab</a> |       |                                                                                                        | Müller-Quade,<br>Wressnegger                            |
| ST 2026  | 7500119 | <a href="#">Application Security Lab</a> |       |                                                                                                        | Müller-Quade,<br>Wressnegger                            |

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

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO). Students have to solve different tasks. An overall grade is awarded.

**Prerequisites**

None.

**Recommendations**

The basics of IT security are assumed.

The content of the lectures "Computer Organization" and "Operating Systems" should be known.

**T****6.274 Module component: Practical Course: Artificial Intelligence & Security Lab (AISEC-Lab) [T-INFO-113760]****Coordinators:** Prof. Dr. Christian Wressnegger**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106867 - Practical Course: Artificial Intelligence & Security Lab \(AISEC-Lab\)](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 4 CP    | Graded  | Each summer term | 1       |

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

At least one assignment from each unit must be successfully completed (comparable results to other students).

**Prerequisites**

None.

**Recommendations**

The basics of IT security and artificial intelligence are a prerequisite.

## T

**6.275 Module component: Practical Course: Chip Design I [T-INFO-114298]**

**Coordinators:** Prof. Dr. Mehdi Baradaran Tahoori  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-107265 - Practical Course: Chip Design I](#)

**Type**  
Examination of another type

**Credits**  
3 CP

**Grading**  
graded

**Term offered**  
Each term

**Version**  
1

| Courses  |         |                                                 |       |                                                                                                        |         |
|----------|---------|-------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------|---------|
| WT 25/26 | 2400216 | <a href="#">Practical Course: Chip Design I</a> | 4 SWS | Practical course /  | Tahoori |
| ST 2026  | 2400104 | <a href="#">Practical Course: Chip Design I</a> | 4 SWS | Practical course /  | Tahoori |
| Exams    |         |                                                 |       |                                                                                                        |         |
| WT 25/26 | 7500192 | <a href="#">Practical Course: Chip Design I</a> |       |                                                                                                        | Tahoori |
| ST 2026  | 7500234 | <a href="#">Practical Course: Chip Design I</a> |       |                                                                                                        | Tahoori |

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

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

The overall impression is evaluated. The grading is based on the results of the practical work (80 %) and the final presentation(20%). An overall grade is awarded.

Students may redraw from the examination during the first two weeks after the topic has been communicated. The assessment can be repeated once.

**Prerequisites**

None.

**Recommendations**

The requirements are individual to each of the offered projects.  
 Knowledge of HDL is helpful.

## T

**6.276 Module component: Practical Course: Chip Design II [T-INFO-114299]**

**Coordinators:** Prof. Dr. Mehdi Baradaran Tahoori  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-107266 - Practical Course: Chip Design II](#)

**Type**  
Examination of another type

**Credits**  
3 CP

**Grading**  
graded

**Term offered**  
Each term

**Version**  
1

| Courses  |         |                                                  |       |                                                                                                        |         |
|----------|---------|--------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------|---------|
| WT 25/26 | 2400219 | <a href="#">Practical Course: Chip Design II</a> | 4 SWS | Practical course /  | Tahoori |
| ST 2026  | 2400107 | <a href="#">Practical Course: Chip Design II</a> | 4 SWS | Practical course /  | Tahoori |
| Exams    |         |                                                  |       |                                                                                                        |         |
| WT 25/26 | 7500220 | <a href="#">Practical Course: Chip Design II</a> |       |                                                                                                        | Tahoori |
| ST 2026  | 7500169 | <a href="#">Practical Course: Chip Design II</a> |       |                                                                                                        | Tahoori |

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

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

The overall impression is evaluated. The grading is based on the results of the practical work (80 %) and the final presentation(20%). An overall grade is awarded.

Students may redraw from the examination during the first two weeks after the topic has been communicated. The assessment can be repeated once.

**Prerequisites**

None.

**Recommendations**

The requirements are individual to each of the offered projects.  
 Knowledge of HDL is helpful.

**T****6.277 Module component: Practical Course: Continuous Software Engineering [T-INFO-115043]****Coordinators:** Prof. Dr.-Ing. Anne Koziolk**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107677 - Practical Course: Continuous Software Engineering](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 6 CP    | Graded  | Each term    | 1       |

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO), in the form of predominantly practical tasks and a final presentation.

**Prerequisites**

None.

**Recommendations**

Solid programming skills are required in order to successfully complete the lab course within the specified workload.

**Additional Information**

In earlier semesters, this course was named „Praktikum: Werkzeuge für agile Modellierung“.

**T****6.278 Module component: Practical Course: Current Topics of Quantum Computing [T-INFO-112741]**

**Coordinators:** Prof. Dr.-Ing. Ina Schaefer  
Prof. Dr. Achim Streit

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-106286 - Practical Course: Current Topics of Quantum Computing](#)

| Type                        | Credits | Grading        | Term offered     | Version |
|-----------------------------|---------|----------------|------------------|---------|
| Examination of another type | 6 CP    | Grading graded | Each summer term | 1       |

| Courses |         |                                                     |       |                  |                        |
|---------|---------|-----------------------------------------------------|-------|------------------|------------------------|
| ST 2026 | 2400203 | <a href="#">Current Topics of Quantum Computing</a> | 3 SWS | Practical course | Kühn, Schaefer, Streit |

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

The overall impression is evaluated. The grading is based on a term paper and a presentation. Students may redraw from the examination during the first two weeks after the topic has been communicated.

**Recommendations**

- Knowledge of linear algebra is recommended
- Programming experience is helpful.

*Below you will find excerpts from courses related to this module component:*

**V****Current Topics of Quantum Computing**

2400203, SS 2026, 3 SWS, Language: German/English, [Open in study portal](#)

**Practical course (P)**

**Content**

This practical course focuses on the theoretical analysis and practical implementation of current topics in quantum computing. The introduction covers necessary mathematical foundations of quantum systems and their representation by qubits and quantum circuits before delving into the specifics of the topics offered. Possible topics include quantum algorithms, optimization of quantum systems, quantum software engineering, or quantum machine learning.

There are fixed dates for topic assignment and lectures to introduce the topic of quantum computing. Additional face-to-face meetings to discuss individual progress are coordinated individually between the participants and supervisors. Participants work on separate tasks that are defined on the basis of current research work and thus offer realistic problems from practice and research. Assignments are graded individually, group work is possible. Prior knowledge and areas of interest of the participants are taken into account when assigning the topics.



T

6.279 Module component: Practical Course: Data Science [T-INFO-111262]

Coordinators:

Prof. Dr.-Ing. Klemens Böhm

Organisation:

KIT Department of Informatics

Part of:

M-INFO-105632 - Practical Course: Data Science

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 6 CP    | graded  | Each summer term | 2       |

| Exams   |         |                                  |              |
|---------|---------|----------------------------------|--------------|
| ST 2026 | 7500091 | Data Science - Laboratory Course | Böhm, Nowack |

## T

**6.280 Module component: Practical Course: Data Science for Scientific Data [T-INFO-112844]****Coordinators:** Prof. Dr.-Ing. Klemens Böhm**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106329 - Practical Course: Data Science for Scientific Data](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 6 CP    | graded  | Irregular    | 2       |

| Courses |        |                                                                    |       |                                                                                                        |                                            |
|---------|--------|--------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------|--------------------------------------------|
| ST 2026 | 242424 | <a href="#">Data Science for Scientific Data</a>                   | 2 SWS | Practical course /  | Böhm, Cribeiro Ramallo, Schäfer, Matteucci |
| Exams   |        |                                                                    |       |                                                                                                        |                                            |
| ST 2026 | 75751  | <a href="#">Practical Course: Data Science for Scientific Data</a> |       |                                                                                                        | Böhm, Schäfer                              |

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

Below you will find excerpts from courses related to this module component:

## V

**Data Science for Scientific Data**242424, SS 2026, 2 SWS, Language: English, [Open in study portal](#)**Practical course (P)**  
**On-Site****Content**

During the course we will put in practice the theoretical knowledge acquired during the Data Science 1 and 2 courses.

The Lab is divided into two parts, each lasting half the semester. During the first phase, shared with the Praktikum: Data Science, we will work on a standard data science task. Among the rest, we will explore the data, clean and engineer it, and train some ML models on it. During the second phase, we will work on a real-world, non-standard task, typically involving advanced techniques and libraries to solve it.

**Organizational issues**

The Lab is a parallel course to the Praktikum: Data Science für die Wissenschaften (242424), they share the qualification task and the first half of the classes. As a consequence, students are only allowed to take one of them.

To ensure that all students are on the same page, admission to the Lab is contingent on (1) being familiar with the Data Science 1 lectures and

(2) the submission of a solution to the Lab Qualification Task, which you can find on the ILIAS page of the Lab (linked above).

On ILIAS you will also find additional information regarding the submission deadline and how to submit.

## T

**6.281 Module component: Practical Course: Database Systems [T-INFO-103201]****Coordinators:** Prof. Dr.-Ing. Klemens Böhm**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-101662 - Practical Course: Database Systems](#)**Type**  
Coursework**Credits**  
4 CP**Grading**  
pass/fail**Term offered**  
Each winter term**Version**  
4

| Courses  |         |                                                   |       |                                                                                                        |                        |
|----------|---------|---------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------|------------------------|
| WT 25/26 | 2424286 | <a href="#">Datenbankpraktikum</a>                | 2 SWS | Practical course /  | Böhm, Richter          |
| ST 2026  | 2424286 | <a href="#">Datenbankpraktikum</a>                | 2 SWS | Practical course /  | Böhm, Richter, Reimann |
| Exams    |         |                                                   |       |                                                                                                        |                        |
| WT 25/26 | 7500130 | <a href="#">Practical Course Database Systems</a> |       |                                                                                                        | Böhm                   |
| ST 2026  | 7500030 | <a href="#">Practical Course Database Systems</a> |       |                                                                                                        | Böhm                   |

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

**T****6.282 Module component: Practical Course: Design and Evaluation of Interactive Systems [T-INFO-112749]****Coordinators:** Prof. Dr. Kathrin Gerling**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106290 - Practical Course: Design and Evaluation of Interactive Systems](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 6 CP    | Graded  | Each summer term | 1       |

| Courses  |         |                                                                                 |         |                                                                                                        |                                 |
|----------|---------|---------------------------------------------------------------------------------|---------|--------------------------------------------------------------------------------------------------------|---------------------------------|
| WT 25/26 | 2400208 | <a href="#">Designing and Evaluating Interactive Systems</a>                    | 4 SWS   | Practical course /  | Gerling, Alexandrovsky, Meiners |
| ST 2026  | 2400023 | <a href="#">Designing and Evaluating Interactive Systems (Internship)</a>       | 4 SWS   | Practical course /  | Gerling, Alexandrovsky          |
| Exams    |         |                                                                                 |         |                                                                                                        |                                 |
| WT 25/26 | 7500094 | <a href="#">Design and Evaluation of Interactive Systems (Practical Course)</a> | Gerling |                                                                                                        |                                 |
| ST 2026  | 7500235 | <a href="#">Design and Evaluation of Interactive Systems (Practical Course)</a> | Gerling |                                                                                                        |                                 |

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

**T****6.283 Module component: Practical Course: Digital Design & Test Automation Flow [T-INFO-105565]****Coordinators:** Prof. Dr. Mehdi Baradaran Tahoori**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-102570 - Practical Course: Digital Design & Test Automation Flow](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 3 CP    | Graded  | Each term    | 1       |

**Assessment**

The assessment is carried out in form of an examination of another type (§ 4 Abs. 2 No. 3 SPO). Students must give a presentation.

The module grade is made up of 80% of the work completed in the practical course and 20% of the presentation.

An overall grade is awarded.

**Prerequisites**

None.

**Recommendations**

Knowledge of “Dependable Computing” and “Fault Tolerant Computing” and Computer Architecture is helpful.

## T

**6.284 Module component: Practical Course: Efficient Parallel C++ [T-INFO-114228]****Coordinators:** Prof. Dr. Peter Sanders**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107203 - Practical Course: Efficient Parallel C++](#)

| Type                        |
|-----------------------------|
| Examination of another type |

| Credits |
|---------|
| 6 CP    |

| Grading |
|---------|
| graded  |

| Term offered |
|--------------|
| Irregular    |

| Version |
|---------|
| 1       |

| Courses  |         |                                             |         |                                                                                                        |                                      |
|----------|---------|---------------------------------------------|---------|--------------------------------------------------------------------------------------------------------|--------------------------------------|
| WT 25/26 | 2400195 | <a href="#">Lab: Efficient Parallel C++</a> | 4 SWS   | Practical course /  | Sanders, Schimek, Williams, Seemaier |
| Exams    |         |                                             |         |                                                                                                        |                                      |
| WT 25/26 | 7500365 | <a href="#">Lab: Efficient parallel C++</a> | Sanders |                                                                                                        |                                      |

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

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO). Students have to solve multiple programming tasks in C++. An overall grade is awarded.

**Prerequisites**

None.

**Recommendations**

At least basic knowledge of the C++ language is necessary for participation in the course. Students should be able to implement given algorithms.

**T****6.285 Module component: Practical Course: Engineering Approaches to Software Development [T-INFO-115044]****Coordinators:** Prof. Dr. Ralf Reussner**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107678 - Practical Course: Engineering Approaches to Software Development](#)

| Type                        | Credits | Grading        | Term offered | Version |
|-----------------------------|---------|----------------|--------------|---------|
| Examination of another type | 6 CP    | Grading graded | Each term    | 1       |

| Courses  |         |                                                                                 |       |                                                                                                        |          |
|----------|---------|---------------------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------|----------|
| WT 25/26 | 2400093 | <a href="#">Practical Course Engineering Approaches to Software Development</a> | 4 SWS | Practical course                                                                                       | Reussner |
| ST 2026  | 24908   | <a href="#">Practical Course Engineering Approaches to Software Development</a> | 4 SWS | Practical course /  | Reussner |

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

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO), in the form of predominantly practical tasks and a final presentation.

**Prerequisites**

None.

**Recommendations**

Solid programming skills are required in order to successfully complete the lab course within the specified workload.

**Additional Information**

In earlier semesters, this course was named „Praktikum Ingenieursmäßige Software-Entwicklung“.

Below you will find excerpts from courses related to this module component:

**V****Practical Course Engineering Approaches to Software Development**

24908, SS 2026, 4 SWS, Language: German/English, [Open in study portal](#)

Practical course (P)  
On-Site

**Content**

This practical course is suited for up to twelve participants.

## T

**6.286 Module component: Practical Course: FPGA Programming [T-INFO-105576]**

**Coordinators:** Prof. Dr. Mehdi Baradaran Tahoori  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-102661 - Practical Course: FPGA Programming](#)

**Type**  
Examination of another type

**Credits**  
3 CP

**Grading**  
graded

**Term offered**  
Each term

**Version**  
1

| Courses  |         |                                                   |       |                    |         |
|----------|---------|---------------------------------------------------|-------|--------------------|---------|
| WT 25/26 | 2400106 | <a href="#">FPGA Programming</a>                  | 4 SWS | Practical course / | Tahoori |
| ST 2026  | 2400106 | <a href="#">FPGA Programming</a>                  | 4 SWS | Practical course / | Tahoori |
| Exams    |         |                                                   |       |                    |         |
| WT 25/26 | 7500083 | <a href="#">Practical Course FPGA Programming</a> |       |                    | Tahoori |
| ST 2026  | 7500087 | <a href="#">Practical Course FPGA Programming</a> |       |                    | Tahoori |

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

**Assessment**

The assessment is carried out in form of an examination of another type (§ 4 Abs. 2 No. 3 SPO). Students must give a presentation. The module grade is made up of 80% of the work completed in the practical course and 20% of the presentation. An overall grade is awarded.

**Prerequisites**

None.

**Recommendations**

Knowledge of “Dependable Computing” and “Fault Tolerant Computing” and Computer Architecture is helpful.

Below you will find excerpts from courses related to this module component:

## V

**FPGA Programming**

2400106, WS 25/26, 4 SWS, Language: English, [Open in study portal](#)

**Practical course (P)**  
On-Site

**Content**

This lab emphasizes on the practical aspects of Field Programmable Gate Arrays (FPGAs). In the beginning, a short background discussion of FPGAs is given, followed by a tutorial on the workflow of configuring and programming an FPGA. This lab includes FPGA design using schematic layouts as well as several example of VHDL/Verilog programming to implement some sample digital circuits. Students will be exposed to the processes used to design and simulate FPGAs as well as compile their design and see it run on an actual FPGA.

**Organizational issues**

Die Veranstaltung **FPGA Programming (WS 25/26)** beginnt am **29.10.2025** und findet alle 2 Wochen mittwochs von **14:00 bis 17:15 Uhr** statt. Der Veranstaltungsort ist:

- **Gebäude:** 07.21
- **Gebäudeteil:** A, 3. OG
- **Raum:** A.3.24 (Praktikumsraum)

Bitte beachten Sie, dass eine **Anwesenheitspflicht** besteht. Um am Labor teilnehmen zu können, ist eine **Registrierung im Campussystem** erforderlich, da die Anzahl der Plätze begrenzt ist.

## V

**FPGA Programming**

2400106, SS 2026, 4 SWS, Language: English, [Open in study portal](#)

**Practical course (P)**  
On-Site



**Content**

This lab emphasizes on the practical aspects of Field Programmable Gate Arrays (FPGAs). In the beginning, a short background discussion of FPGAs is given, followed by a tutorial on the workflow of configuring and programming an FPGA. This lab includes FPGA design using schematic layouts as well as several example of VHDL/Verilog programming to implement some sample digital circuits. Students will be exposed to the processes used to design and simulate FPGAs as well as compile their design and see it run on an actual FPGA. The lab is designed around the DE2-115 prototyping board, which provides a programmer, program memory, and array of switches, buttons, LEDs, an LCD, and several I/O ports.

**Organizational issues**

ab 22.04.2026, alle 2 Wochen mittwochs 14:00-15:30, Geb. 07.21, Gebäudeteil A, 3.OG, Praktikumsraum A.3.24, Anwesenheitspflicht

**Start:**

- 22.04.2026
- every 14 days on Wednesday
- lab: 14:00-15:30
- location: building 07.21, wing A, 3rd floor, practical room A.3.24

**Attendance mandatory**

Since the number of seats is limited, a registration for this laboratory in the campussystem is necessary.

## T

**6.287 Module component: Practical Course: General-Purpose Computation on Graphics Processing Units [T-INFO-109914]****Coordinators:** Prof. Dr.-Ing. Carsten Dachsbacher**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-100724 - Practical Course: General-Purpose Computation on Graphics Processing Units](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 3 CP    | Graded  | Each term    | 1       |

| Courses  |         |                                                                                            |       |                                                                                                        |                                             |
|----------|---------|--------------------------------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------|---------------------------------------------|
| WT 25/26 | 2424297 | <a href="#">Practical course General-Purpose Computation on Graphics Processing Units</a>  | 2 SWS | Practical course /  | Klepikov, Alber, Lerzer, Dachsbacher        |
| ST 2026  | 24911   | <a href="#">Practical course General-Purpose Computation on Graphics Processing Units</a>  | 2 SWS | Practical course /  | Lerzer, Klepikov, Dachsbacher, Dereviannykh |
| Exams    |         |                                                                                            |       |                                                                                                        |                                             |
| WT 25/26 | 7500470 | <a href="#">Practical Course: General-Purpose Computation on Graphics Processing Units</a> |       |                                                                                                        | Dachsbacher                                 |

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

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

Performance is assessed continuously for the individual projects and in a final presentation.

**Prerequisites**

None.

**Recommendations**

It is recommended to have attended relevant lectures in the specialisation area of computer graphics.

*Below you will find excerpts from courses related to this module component:*

## V

**Practical course General-Purpose Computation on Graphics Processing Units** Practical course (P)  
 2424297, WS 25/26, 2 SWS, Language: English, [Open in study portal](#) On-Site
**Content****Kick-off event & Registration**

The kick-off event will take place Tuesday 28.10.25 at 14:00 in 50.34 Room 148.

Course seats are allocated by joining the ILIAS course.

**T****6.288 Module component: Practical Course: Graphics and Game Development [T-INFO-110872]****Coordinators:** Prof. Dr.-Ing. Carsten Dachsbacher**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-105384 - Practical Course: Graphics and Game Development](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 6 CP    | graded  | Irregular    | 1       |

**Recommendations**

Knowledge of basics or algorithms of computer graphics are recommended.

T

6.289 Module component: Practical Course: Hot Research Topics in Computer Graphics [T-INFO-109577]

Coordinators:

Prof. Dr.-Ing. Carsten Dachsbacher

Organisation:

KIT Department of Informatics

Part of:

[M-INFO-104699 - Practical Course: Hot Research Topics in Computer Graphics](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 6 CP    | graded  | Irregular    | 1       |

## T

**6.290 Module component: Practical Course: Human-Centred Robotics [T-INFO-113393]****Coordinators:** Prof. Dr. Katja Mombaur**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106646 - Practical Course: Human-Centred Robotics](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 6 CP    | Graded  | Each term    | 1       |

| Courses  |         |                                                                   |         |                                                                                                        |              |
|----------|---------|-------------------------------------------------------------------|---------|--------------------------------------------------------------------------------------------------------|--------------|
| WT 25/26 | 2400193 | <a href="#">Practical Course: Human-Centred Robotics Projects</a> | 4 SWS   | Practical course /  | Mombaur, Lee |
| ST 2026  | 2400149 | <a href="#">Practical course: Human-Centred Robotics</a>          | 4 SWS   | Practical course /  | Mombaur, Lee |
| Exams    |         |                                                                   |         |                                                                                                        |              |
| WT 25/26 | 7500387 | <a href="#">Practical Course: Human-Centred Robotics</a>          | Mombaur |                                                                                                        |              |

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

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

This includes the preparation of a project report (ca. 10 pages and an oral presentation with slides and hardware demonstration (30 Min + 15 min questions). Students may withdraw from the examination during the first two weeks after the topic has been communicated.

**Prerequisites**

Programming skills are required.

**Recommendations**

Knowledge in Robotics (e.g. from the class Robotics 1 and follow-ups) are very helpful.

**Additional Information**

Limited number of projects and participants. Specific project topics will be different each term and will be announced in a presentation during the first semester week.

Below you will find excerpts from courses related to this module component:

## V

**Practical course: Human-Centred Robotics**2400149, SS 2026, 4 SWS, Language: German/English, [Open in study portal](#)**Practical course (P)  
On-Site****Content**

Human-centered robots are robots that directly interact with humans or support humans in their motions. This includes humanoid robots, but also wearable robots (exoskeletons and prostheses) or external physical assistive devices. In this practical course, students learn how to implement theoretical knowledge about human-centered robots and use it to solve a given task based on a special project with robot hardware.

Projects can either focus on code development for a given hardware or on the development or modification of robot hardware along with the basic code. Students learn about the challenges of working with real robot hardware vs model computations, and about working principles and practical implementation of sensors and actuators.

## T

**6.291 Module component: Practical Course: Interactive Theorem Proving [T-INFO-114691]**

**Coordinators:** Prof. Dr. Bernhard Beckert  
Terru Stübinger

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-107494 - Practical Course: Interactive Theorem Proving](#)

| Type                        | Credits | Grading | Term offered | Expansion   | Version |
|-----------------------------|---------|---------|--------------|-------------|---------|
| Examination of another type | 3 CP    | Graded  | Irregular    | 1 semesters | 1       |

| Courses  |         |                                                                 |       |                    |                            |
|----------|---------|-----------------------------------------------------------------|-------|--------------------|----------------------------|
| WT 25/26 | 2400229 | <a href="#">"Practical Course: Interactive Theorem Proving"</a> | 2 SWS | Practical course / | Beckert, Stübinger, Färber |
| ST 2026  | 2400216 | <a href="#">Interactive Theorem Proving</a>                     | 2 SWS | Practical course / | Erdweg, Xu, Bitar, Lego    |
| Exams    |         |                                                                 |       |                    |                            |
| WT 25/26 | 7500297 | <a href="#">Practical Course: Interactive Theorem Proving</a>   |       |                    | Beckert                    |
| ST 2026  | 7500320 | <a href="#">Practical Course: Interactive Theorem Proving</a>   |       |                    | Erdweg                     |

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

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO). Students are graded on the formalisation (e.g. Isabelle theory files) produced during the project phase, along with a presentation on their completed project (duration approx. 20min). Students may redraw from the examination until two weeks before the final presentations. The assessment can be repeated once.

**Prerequisites**

None.

**Recommendations**

- Knowledge of functional programming is assumed.
- Some knowledge of logic (e.g. via courses such as Formale Systeme and/or Constructive Logic) will be helpful, but is not required

*Below you will find excerpts from courses related to this module component:*

## V

**"Practical Course: Interactive Theorem Proving"**

2400229, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

**Practical course (P)**  
**On-Site**

**Content**

In this lab course students should become familiar with the use of the

interactive theorem prover Isabelle/HOL and use it to formalise and verify their own project. In the first half of the course, important principles of theorem proving (e.g. simplification, recursion, inductive definitions and proofs) are learned and practiced via exercise sheets. In the second half of the course, students will work independently in teams formalising and verifying a topic in the area of formal methods, e.g. in programming language theory, type systems, or compilers.

## T

**6.292 Module component: Practical Course: Internet of Things (IoT) [T-INFO-107493]****Coordinators:** Prof. Dr.-Ing. Jörg Henkel**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-103706 - Practical Course: Internet of Things \(IoT\)](#)**Type**  
Examination of another type**Credits**  
4 CP**Grading**  
graded**Term offered**  
Each term**Version**  
1

| Courses  |         |                                               |        |                                                                                                        |                        |
|----------|---------|-----------------------------------------------|--------|--------------------------------------------------------------------------------------------------------|------------------------|
| WT 25/26 | 2424304 | <a href="#">Internet of Things (IoT) Lab</a>  | 4 SWS  | Practical course /  | Mentzos, Henkel, Tobar |
| ST 2026  | 2424304 | <a href="#">Internet of Things (IoT) Lab</a>  | 4 SWS  | Practical course /  | Henkel, Mentzos, Tobar |
| Exams    |         |                                               |        |                                                                                                        |                        |
| WT 25/26 | 7500183 | <a href="#">Lab: Internet of Things (IoT)</a> | Henkel |                                                                                                        |                        |

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

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO), in the form of a practical assignment, presentations and, if necessary, a written report. Written reports, presentations and practical work are weighted depending on the event.

**Prerequisites**

Basic skills in C or C++ programming.

**Recommendations**

- Familiarity with other (than C) languages like Python could be helpful as well.
- Basic knowledge from the modules "Design and Architectures of Embedded Systems (ESII)" and "Optimization and Synthesis of Embedded Systems (ESI)" are helpful but not essential for understanding the lab.

Below you will find excerpts from courses related to this module component:

## V

**Internet of Things (IoT) Lab**

2424304, WS 25/26, 4 SWS, Language: English, [Open in study portal](#)

**Practical course (P)**  
On-Site

**Content**

Welcome to the Internet of Things (IoT) world, where millions of connected devices are now involved almost in our everyday life, including our homes, offices, transportation, and our healthcare, from home appliances, vehicles, smartphones to wearable devices like smartwatches. IoT is growing very fast and spreads very quickly.

**Overview:** This lab aims at providing the student with the practical concept of IoT systems design.

- It provides an overview of the IoT systems' aspects including embedded intelligence, connectivity, interaction with the physical world, etc.
- It covers the main design and implementation issues for IoT devices and their applications. These issues challenge the students to tailor smart techniques to optimize the embedded software on IoT devices to meet the constrained resources.
- The students gain in-depth practical experiences in embedded system design with a focus on IoT applications as well as communication in connected devices.

**Lab's Goals:**

- The students will understand the main concept of IoT systems including the design objectives, application domains, and their requirements, design challenges, etc.
- The students will gain the ability to develop software programs for the IoT embedded devices, implement the code on the hardware, conduct the tests, find the bugs and errors, and debug the software code on the hardware.
- The students shall be able to implement and apply the concepts that are critical in the IoT domain, e.g. low power design, security, etc.
- The students will be able to develop, integrate and evaluate a small IoT system with its main components: sensors to get data from the physical world, the embedded processor for control the device and process the data, wireless radio to transmit the data from the device to the Internet, storage (on the Internet or on a Smart Phone) to keep the data for further analysis.

**Target Audience:**

- This lab is also suitable for electrical engineering and informatics' students and those who have an interest in embedded systems design.

**Prerequisites:**

- The ability to develop software programs in C or C++ is recommended.
- Basic knowledge about other programming languages can be helpful (e.g., Java or Python)

**Details:**

- The lab manuals and exercises are conducted **only in English**.
- The lab is split into weekly sessions throughout the semester. Each session is approximately 3-4 hours per week. At the end of the semester, there would be a final project.
- The state-of-the-art low-power IoT boards and the corresponding development software, are used in the lab. Currently, Texas Instrument (TI) CC1350 microcontroller, and the latest version of Code Composer Studio is the base platform.
- The exercises in the lab are based on the TI repository. But for the final projects, the students have the flexibility to design their desired systems.

**Internet of Things (IoT) Lab**

2424304, SS 2026, 4 SWS, Language: English, [Open in study portal](#)

**Practical course (P)**  
**Online**



**Content**

**For registration please use ILIAS too, in order to follow the course!**

Welcome to the Internet of Things (IoT) world, where millions of connected devices are now involved almost in our everyday life, including our homes, offices, transportation, and our healthcare, from home appliances, vehicles, smartphones to wearable devices like smartwatches. IoT is growing very fast and spreads very quickly.

**Overview:** This lab aims at providing the student with the practical concept of IoT systems design.

- It provides an overview of the IoT systems' aspects including embedded intelligence, connectivity, interaction with the physical world, etc.
- It covers the main design and implementation issues for IoT devices and their applications. These issues challenge the students to tailor smart techniques to optimize the embedded software on IoT devices to meet the constrained resources.
- The students gain in-depth practical experiences in embedded system design with a focus on IoT applications as well as communication in connected devices.

**Lab's Goals:**

- The students will understand the main concept of IoT systems including the design objectives, application domains, and their requirements, design challenges, etc.
- The students will gain the ability to develop software programs for the IoT embedded devices, implement the code on the hardware, conduct the tests, find the bugs and errors, and debug the software code on the hardware.
- The students shall be able to implement and apply the concepts that are critical in the IoT domain, e.g. low power design, security, etc.
- The students will be able to develop, integrate and evaluate a small IoT system with its main components: sensors to get data from the physical world, the embedded processor for control the device and process the data, wireless radio to transmit the data from the device to the Internet, storage (on the Internet or on a Smart Phone) to keep the data for further analysis.

**Target Audience:**

- This lab is also suitable for electrical engineering students and those who have an interest in embedded systems design.

**Prerequisites:**

- The ability to develop software programs in C or C++ is recommended.
- Basic knowledge about other programming languages can be helpful (e.g., Java or Python)

**Details:**

- The lab manuals and exercises are available in English.
- The lab is split into weekly sessions throughout the semester. Each session is approximate ~4hours per week. At the end of the semester, there would be a final project.
- The state-of-the-art low-power IoT boards and the corresponding development software, are used in the lab. Currently, Texas Instrument (TI) CC1350 microcontroller, and the latest version of Code Composer Studio is the base platform.
- The exercises in the lab are based on the TI repository. But for the final projects, the students have the flexibility to design their desired systems.

**T****6.293 Module component: Practical Course: Low Power Design and Embedded Systems [T-INFO-108323]****Coordinators:** Prof. Dr.-Ing. Jörg Henkel**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-104031 - Practical Course: Low Power Design and Embedded Systems](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 4 CP    | graded  | Each term    | 2       |

| Courses |         |                                                       |       |                                                                                                        |                              |
|---------|---------|-------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------|------------------------------|
| ST 2026 | 2424811 | <a href="#">Low Power Design and Embedded Systems</a> | 4 SWS | Practical course /  | Henkel, Khdr, Sikal, Mentzos |

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

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

The overall impression is evaluated.

The grading will be based on multiple exercises and a final report.

Details of the grading scale will be announced during the course.

**Prerequisites**

None.

**Recommendations**

Students should be familiar with software development practices under Linux-based systems. Practical knowledge in C/C++ as well as Python is required.

*Below you will find excerpts from courses related to this module component:*

**V****Low Power Design and Embedded Systems**2424811, SS 2026, 4 SWS, Language: English, [Open in study portal](#)**Practical course (P)  
Blended (On-Site/Online)****Content****Lab Description**

Nowadays, power and energy consumption are two of the most important criteria in the design of on-chip applications. Other design constraints, such as performance, were dominant in the past, but now it is imperative to optimize for low power, since on-chip temperature and battery life are limiting design factors on modern multi / many core systems.

This lab explores different software and hardware approaches for power and energy reduction on modern embedded systems, considering other relevant metrics and constraints (eg, temperature, performance, chip area).

**First part: software effects on power and performance**

The first part of the lab consists of an exploration and analysis of the effect of different resource management techniques on a many-core platform, to optimize for a specific metric (e.g. energy, power, temperature) under predefined application constraints (e.g. performance).

**Second part: hardware / software co-design**

The second part of the lab consists of a Hardware/Software Co-design exploration using the High-Level Synthesis (HLS) technique. This technique takes a C/C++ code implementation and produces a hardware accelerator module from a function, which is then synthesized for a Field Programmable Gate Array (FPGA) device.

This part explores the trade-off between performance, speed, power and area usage in the design of HW/SW systems.

**Third Part: Demo in Thermal Lab**

As part of the course, there will be access to the CES thermal lab, in which an experiment will be carried out to analyze the effect of power and temperature on a real board setup, using a thermal camera.

Preliminary discussion appointment: it will be announced via email to all registrants.

**Note: The lab is given as a full week block the week after the end of the lecture period.**

**T****6.294 Module component: Practical Course: Machine Learning and Intelligent Systems [T-INFO-112104]****Coordinators:** Michael Fennel

Prof. Dr.-Ing. Uwe Hanebeck

**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-105958 - Practical Course: Machine Learning and Intelligent Systems](#)

| Type                        |
|-----------------------------|
| Examination of another type |

| Credits |
|---------|
| 8 CP    |

| Grading |
|---------|
| graded  |

| Term offered |
|--------------|
| Each term    |

| Version |
|---------|
| 1       |

| Courses  |         |                                                                           |       |                                                                                                        |          |
|----------|---------|---------------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------|----------|
| ST 2026  | 24871   | <a href="#">Practical Course Machine Learning and Intelligent Systems</a> | 4 SWS | Practical course /  | Hanebeck |
| Exams    |         |                                                                           |       |                                                                                                        |          |
| WT 25/26 | 7500103 | <a href="#">Practical Course Machine Learning and Intelligent Systems</a> |       |                                                                                                        | Hanebeck |

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

Success is assessed in the form of another type of examination in accordance with Section 4 (2) No. 3 SPO .

**Prerequisites**

None.

**T****6.295 Module component: Practical Course: Model-Driven Software Development [T-INFO-113897]**

**Coordinators:** Dr.-Ing. Erik Burger  
Prof. Dr. Ralf Reussner

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-106932 - Practical Course: Model-Driven Software Development](#)

**Type**  
Examination of another type

**Credits**  
6 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
2

| Courses |         |                                                                     |       |                                                                                                        |          |
|---------|---------|---------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------|----------|
| ST 2026 | 2400091 | <a href="#">Practical Course: Model-Driven Software Development</a> | 4 SWS | Practical course /  | Burger   |
| Exams   |         |                                                                     |       |                                                                                                        |          |
| ST 2026 | 7500017 | <a href="#">Practical Course: Model-Driven Software Development</a> |       |                                                                                                        | Reussner |

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

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO), in the form of predominantly practical tasks.

**Prerequisites**

None.

**Recommendations**

Attending the lectures Software Engineering II and Model-Driven Software Development is helpful.

**T****6.296 Module component: Practical Course: Movement and Technology [T-INFO-113394]****Coordinators:** Prof. Dr. Katja Mombaur**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106648 - Practical Course: Movement and Technology](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 6 CP    | Graded  | Each summer term | 2       |

| Courses |         |                                                           |       |                                                                                                        |              |
|---------|---------|-----------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------|--------------|
| ST 2026 | 2400151 | <a href="#">Practical Course: Movement and Technology</a> | 4 SWS | Practical course /  | Mombaur, Lau |

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

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

This includes the preparation of a project report (ca. 10 pages and an oral presentation of the project topics and results with slides. Students may withdraw from the examination during the first two weeks after the topic has been communicated.

**Prerequisites**

Programming skills are required.

**Recommendations**

Knowledge in Robotics (e.g. from the class Robotics 1 and follow-ups) are very helpful.

Programming skills.

**Additional Information**

Limited number of projects and participants. Specific project topics will be different each term and will be announced in a presentation during the first semester week.

*Below you will find excerpts from courses related to this module component:*

**V****Practical Course: Movement and Technology**2400151, SS 2026, 4 SWS, Language: English, [Open in study portal](#)**Practical course (P)  
On-Site****Content**

In this joint course between Informatics and Sports Science, and in the sense of research-oriented teaching, students learn about current research projects of the BioRobotics Lab (Informatics) and the BioMotion Center (Sports Science) at the interface of interface of motor control and biomechanics of human movement. This research involve the use of latest motion capture technology, advanced analysis tools, and partly also assistive robotics technology. Students carry out their own scientific motion capture experiments in teams (interdisciplinary teams between students from informatics and sports science are highly encouraged), analyze the results and present them in written and oral form.

**T****6.297 Module component: Practical Course: Natural Language Dialog Systems [T-INFO-114206]****Coordinators:** Prof. Dr. Jan Niehues**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107177 - Practical Course: Natural Language Dialog Systems](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 6 CP    | Graded  | Irregular    | 1       |

| Courses |         |                                                           |       |                                                                                                        |                 |
|---------|---------|-----------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------|-----------------|
| ST 2026 | 2400187 | <a href="#">Praktikum Natural Language Dialog Systems</a> | 2 SWS | Practical course /  | Niehues, Koneru |

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

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

**Prerequisites**

None.

T

6.298 Module component: Practical Course: Programme Verification [T-INFO-102953]

Coordinators: Prof. Dr. Bernhard Beckert

Organisation: KIT Department of Informatics

Part of: [M-INFO-101537 - Practical Course: Programme Verification](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 3 CP    | graded  | Irregular    | 1       |

| Exams    |         |                                                          |         |
|----------|---------|----------------------------------------------------------|---------|
| WT 25/26 | 7500260 | <a href="#">Practical Course: Programme Verification</a> | Beckert |
| ST 2026  | 7500281 | <a href="#">Practical Course: Programme Verification</a> | Beckert |

**T****6.299 Module component: Practical Course: Realtime Computer Graphics [T-INFO-113737]****Coordinators:** Prof. Dr.-Ing. Carsten Dachsbacher**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106851 - Practical Course: Realtime Computer Graphics](#)**Type**  
Examination of another type**Credits**  
6 CP**Grading**  
graded**Term offered**  
Each term**Version**  
1

| Courses  |         |                                                              |       |                                                                                                        |                                      |
|----------|---------|--------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------|--------------------------------------|
| WT 25/26 | 2424287 | <a href="#">Practical course Realtime Computer Graphics</a>  | 4 SWS | Practical course /  | Klepikov, Alber, Lerzer, Dachsbacher |
| ST 2026  | 2400026 | <a href="#">Real Time Computer Graphics</a>                  | 4 SWS | Practical course /  | Lerzer, Klepikov, Dachsbacher        |
| Exams    |         |                                                              |       |                                                                                                        |                                      |
| WT 25/26 | 7500097 | <a href="#">Practical Course: Realtime Computer Graphics</a> |       |                                                                                                        | Dachsbacher                          |

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

Below you will find excerpts from courses related to this module component:

**V****Practical course Realtime Computer Graphics**2424287, WS 25/26, 4 SWS, Language: English, [Open in study portal](#)**Practical course (P)**  
**On-Site****Content****Kick-off event & Registration**

The kick-off event will take place on Wednesday 29.10.25 at 11:30 in 50.34 Room 131.

Course seats are allocated by joining the ILIAS course.



## T

**6.300 Module component: Practical Course: Real-world Vulnerability Discovery and Exploits [T-INFO-113350]****Coordinators:** Prof. Dr. Christian Wressnegger**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106627 - Practical Course: Real-world Vulnerability Discovery and Exploits](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 4 CP    | Graded  | Each term    | 1       |

| Courses  |         |                                                                                   |             |                                                                                                        |             |
|----------|---------|-----------------------------------------------------------------------------------|-------------|--------------------------------------------------------------------------------------------------------|-------------|
| WT 25/26 | 241337  | <a href="#">Practical Course: Real-world Vulnerability Discovery and Exploits</a> | 4 SWS       | Practical course /  | Wressnegger |
| ST 2026  | 241337  | <a href="#">Practical Course: Real-world Vulnerability Discovery and Exploits</a> | 2 SWS       | Practical course /  | Wressnegger |
| Exams    |         |                                                                                   |             |                                                                                                        |             |
| WT 25/26 | 7500383 | <a href="#">Practical Course: Real-world Vulnerability Discovery and Exploits</a> | Wressnegger |                                                                                                        |             |

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

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

**Prerequisites**

None.

**Recommendations**

Application security internship

## T

**6.301 Module component: Practical Course: Rendering in CGI [T-INFO-113443]**

**Coordinators:** Prof. Dr.-Ing. Carsten Dachsbacher  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-106687 - Practical Course: Rendering in CGI](#)

**Type**  
Examination of another type

**Credits**  
6 CP

**Grading**  
graded

**Term offered**  
Each term

**Version**  
1

| Courses  |         |                                                    |             |                                                                                                        |                                      |
|----------|---------|----------------------------------------------------|-------------|--------------------------------------------------------------------------------------------------------|--------------------------------------|
| WT 25/26 | 2400139 | <a href="#">Practical course Rendering in CGI</a>  | 4 SWS       | Practical course /  | Klepikov, Alber, Lerzer, Dachsbacher |
| ST 2026  | 2400041 | <a href="#">Rendering in CGI</a>                   | 4 SWS       | Practical course /  | Lerzer, Klepikov, Dachsbacher        |
| Exams    |         |                                                    |             |                                                                                                        |                                      |
| WT 25/26 | 7500098 | <a href="#">Practical Course: Rendering in CGI</a> | Dachsbacher |                                                                                                        |                                      |

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

Below you will find excerpts from courses related to this module component:

## V

**Practical course Rendering in CGI**

2400139, WS 25/26, 4 SWS, Language: English, [Open in study portal](#)

**Practical course (P)**  
On-Site

**Content****Kick-off event & Registration**

The kick-off event will take place on Wednesday 29.10.25 at 11:30 in 50.34 Room 131.  
 Course seats are allocated by joining the ILIAS course.

## T

**6.302 Module component: Practical Course: Robotics [T-INFO-114172]**

**Coordinators:** Prof. Dr.-Ing. Tamim Asfour  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-107155 - Robotics - Practical Course](#)

**Type**  
Examination of another type

**Credits**  
6 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
1

| Courses |         |                                             |        |                                                                                                        |        |
|---------|---------|---------------------------------------------|--------|--------------------------------------------------------------------------------------------------------|--------|
| ST 2026 | 24870   | <a href="#">Robotics - Practical Course</a> | 4 SWS  | Practical course /  | Asfour |
| Exams   |         |                                             |        |                                                                                                        |        |
| ST 2026 | 7500261 | <a href="#">Robotics - Practical Course</a> | Asfour |                                                                                                        |        |

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

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO). It is composed of several sub-tasks.

**Prerequisites**

Knowledge of the programming language C++ is required.

**Recommendations**

Attending the lectures Robotics I – Introduction to Robotics, Robotics II: Humanoid Robotics, Robotics III - Sensors and Perception in Robotics and Mechano-Informatics and Robotics is recommended.

*Below you will find excerpts from courses related to this module component:*

## V

**Robotics - Practical Course**

24870, SS 2026, 4 SWS, Language: English, [Open in study portal](#)

**Practical course (P)**  
On-Site

**Content**

The practical course is offered as an accompanying course to the lectures Robotics I–III. Every week, students will work in a small team on solving a given robotics problem. In advance, the students have to prepare for the exercise using provided material. Every week, a small team of students will work on solving a given robotics problem. The list of topics includes robot modeling and simulation, inverse kinematics, collision-free motion planning, grasp planning, robot vision and robot learning.

The course provides an introduction to the robot development framework and episodic robotic memory of the cognitive architecture ArmarX. Further exercises address geometric and kinematic modeling of robots, inverse kinematics, motion planning, task space control, grasp planning, geometric scene understanding, point cloud segmentation, and programming by demonstration using movement primitives.

**Learning Objectives:**

Students can apply concrete solutions for different problems in robotics from the fields of modeling, perception, cognition and control.

Students are able to understand provided material to prepare for the exercises and to answer related questions.

Students can implement solutions in the programming languages C++ and Python with the help of suitable software frameworks. They have a deep understanding of their written code, and can reflect on the abilities and limitations of the chosen approach.

**Organizational issues**

The assessment takes the form of a different type of examination in accordance with Section 4 (2) No. 3 SPO and consists of several exercises.

**Requirements:**

Knowledge of the C++ programming language is required.

**Recommendations**

Attending the lectures *Robotics I – Introduction to Robotics*, *Robotics II – Humanoid Robotics*, *Robotics III – Sensors and Perception in Robotics* is recommended.

**Workload:**

180 h

- approx. 2 h introductory session
- approx. 18 h initial training (software framework)
- approx. 120 h group work
- approx. 40 h attendance time

## T

**6.303 Module component: Practical Course: Route Planning [T-INFO-114899]**

**Coordinators:** TT-Prof. Dr. Thomas Bläsius  
Dr. rer. nat. Torsten Ueckerdt

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-107600 - Practical Course: Route Planning](#)

**Type**  
Examination of another type

**Credits**  
6 CP

**Grading**  
graded

**Term offered**  
Irregular

**Version**  
1

| Courses  |         |                                                  |       |                                                                                                        |                                            |
|----------|---------|--------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------|--------------------------------------------|
| WT 25/26 | 2400252 | <a href="#">Practical Course: Route Planning</a> | 4 SWS | Practical course /  | Bläsius, Zündorf,<br>Feilhauer, Laupichler |

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

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO)

The grade is made up of the completion of the programming task, a written evaluation of the results (approx. 10 pages) and the final presentation.

**Prerequisites**

None.

*Below you will find excerpts from courses related to this module component:*

## V

**Practical Course: Route Planning**

2400252, WS 25/26, 4 SWS, Language: English, [Open in study portal](#)

**Practical course (P)**  
**On-Site**

**Content****Competence Goal**

The students

- can practically apply the knowledge from the the module "Algorithmen für Routenplanung",
- are capable of efficiently implementing given topics in route planning (e.g., separator computation, shortest path acceleration techniques, ...),
- master the steps from design to implementation and evaluation in the practical application of algorithmic methods,
- possess the ability to act in a results-oriented manner within a team, critically assess their own actions, and demonstrate strong communication skills.

The participants are furthermore able to efficiently implement algorithms with consideration for modern computer architectures, as well as to plan and conduct meaningful experimental evaluations.

**Content**

In the practical course route planning, various topics from route planning are assigned, which are to be implemented independently by small student groups.

A main focus is placed on efficient programming in C++ or Rust.

**Workload**

Practical course with 4 SWS, 6 LP

6 LP corresponds to approx. 180 working hours, of which

- approx. 10 hours attendance time,
- approx. 12 hours working on the exercises,
- approx. 128 hours implementation phase,
- approx. 30 hours elaboration and preparation of the presentation

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO)

The grade is made up of the completion of the programming task, a written evaluation of the results (approx. 10 pages) and the final presentation.

**Prerequisites**

None.

**Organizational issues**

See course website for registration details

**T****6.304 Module component: Practical Course: Scientific Data Management [T-INFO-112810]****Coordinators:** Prof. Dr.-Ing. Klemens Böhm**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106312 - Practical Course: Scientific Data Management](#)

| Type       | Credits | Grading   | Term offered | Version |
|------------|---------|-----------|--------------|---------|
| Coursework | 4 CP    | pass/fail | Irregular    | 1       |

**Modeled Prerequisites**

The following conditions have to be fulfilled:

1. The module component [T-INFO-112689 - Practical Course: Graph Databases](#) must not have been started.

## T

**6.305 Module component: Practical Course: Scientific Visualization [T-INFO-113442]****Coordinators:** Prof. Dr.-Ing. Carsten Dachsbacher**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106686 - Practical Course: Scientific Visualization](#)**Type**  
Examination of another type**Credits**  
6 CP**Grading**  
graded**Term offered**  
Each term**Version**  
1

| Courses  |         |                                                            |             |                                                                                                        |                                      |
|----------|---------|------------------------------------------------------------|-------------|--------------------------------------------------------------------------------------------------------|--------------------------------------|
| WT 25/26 | 2400146 | <a href="#">Practical course Scientific Visualisation</a>  | 4 SWS       | Practical course /  | Klepikov, Lerzer, Alber, Dachsbacher |
| ST 2026  | 2400039 | <a href="#">Scientific Visualization</a>                   | 4 SWS       | Practical course /  | Lerzer, Klepikov, Dachsbacher        |
| Exams    |         |                                                            |             |                                                                                                        |                                      |
| WT 25/26 | 7500133 | <a href="#">Practical Course: Scientific Visualization</a> | Dachsbacher |                                                                                                        |                                      |

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

Below you will find excerpts from courses related to this module component:

## V

**Practical course Scientific Visualisation**2400146, WS 25/26, 4 SWS, Language: English, [Open in study portal](#)**Practical course (P)**  
On-Site**Content****Kick-off event & Registration**

The kick-off event will take place on Wednesday 29.10.25 at 11:30 in 50.34 Room 131.  
Course seats are allocated by joining the ILIAS course.



**T****6.306 Module component: Practical Course: Smart Data Analytics [T-INFO-106426]****Coordinators:** Prof. Dr.-Ing. Michael Beigl**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-103235 - Practical Course: Smart Data Analytics](#)
**Type**  
 Examination of another type

**Credits**  
 6 CP

**Grading**  
 graded

**Term offered**  
 Each summer term

**Version**  
 1

| Courses |         |                                                        |       |                                                                                                        |       |
|---------|---------|--------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------|-------|
| ST 2026 | 2424895 | <a href="#">Practical Course: Smart Data Analytics</a> | 4 SWS | Practical course /  | Beigl |
| Exams   |         |                                                        |       |                                                                                                        |       |
| ST 2026 | 7500088 | <a href="#">Practical Course: Smart Data Analytics</a> |       |                                                                                                        | Beigl |

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

## T

**6.307 Module component: Practical Course: Smart Energy System [T-INFO-112030]****Coordinators:** Dr.-Ing. Richard Jumar**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-105955 - Practical Course: Smart Energy System](#)**Type**  
Examination of another type**Credits**  
6 CP**Grading**  
graded**Term offered**  
Each term**Version**  
1

| Courses  |         |                                                           |       |                                                                                                        |                                            |
|----------|---------|-----------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------|--------------------------------------------|
| WT 25/26 | 2400230 | <a href="#">Lab Course: Smart Energy System Lab</a>       | 4 SWS | Practical course /  | Hagenmeyer, Jumar, Fernengel               |
| ST 2026  | 2400170 | <a href="#">Laboratory: Smart Energy System Lab</a>       | 4 SWS | Practical course /  | Hagenmeyer, Waczowicz, Jumar, Aghaei Attar |
| Exams    |         |                                                           |       |                                                                                                        |                                            |
| WT 25/26 | 7500318 | <a href="#">Practical Course: Smart Energy System Lab</a> |       |                                                                                                        | Hagenmeyer                                 |
| ST 2026  | 7500318 | <a href="#">Practical Course: Smart Energy System Lab</a> |       |                                                                                                        | Hagenmeyer                                 |

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

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

An overall grade is awarded which consists of:

40% 10 min presentation (per team) + 5 min of discussion

60% Write up in the style of a research paper of around 5-6 pages (for solo participants) or 7-8 pages (for teams of two)

The students may redraw from the examination before the end of the first laboratory week. The assessment can be repeated once.

**Prerequisites**

None.

**Recommendations**

- Knowledge of the fundamentals of energy informatics is a prerequisite.
- Knowledge of the fundamentals of electrical engineering and energy technology is required.
- Knowledge of the basics of mechatronics, data analysis and signal processing is helpful.
- Knowledge of power systems or power electronics is helpful.

Below you will find excerpts from courses related to this module component:

## V

**Lab Course: Smart Energy System Lab**

2400230, WS 25/26, 4 SWS, [Open in study portal](#)

**Practical course (P)**  
**On-Site**

## Content

### Registration information

The number of participants is limited and varies with the number of topics available at the Institute. The lab course and topic assignments are organized as follows:

Application period: 08.09.2025 - 22.09.2025

In-person work period: 13.10.2025 - 24.10.2025 (**Before the lectures begin!**)

- Interested students register via the Campus Plus portal (search for "Laboratory: Smart Energy System Lab")
- You indicate your topic preferences during the application. As far as possible, we will take this into account when assigning the topics.
- The CAS portal will indicate when and if you are accepted (limited number of participants).
- Your topic assignment will be announced together with the acceptance confirmation from CAS.
- Acceptances will be sent out September 19th, 2025.

### Compulsory work

- Completion of the assigned task
- Attendance during the attendance phase (min. 42 hours)
- Handover of results, documentation and presentation
- Relevant for your grade are: Preparation (literature research and discussion at the end of the preparation phase), practical work, presentation and write-up.

## Contents

The Institute of Automation and Applied Informatics (IAI) conducts research and development in the field of innovative, application-oriented information, automation and system technology for sustainable energy systems. The IAI is also responsible for the scientific operation and ongoing development of the Energy Lab energy research infrastructure at KIT Campus North.

As part of the ten-day lab course, students work in teams of two on one of several project topics derived from current research questions. The group of students typically goes through the following phases: Concept development/experiment preparation, implementation/experiment execution, evaluation/experiment analysis, presentation of results.

A list of project topics will be made available in advance. Interested students can express their topic preferences, based on which the students are assigned to the respective project topics. The participants will work independently on the assigned project - supervision is provided by IAI research assistants. At the end of the lab course, the work must be documented and presented in the style of a scientific paper. Additionally, each participant or team reports (approx. 10 min presentation + 5 min questions) on the topic worked on. This appointment takes place at the end of the internship.

The ten-day lab course begins with a joint kick-off event. This includes an organizational introduction, a tour of the Energy Lab and the Smart Energy System Simulation and Control Center (SEnSSiCC) and a brief presentation of all project topics. This is followed by the preparation phase (including an in-depth talk with your project manager) and the attendance phase. The course ends with a joint event at which the students present their solutions and work results in an examination presentation.

### Dates

08.09.2025 Upload of the project topics to the IAI page and the Campus-Plus portal

08.09.2025 - 18.09.2025 Application period

19.09.2025 Notification: Participation and topic

01.10.2025 10:00 - 11:30 Kick-Off-Event (attendance mandatory) Campus North B668.

01.10.2025 - 10.10.2025 Preparation phase: Familiarization with the project topic and submission of literature review

13.10.2025 In-depth talk with your project managers

13.10.2025 - 24.10.2025 Work phase on site at the Energy Lab (min. 42h required attendance)

Final presentations with grading:

11.11.2025 9:30-13:30 Slot 1

14.11.2025 14:30 - 17:30 Slot 2

18.11.2025 13:00 - 16:00 Slot 3

19.12.2025 Deadline for handing in your paper

### Notes

The courses are generally held in English. However, student presentations in German are possible. Quite often the topics are suitable for an extension into Master's thesis. The number of participants in the course is generally limited and varies according to the number of research projects available at the institute.

Further links

<https://www.iai.kit.edu/IAI-Lehrveranstaltungen.php>

<https://www.iai.kit.edu/english/RPE.php>

Campus-Plus-Portal for registration

### Organizational issues

Zweiwöchiges Praktikum im Energy Lab (KIT Campus Nord, Gebäude 668)

**Laboratory: Smart Energy System Lab**2400170, SS 2026, 4 SWS, Language: German/English, [Open in study portal](#)**Practical course (P)**  
**On-Site**

## Content

### Registration information

The number of participants is limited and varies with the number of topics available at the Institute. The lab course and topic assignments are organized as follows:

Application period: 06.04.2026 - 24.04.2026

In-person work period: 18.05.2026 - 29.05.2026 (**over Pentecost break**)

- Interested students register via the Campus Plus portal (search for "Laboratory: Smart Energy System Lab")
- You indicate your topic preferences during the application. As far as possible, we will take this into account when assigning the topics.
- The CAS portal will indicate when and if you are accepted (limited number of participants).
- Your topic assignment will be announced together with the acceptance confirmation from CAS.
- Acceptances will be sent out by 26.04.2026.

### Compulsory work

- Completion of the assigned task
- Attendance during the attendance phase (min. 42 hours)
- Handover of results, documentation and presentation
- Relevant for your grade are: Preparation (literature research and discussion at the end of the preparation phase), practical work, presentation and write-up.

### Contents

The Institute of Automation and Applied Informatics (IAI) conducts research and development in the field of innovative, application-oriented information, automation and system technology for sustainable energy systems. The IAI is also responsible for the scientific operation and ongoing development of the Energy Lab energy research infrastructure at KIT Campus North.

As part of the ten-day lab course, students work in teams of two on one of several project topics derived from current research questions. The group of students typically goes through the following phases: Concept development/experiment preparation, implementation/experiment execution, evaluation/experiment analysis, presentation of results.

A list of project topics will be made available in advance. Interested students can express their topic preferences, based on which the students are assigned to the respective project topics. The participants will work independently on the assigned project - supervision is provided by IAI research assistants. At the end of the lab course, the work must be documented and presented in the style of a scientific paper. Additionally, each participant or team reports (approx. 10 min presentation + 5 min questions) on the topic worked on. This appointment takes place at the end of the internship.

The ten-day lab course begins with a joint kick-off event. This includes an organizational introduction, a tour of the Energy Lab and the Smart Energy System Simulation and Control Center (SEnSSiCC) and a brief presentation of all project topics. This is followed by the preparation phase (including an in-depth talk with your project manager) and the attendance phase. The course ends with a joint event at which the students present their solutions and work results in an examination presentation.

### Dates

05.04.2026 Upload of the project topics to the IAI page and the Campus-Plus portal

06.04.2026 - 24.04.2026 Application period

26.04.2026 Notification: Participation and topic

04.05.2026 10:00 - 11:30 Uhr Kick-Off-Event (attendance mandatory) Campus North B668.

18.05.2026 In-depth talk with your project managers

18.05.2026 - 29.05.2026 Preparation phase: Familiarization with the project topic and submission of literature review

18.05.2026 - 29.05.2026 Work phase on site at the Energy Lab (min. 42h required attendance)

Final presentations with grading:

22.06.2026 09:00 - 12:00 Slot 1

03.07.2026 09:00 - 12:00 Slot 2

03.07.2026 13:00 - 16:00 Slot 3

08.07.2026 09:00 - 12:00 Slot 4

08.07.2026 13:00 - 16:00 Slot 5

31.07.2026 Deadline for handing in your paper

### Notes

The courses are generally held in English. However, student presentations in German are possible. Quite often the topics are suitable for an extension into Master's thesis. The number of participants in the course is limited and varies according to the number of research projects available at the institute.

Further links

<https://www.iai.kit.edu/IAI-Lehrveranstaltungen.php>

<https://www.iai.kit.edu/english/RPE.php>

Campus-Plus-Portal for registration

### Organizational issues

Zweiwöchiges Praktikum

**T****6.308 Module component: Practical Course: Software Defined Networking [T-INFO-114240]****Coordinators:** Prof. Dr. Martina Zitterbart**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107221 - Practical Course: Software Defined Networking](#)

| Type                        | Credits | Grading        | Term offered     | Version |
|-----------------------------|---------|----------------|------------------|---------|
| Examination of another type | 6 CP    | Grading graded | Each summer term | 1       |

| Courses |         |                                                              |       |                                                                                                        |                             |
|---------|---------|--------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------|-----------------------------|
| ST 2026 | 2400223 | <a href="#">Practical Course Software Defined Networking</a> | 4 SWS | Practical course /  | König, Seehofer, Zitterbart |

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

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

**Prerequisites**

None.

**Recommendations**

Knowledge of a programming language (Java, C++, Python, ...) and the contents of the telematics lectures are assumed. Previous knowledge of SDN is not mandatory: the topic will be introduced in an introductory task at the beginning of the practical course. Note: Successful participation in the introductory assignment is a prerequisite for further participation in the practical course.

Below you will find excerpts from courses related to this module component:

**V****Practical Course Software Defined Networking**2400223, SS 2026, 4 SWS, Language: English, [Open in study portal](#)**Practical course (P)  
Blended (On-Site/Online)****Content**

Software-defined networking (SDN) is an emerging approach for controlling and managing network infrastructures. All control functionality (such as routing) is implemented in software and executed with the help of a centralized controller. As part of this practical course, we now want to find out how such SDN applications can be developed

## T

**6.309 Module component: Practical Course: Visual Computing [T-INFO-103000]****Coordinators:** Prof. Dr.-Ing. Carsten Dachsbacher**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-101567 - Practical Course: Visual Computing](#)**Type**  
Examination of another type**Credits**  
6 CP**Grading**  
graded**Term offered**  
Each term**Version**  
4

| Courses  |         |                                                |             |                                                                                                        |                                             |
|----------|---------|------------------------------------------------|-------------|--------------------------------------------------------------------------------------------------------|---------------------------------------------|
| WT 25/26 | 2424283 | <a href="#">Practical course GPU-Computing</a> | 4 SWS       | Practical course /  | Klepikov, Alber, Lerzer, Dachsbacher        |
| ST 2026  | 2424902 | <a href="#">Practical course GPU-Computing</a> | 4 SWS       | Practical course /  | Lerzer, Klepikov, Dereviannykh, Dachsbacher |
| Exams    |         |                                                |             |                                                                                                        |                                             |
| WT 25/26 | 7500110 | <a href="#">Practical Course GPU-Computing</a> | Dachsbacher |                                                                                                        |                                             |

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

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO) in the form of practical work, presentations and, if applicable, a written paper

Written papers, presentations and practical work are weighted according to the course.

**Prerequisites**

None.

**Recommendations**

Programming skills in C/C++ are recommended.

*Below you will find excerpts from courses related to this module component:*

## V

**Practical course GPU-Computing**

2424283, WS 25/26, 4 SWS, Language: English, [Open in study portal](#)

**Practical course (P)**  
**On-Site**

**Content****Kick-off event & Registration**

The kick-off event will take place Tuesday 28.10.25 at 14:00 in 50.34 Room 148.  
Course seats are allocated by joining the ILIAS course.

## T

**6.310 Module component: Practical Course: Wearable Computing [T-INFO-114744]****Coordinators:** Prof. Dr.-Ing. Michael Beigl**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107527 - Practical Course: Wearable Computing](#)

| Type                        |
|-----------------------------|
| Examination of another type |

| Credits |
|---------|
| 6 CP    |

| Grading |
|---------|
| graded  |

| Term offered |
|--------------|
| Each term    |

| Version |
|---------|
| 1       |

| Courses  |         |                                                      |       |                                                                                                        |               |
|----------|---------|------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------|---------------|
| WT 25/26 | 2424895 | <a href="#">Practical Course: Wearable Computing</a> | 4 SWS | Practical course /  | Riedel, Beigl |
| Exams    |         |                                                      |       |                                                                                                        |               |
| WT 25/26 | 7500027 | <a href="#">Practical Course: Wearable Computing</a> |       |                                                                                                        | Beigl         |

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

**Assessment**

Success is assessed in the form of a different type of examination in accordance with Section 4 (2) No. 3 SPO. A written paper must be prepared and a presentation given. Withdrawal is possible within two weeks of the topic being assigned.

**Prerequisites**

None.

**Recommendations**

Experience with ML frameworks, signal processing and embedded systems is an advantage



**T****6.311 Module component: Practical Course: Web Applications and Service-Oriented Architectures (II) [T-INFO-103121]****Coordinators:** Prof. Dr. Sebastian Abeck**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-101635 - Practical Course: Web Applications and Service-Oriented Architectures \(II\)](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 5 CP    | Graded  | Each summer term | 3       |

| Courses |         |                                                                                            |       |                                                                                                        |                           |
|---------|---------|--------------------------------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------|---------------------------|
| ST 2026 | 24873   | <a href="#">Practical Course: Microservice2Go (II)</a>                                     | 2 SWS | Practical course /  | Abeck, Schneider, Throner |
| Exams   |         |                                                                                            |       |                                                                                                        |                           |
| ST 2026 | 7500139 | <a href="#">Practical Course: Web Applications and Service-Oriented Architectures (II)</a> |       |                                                                                                        | Abeck                     |

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

## T

**6.312 Module component: Practical Introduction to Hardware Security [T-INFO-114267]**

**Coordinators:** Prof. Dr. Mehdi Baradaran Tahoori  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-107241 - Practical Introduction to Hardware Security](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 6 CP    | Graded  | Each term    | 1       |

| Courses  |         |                                                             |       |                                                                                                        |               |
|----------|---------|-------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------|---------------|
| WT 25/26 | 2400033 | <a href="#">Practical Introduction to Hardware Security</a> | 4 SWS | Lecture / Practice /  | Gnad, Tahoori |
| ST 2026  | 2400009 | <a href="#">Practical Introduction in Hardware Security</a> | 4 SWS | Lecture / Practice /  | Tahoori, Gnad |
| Exams    |         |                                                             |       |                                                                                                        |               |
| WT 25/26 | 7500226 | <a href="#">Practical Introduction to Hardware Security</a> |       |                                                                                                        | Tahoori       |
| ST 2026  | 7500224 | <a href="#">Practical Introduction to Hardware Security</a> |       |                                                                                                        | Tahoori       |

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

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO). 4 topics will be covered in this lecture. After each topic the student will receive an assignment. The quality of his tasks will be evaluated afterwards of its correctness.

**Prerequisites**

None.

**Recommendations**

Knowledge of Digital Design (lecture TI)  
 Practical Course "FPGA Programming"

Below you will find excerpts from courses related to this module component:

## V

**Practical Introduction to Hardware Security**

2400033, WS 25/26, 4 SWS, Language: English, [Open in study portal](#)

Lecture / Practice (VÜ)  
On-Site

**Content**

4 SWS / 6 ECTS = 180h

**Organizational issues**

Die Veranstaltung **Praktische Einführung in die Hardware Sicherheit** (2400033) findet im Wintersemester 25/26 statt.

**Termin:**

- Beginn: **29.10.2025**
- Wöchentlich: **mittwochs**
- Vorlesung: **14:00-15:30**
- Übung: **15:30-17:15**
- Ort: **Gebäude 07.21, Gebäudeteil A, 3. OG, Seminarraum A.3.15**

Es besteht eine Anwesenheitspflicht.

Die Plätze sind limitiert und die Anmeldung erfolgt nach dem Prinzip „wer zuerst kommt, mahlt zuerst“. Daher ist es wichtig, sich so früh wie möglich anzumelden. Bitte beachten Sie, dass nur Anmeldungen mit den korrekten Unterlagen oder aus dem [Online-System](#) berücksichtigt werden können. Die Anwesenheit ist zwingend erforderlich.

## V

**Practical Introduction in Hardware Security**

2400009, SS 2026, 4 SWS, Language: English, [Open in study portal](#)

Lecture / Practice (VÜ)  
On-Site

**Content**

4 SWS / 6 ECTS = 180h

1. Hardware security primitives (PUF, TRNG)
2. Hardware Implementation of encryption modules (AES)
3. Passive Attack with side channel (on AES)
4. Active fault attack (on simple circuits, if feasible also on AES)

Security is a major concern for a variety of domains like embedded and cyber-physical systems in which threats in hardware and software components may pose catastrophic consequences. Software security has been studied extensively, since the majority of security attacks were typically at the software level. However, currently hardware becomes the Achilles heel for on-chip system security as recent events show. There is evidence of hardware security breaches and hence, there is a growing emphasis in hardware security from academic, industry, and government sectors. In this regard, physical attacks, side-channel analysis and fault-injection attacks for security-enabled application domains is becoming a real-world challenge.

**Organizational issues****Start:**

- **22.04.2026**
- weekly: **every Wednesday**
- lecture: **14:00-15:30**
- lab: **15:30-17:15**
- location: **building 07.21, wing A, 3rd floor, seminar room A.3.16**

**4x mandatory time slots for practical sessions**

There are limited seats and the registration is handled in a first-come, first-served manner. So make sure you sign-up as early as possible. Registration at *ilias*. (We can only consider registrations with the correct documents or from the online system (<https://campus.studium.kit.edu/exams/index.php>))

## T

**6.313 Module component: Practical SAT Solving [T-INFO-114262]**

**Coordinators:** Dr. Tomas Balyo  
 Dr. Ashlin Iser  
 Prof. Dr. Peter Sanders  
 Dr. Dominik Schreiber

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-107238 - Practical SAT Solving](#)

| Type             | Credits | Grading | Term offered | Version |
|------------------|---------|---------|--------------|---------|
| Oral examination | 5 CP    | graded  | Irregular    | 1       |

| Courses |         |                                       |       |                    |                          |
|---------|---------|---------------------------------------|-------|--------------------|--------------------------|
| ST 2026 | 2400218 | <a href="#">Practical SAT Solving</a> | 3 SWS | Lecture / Practice | Sanders, Iser, Schreiber |

**Assessment**

The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) usually lasting 30 minutes.

**Prerequisites**

None.

**Recommendations**

Relevant literature will be announced in the lecture.

## T

**6.314 Module component: Practical Seminar Digital Service Systems [T-WIWI-106563]**

**Coordinators:** Prof. Dr. Gerhard Satzger  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-102808 - Digital Service Systems in Industry](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 4,5 CP  | graded  | Irregular    | 1       |

| Exams    |         |                                                           |  |        |
|----------|---------|-----------------------------------------------------------|--|--------|
| WT 25/26 | 7900341 | <a href="#">Practical Seminar: Human-Centered Systems</a> |  | Mädche |
| ST 2026  | 7900262 | <a href="#">Practical Seminar: Human-Centered Systems</a> |  | Mädche |

**Assessment**

The assessment is carried out as a single examination of another type that combines three mandatory components:

1. written documentation
2. presentation of the results of the practical components
3. active participation in the discussions

A practical component—e.g. conducting a survey or implementing an application—may also be part of the regular workload and is described in the specific assignment description of the course.

The individual components are integrated into an overall assessment that reflects the overall impression of the combined performance

**Prerequisites**

None

**Recommendations**

None

**Additional Information**

The current range of seminar topics is announced on the KSRI website [www.ksri.kit.edu](http://www.ksri.kit.edu).

**T****6.315 Module component: Practical Seminar: Advanced Analytics [T-WIWI-108765]**

**Coordinators:** Prof. Dr. Christof Weinhardt  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-103118 - Data Science: Data-Driven User Modeling](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 4,5 CP  | graded  | Each term    | 1       |

**Assessment**

The assessment consists of practical work in the field of advanced analytics, a seminar paper, a presentation of the results and the contribution to the discussion (according to §4(2), 3 of the examination regulation). The final grade is based on the evaluation of each component (seminar paper, oral presentation, and active participation).

**Prerequisites**

None

**Recommendations**

At least one module offered by the institute should have been chosen before attending this seminar.

**Additional Information**

The course is held in English. The course is not offered regularly.

## T

**6.316 Module component: Practical Seminar: AI & Data Science [T-WIWI-114892]****Coordinators:** Prof. Dr. Alexander Mädche**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-107530 - Information Systems: AI & Data Science](#)**Type**  
Examination of another type**Credits**  
4,5 CP**Grading**  
graded**Term offered**  
Irregular**Version**  
1

| Courses  |         |                                                               |       |                                                                                               |                   |
|----------|---------|---------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|-------------------|
| WT 25/26 | 2500019 | <a href="#">Practical Seminar: AI &amp; Data Science</a>      | 3 SWS | Lecture /  | Mädche            |
| ST 2026  | 2500027 | <a href="#">Practical Seminar: AI &amp; Data Science</a>      | 3 SWS | Lecture /  | Mädche            |
| ST 2026  | 2500073 | <a href="#">Practical Seminar: AI-based Mental Healthcare</a> | 3 SWS | Lecture /  | Kuhlmeier, Mädche |
| Exams    |         |                                                               |       |                                                                                               |                   |
| WT 25/26 | 7900089 | <a href="#">Practical Seminar: AI &amp; Data Science</a>      |       |                                                                                               | Mädche            |

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

Success is assessed in the form of an alternative exam assessment. Success is assessed by carrying out a practical component, preparing written documentation and actively participating in the discussions. A total of 60 points can be achieved, of which

- a maximum of 25 points for the written documentation
- a maximum of 25 points for the practical component
- a maximum of 10 points for active participation in the discussions

At least 30 points must be achieved to pass the performance review. Please note that a practical component such as conducting a survey or implementing an application is also part of the regular scope of the course in addition to the written documentation. The respective tasks can be found in the announcement on the institute's website <https://h-lab.win.kit.edu>.

**Prerequisites**

None

**Workload**

135 hours

*Below you will find excerpts from courses related to this module component:*

## V

**Practical Seminar: AI-based Mental Healthcare**2500073, SS 2026, 3 SWS, Language: English, [Open in study portal](#)**Lecture (V)**  
**Blended (On-Site/Online)**

### Content

Mental health disorders affect a significant share of the global population. Meeting the resulting demand for care is a challenge on two fronts: patients face long waiting times and limited access to support, while mental health practitioners work under significant time pressure with processes that are often still manual and fragmented. Two developments in AI offer complementary responses: AI-based process digitalization can make clinical and therapeutic workflows more efficient for practitioners, while conversational AI agents can extend therapeutic support directly to those who need it. This seminar engages students with both developments: working on real, ongoing projects at the h-lab and its clinical partners, students design, build, and evaluate prototypes of AI-based applications for mental health and acquire the domain knowledge needed to do so responsibly.

**Three project briefs are available**, each rooted in an active h-lab research project. Students may also propose their own project in the mental health and AI space.

1. **AI-assisted ADHD assessment system** in collaboration with [LWL-Klinikum Marsberg](#), centered on the analysis of primary school reports as a source of retrospective diagnostic evidence. Example tasks include building an OCR and LLM pipeline for extracting and analyzing free-text reports, or evaluating the diagnostic utility of LLM-generated assessments against clinician judgments.
2. **AI-enhanced CBT group therapy platform** in collaboration with [Rethink Wellbeing](#). Example tasks include building a facilitator feedback system that monitors group dynamics and recommends facilitator actions, automating participant or facilitator selection workflows, or evaluating the accuracy and clinical acceptability of AI-generated recommendations.
3. **AI-based Conversational Mental Health Agents**, in collaboration with the [Chair of Clinical Psychology and Psychotherapy at the University of Greifswald](#). The h-lab and its partners developed an LLM-based chatbot that delivers a single-session behavioral activation session for young people with depressive symptoms. Example tasks include improving the behavioral activation module, implementing additional therapeutic modules (cognitive restructuring, sleep hygiene, emotion regulation, social skills) as LLM-based multi-agent systems, or evaluating agent outputs for therapeutic fidelity and safety.

The seminar is structured around **three phases**:

1. **Introductory session:** Introduction to designing and evaluating AI-based mental health and the project briefs.
2. **Working phase:** Students design, develop, and evaluate their prototypes (individually or in groups), with ad hoc support from h-lab assistants.
3. **Final presentation:** Groups present their projects, including a demonstration of their working prototype and a discussion of their evaluation approach and preliminary findings. Participants provide feedback to each other's projects. Technical documentation and a brief evaluation report are due at the end of the semester.

**Learning Objectives:** Upon completion, students will be able to:

- Understand the mental health domain sufficiently to make informed design decisions
- Build functional AI-based application prototypes addressing a concrete need in an active mental health research or practice context
- Design and apply appropriate evaluation strategies for AI-based mental health applications, assessing feasibility, effectiveness, and safety of their prototypes



**T****6.317 Module component: Practical Seminar: Artificial Intelligence in Service Systems [T-WIWI-112152]**

**Coordinators:** Prof. Dr. Gerhard Satzger  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101506 - Service Analytics](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 4,5 CP  | graded  | Irregular    | 1       |

**Assessment**

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 final mark is based on the graded and weighted attainments (such as the written documentation, presentation, practical work and an active participation in class).

**Prerequisites**

None.

**Recommendations**

Knowledge in the field of Artificial Intelligence in Service Systems is assumed. Therefore, it is recommended to attend the course Artificial Intelligence in Service Systems [2595650] beforehand.

**Workload**

135 hours

**T****6.318 Module component: Practical Seminar: Data-Driven Information Systems [T-WIWI-106207]**

**Coordinators:** Prof. Dr. Gerhard Satzger  
Prof. Dr. Christof Weinhardt

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

**Part of:** [M-WIWI-103117 - Data Science: Data-Driven Information Systems](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 4,5 CP  | graded  | Irregular    | 1       |

| Exams    |         |                                                                         |           |
|----------|---------|-------------------------------------------------------------------------|-----------|
| WT 25/26 | 7900291 | <a href="#">Learning How to Prompt - Developing an Adaptive Chatbot</a> | Weinhardt |

**Assessment**

The assessment consists of a seminar paper, a presentation of the results and the contribution to the discussion (according to §4(2), 3 of the examination regulation). The final grade is based on the evaluation of each component (seminar paper, oral presentation, and active participation).

**Prerequisites**

None

**Recommendations**

At least one module offered by the institute should have been chosen before attending this seminar.

**Additional Information**

The course is held in english. The course is not offered regularly.

T

**6.319 Module component: Practical Seminar: Health Care Management (with Case Studies) [T-WIWI-102716]**

**Coordinators:** Prof. Dr. Stefan Nickel  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-102805 - Service Operations](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 4,5 CP  | Graded  | Each term    | 3       |

| Courses  |         |                                                                               |       |                                                                                              |                     |
|----------|---------|-------------------------------------------------------------------------------|-------|----------------------------------------------------------------------------------------------|---------------------|
| WT 25/26 | 2500008 | <a href="#">Practical seminar: Health Care Management</a>                     | 3 SWS | Others /  | Nickel, Mitarbeiter |
| Exams    |         |                                                                               |       |                                                                                              |                     |
| WT 25/26 | 7900105 | <a href="#">Practical Seminar: Health Care Management (with Case Studies)</a> |       |                                                                                              | Nickel              |

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

**Assessment**

The assessment of this module is an examination of another type and consists of the following components:

- a case study to be worked on,
- a seminar paper and
- a final oral examination.

The overall grade results from the weighted evaluation of the case study, the seminar paper and the presentation. The exact weighting of these individual components for the grade will be announced at the beginning of the course.

**Prerequisites**

None.

**Recommendations**

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

**Additional Information**

The lecture is offered every term.

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

**Workload**

135 hours

## T

**6.320 Module component: Practical Seminar: Human-Centered Systems [T-WIWI-113459]****Coordinators:** Prof. Dr. Alexander Mädche**Organisation:** KIT Department of Business and Economics

**Part of:** M-WIWI-102806 - Service Innovation, Design & Engineering  
 M-WIWI-103117 - Data Science: Data-Driven Information Systems  
 M-WIWI-104068 - Information Systems in Organizations  
 M-WIWI-104080 - Designing Interactive Information Systems  
 M-WIWI-107531 - Information Systems: Interactive Systems

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 4,5 CP  | graded  | Each term    | 1       |

| Courses  |         |                                               |       |                                                                                               |                   |
|----------|---------|-----------------------------------------------|-------|-----------------------------------------------------------------------------------------------|-------------------|
| WT 25/26 | 2540554 | Practical Seminar: Human-Centered Systems     | 3 SWS | Lecture /  | Mädche            |
| ST 2026  | 2500073 | Practical Seminar: AI-based Mental Healthcare | 3 SWS | Lecture /  | Kuhlmeier, Mädche |
| ST 2026  | 2540554 | Practical Seminar: Human-Centered Systems     | 3 SWS | Lecture /  | Mädche            |
| Exams    |         |                                               |       |                                                                                               |                   |
| WT 25/26 | 7900341 | Practical Seminar: Human-Centered Systems     |       |                                                                                               | Mädche            |
| ST 2026  | 7900262 | Practical Seminar: Human-Centered Systems     |       |                                                                                               | Mädche            |

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

**Assessment**

The assessment of this course is in the form of a different type of examination. The assessment is carried out by a practical component, preparing written documentation and actively participating in the discussions. A total of 60 points can be achieved, of which:

- a maximum of 25 points for the written documentation
- a maximum of 25 points for the practical component
- a maximum of 10 points for active participation in the discussions

At least 30 points must be achieved to pass the performance assessment. Please note that a practical component such as conducting a survey or implementing an application is also part of the regular scope of the course in addition to the written documentation. The respective tasks can be found in the announcement on the institute's website <https://h-lab.iism.kit.edu>.

Below you will find excerpts from courses related to this module component:

|                                                                                     |                                                                                                                                          |                                         |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|
|  | <b>Practical Seminar: Human-Centered Systems</b><br>2540554, WS 25/26, 3 SWS, Language: English, <a href="#">Open in study portal</a>    | Lecture (V)<br>Blended (On-Site/Online) |
|  | <b>Practical Seminar: AI-based Mental Healthcare</b><br>2500073, SS 2026, 3 SWS, Language: English, <a href="#">Open in study portal</a> | Lecture (V)<br>Blended (On-Site/Online) |

### Content

Mental health disorders affect a significant share of the global population. Meeting the resulting demand for care is a challenge on two fronts: patients face long waiting times and limited access to support, while mental health practitioners work under significant time pressure with processes that are often still manual and fragmented. Two developments in AI offer complementary responses: AI-based process digitalization can make clinical and therapeutic workflows more efficient for practitioners, while conversational AI agents can extend therapeutic support directly to those who need it. This seminar engages students with both developments: working on real, ongoing projects at the h-lab and its clinical partners, students design, build, and evaluate prototypes of AI-based applications for mental health and acquire the domain knowledge needed to do so responsibly.

**Three project briefs are available**, each rooted in an active h-lab research project. Students may also propose their own project in the mental health and AI space.

1. **AI-assisted ADHD assessment system** in collaboration with [LWL-Klinikum Marsberg](#), centered on the analysis of primary school reports as a source of retrospective diagnostic evidence. Example tasks include building an OCR and LLM pipeline for extracting and analyzing free-text reports, or evaluating the diagnostic utility of LLM-generated assessments against clinician judgments.
2. **AI-enhanced CBT group therapy platform** in collaboration with [Rethink Wellbeing](#). Example tasks include building a facilitator feedback system that monitors group dynamics and recommends facilitator actions, automating participant or facilitator selection workflows, or evaluating the accuracy and clinical acceptability of AI-generated recommendations.
3. **AI-based Conversational Mental Health Agents**, in collaboration with the [Chair of Clinical Psychology and Psychotherapy at the University of Greifswald](#). The h-lab and its partners developed an LLM-based chatbot that delivers a single-session behavioral activation session for young people with depressive symptoms. Example tasks include improving the behavioral activation module, implementing additional therapeutic modules (cognitive restructuring, sleep hygiene, emotion regulation, social skills) as LLM-based multi-agent systems, or evaluating agent outputs for therapeutic fidelity and safety.

The seminar is structured around **three phases**:

1. **Introductory session:** Introduction to designing and evaluating AI-based mental health and the project briefs.
2. **Working phase:** Students design, develop, and evaluate their prototypes (individually or in groups), with ad hoc support from h-lab assistants.
3. **Final presentation:** Groups present their projects, including a demonstration of their working prototype and a discussion of their evaluation approach and preliminary findings. Participants provide feedback to each other's projects. Technical documentation and a brief evaluation report are due at the end of the semester.

**Learning Objectives:** Upon completion, students will be able to:

- Understand the mental health domain sufficiently to make informed design decisions
- Build functional AI-based application prototypes addressing a concrete need in an active mental health research or practice context
- Design and apply appropriate evaluation strategies for AI-based mental health applications, assessing feasibility, effectiveness, and safety of their prototypes



### Practical Seminar: Human-Centered Systems

2540554, SS 2026, 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.

Please find the current open offerings on our website: <https://h-lab.iism.kit.edu/thesis.php>

### Prerequisites

Profound skills in software development are required

### Literature

Further literature will be made available in the seminar.

## T

**6.321 Module component: Practical Seminar: Service Innovation [T-WIWI-110887]****Coordinators:** Prof. Dr. Gerhard Satzger**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-101410 - Business & Service Engineering](#)  
[M-WIWI-102806 - Service Innovation, Design & Engineering](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 4,5 CP  | Graded  | Irregular    | 1       |

**Assessment**

Success is assessed through the preparation of written documentation, a presentation of the results of the practical components carried out and active participation in the discussions (in accordance with §4(2), 3 SPO).

Please note that a practical component such as conducting a survey or implementing an application is also part of the regular scope of the course in addition to the written documentation. Please refer to the course description for the respective tasks.

The overall grade is made up of the weighted components (e.g. documentation, oral presentation, practical work and active participation). The weighting of these components for the grade will be announced at the beginning of the course.

**Recommendations**

Knowledge of Service Innovation Methods is assumed. Therefore it is recommended (but not mandatory) to attend the course Service Innovation [2540468] beforehand.

**Additional Information**

Due to the project work, the number of participants is limited and participation requires knowledge about models, concepts and approaches that are taught in the Service Innovation lecture. Having taken the Service Innovation lecture or demonstrating equivalent knowledge is a prerequisite for participating in this Practical Seminar. Details for registration will be announced on the web pages for this course.

The seminar is not offered regularly.

**Workload**

135 hours

## T

**6.322 Module component: Predictive Mechanism and Market Design [T-WIWI-102862]****Coordinators:** Prof. Dr. Johannes Philipp Reiß**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-101453 - Applied Strategic Decisions](#)  
[M-WIWI-101505 - Experimental Economics](#)**Type**  
Written examination**Credits**  
4,5 CP**Grading**  
graded**Term offered**  
Irregular**Version**  
1

| Courses |         |                                                                 |       |                                                                                                |              |
|---------|---------|-----------------------------------------------------------------|-------|------------------------------------------------------------------------------------------------|--------------|
| ST 2026 | 2500014 | <a href="#">Predictive Mechanism and Market Design</a>          | 2 SWS | Lecture /   | Reiß         |
| ST 2026 | 2500037 | <a href="#">Übung zu Predictive Mechanism and Market Design</a> | 1 SWS | Practice /  | Reiß, Peters |

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

The assessment consists of a written exam (60 minutes) (following §4(2), 1 of the examination regulation).

**Prerequisites**

None

**Additional Information**

The retake exam is given in the summer term subsequent to the fall term where the course (lecture and final exam) is given.

## T

**6.323 Module component: Predictive Modeling [T-WIWI-110868]**

**Coordinators:** Prof. Dr. Fabian Krüger  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101638 - Econometrics and Statistics I](#)  
[M-WIWI-101639 - Econometrics and Statistics II](#)

**Type**  
Written examination

**Credits**  
4,5 CP

**Grading**  
graded

**Term offered**  
Irregular

**Version**  
2

| Courses |         |                                                |       |            |                 |
|---------|---------|------------------------------------------------|-------|------------|-----------------|
| ST 2026 | 2521311 | <a href="#">Predictive Modeling</a>            | 2 SWS | Lecture /  | Krüger, Siefert |
| ST 2026 | 2521312 | <a href="#">Predictive Modeling (Tutorial)</a> | 2 SWS | Practice / | Siefert, Krüger |

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

**Assessment**

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

**Workload**

135 hours

Below you will find excerpts from courses related to this module component:

## V

**Predictive Modeling**

2521311, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

**Lecture (V)**  
On-Site

**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**

- Elliott, G., und A. Timmermann (Hrsg.): "Handbook of Economic Forecasting", vol. 2A und 2B, 2013.
- Gneiting, T., und M. Katzfuss: "Probabilistic Forecasting", Annual Review of Statistics and Its Application 1, 125-151, 2014.
- Hastie, T., Tibshirani, R., and J. Friedman: "The Elements of Statistical Learning", 2. Ausgabe, Springer, 2009.
- Weitere Literatur wird in der Vorlesung bekanntgegeben.

## V

**Predictive Modeling (Tutorial)**

2521312, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

**Practice (Ü)**  
On-Site



## T

**6.324 Module component: Price Management [T-WIWI-105946]**

**Coordinators:** Prof. Dr. Andreas Geyer-Schulz  
Dr Paul Glenn

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

**Part of:** [M-WIWI-101409 - Electronic Markets](#)

**Type**  
Written examination

**Credits**  
4,5 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
1

| Courses  |         |                                                          |              |                                                                                                |       |
|----------|---------|----------------------------------------------------------|--------------|------------------------------------------------------------------------------------------------|-------|
| ST 2026  | 2540529 | <a href="#">Price Management</a>                         | 2 SWS        | Lecture /   | Glenn |
| ST 2026  | 2540530 | <a href="#">Exercise Price Management</a>                | 1 SWS        | Practice /  | Glenn |
| Exams    |         |                                                          |              |                                                                                                |       |
| WT 25/26 | 7900170 | <a href="#">Price Management (Nachklausur SoSe 2025)</a> | Geyer-Schulz |                                                                                                |       |
| ST 2026  | 7900139 | <a href="#">Price Management</a>                         | Geyer-Schulz |                                                                                                |       |
| ST 2026  | 7900254 | <a href="#">Price Management (Nachklausur SoSe 2026)</a> | Geyer-Schulz |                                                                                                |       |

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

**Assessment**

Written examination (60 minutes) according to §4(2), 1 SPO. The exam is considered passed if at least 50 out of a maximum of 100 possible points are achieved. The grades are graded in five steps (best grade 1.0 from 95 points). Details of the grade formation and scale will be announced in the course.

A bonus can be acquired through successful participation in the practice. If the grade of the written examination is between 4.0 and 1.3, the bonus improves the grade by one grade level (0.3 or 0.4). The exact criteria for awarding a bonus will be announced at the beginning of the course.

**Please note: this exam will no longer be offered after August 2026.**

**Prerequisites**

None

**Recommendations**

None

**Additional Information**

Please note: this course, exercises and exam will no longer be offered after August 2026.

Below you will find excerpts from courses related to this module component:

## V

**Price Management**

2540529, SS 2026, 2 SWS, Language: German, [Open in study portal](#)

**Lecture (V)**  
On-Site

**Literature**

- H. Simon and M. Fassnacht, *Preismanagement*, vol. 4. Wiesbaden: Springer Gabler, 2016.
- T. T. Nagle, J. E. Hogan, und J. Zalee, *The Strategy and Tactics of Pricing: A guide to growing more profitably*. New Jersey: Prentice Hall, 2010.

## T

**6.325 Module component: Pricing [T-WIWI-102883]**

**Coordinators:** Prof. Dr. Martin Klarmann  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-105312 - Marketing and Sales Management](#)

**Type**  
Examination of another type

**Credits**  
4,5 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
3

| Courses  |         |                         |          |                                                                                             |                          |
|----------|---------|-------------------------|----------|---------------------------------------------------------------------------------------------|--------------------------|
| WT 25/26 | 2572199 | <a href="#">Pricing</a> | 3 SWS    | Block /  | Klarmann, Bill, Schröder |
| Exams    |         |                         |          |                                                                                             |                          |
| WT 25/26 | 7900343 | <a href="#">Pricing</a> | Klarmann |                                                                                             |                          |

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

**Assessment**

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.

**Recommendations**

Students are highly encouraged to actively participate in class.

**Additional Information**

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](http://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 courses related to this module component:*

## V

**Pricing**

2572199, WS 25/26, 3 SWS, Language: English, [Open in study portal](#)

**Block (B)**  
**On-Site**

**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.

T

## 6.326 Module component: Probabilistic Time Series Forecasting Challenge [T-WIWI-111387]

**Coordinators:** Prof. Dr. Fabian Krüger  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101638 - Econometrics and Statistics I](#)  
[M-WIWI-101639 - Econometrics and Statistics II](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 4,5 CP  | graded  | Irregular    | 2       |

### Assessment

Alternative exam assessment. Necessary conditions to pass the course:

- Weekly submission of statistical forecasts during the semester (excluding the Christmas break),
- Presentation (ca. 20 minutes) during the semester,
- Submission of a final report (5-10 pages) around the end of the semester.

Grading is based on the presentation (30%) and the final report (70%).

### 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.

### Additional Information

The course is limited in participation. Participants will be selected via the WIWI portal.

### Workload

135 hours

## T

**6.327 Module component: Probability and Computing [T-INFO-114196]**

**Coordinators:** TT-Prof. Dr. Thomas Bläsius  
Dr. Maximilian Katzmann  
Prof. Dr. Peter Sanders

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-107168 - Probability and Computing](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 5 CP    | Graded  | Each winter term | 1       |

| Courses  |         |                                           |       |                                                                                                         |                          |
|----------|---------|-------------------------------------------|-------|---------------------------------------------------------------------------------------------------------|--------------------------|
| WT 25/26 | 2400153 | <a href="#">Probability and Computing</a> | 3 SWS | Lecture / Practice /  | Sanders, Walzer, Hermann |
| Exams    |         |                                           |       |                                                                                                         |                          |
| WT 25/26 | 7500376 | <a href="#">Probability and Computing</a> |       |                                                                                                         | Bläsius, Sanders         |

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

**Assessment**

The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting 20 minutes.

**Prerequisites**

None.

**Recommendations**

Basic knowledge of algorithms and data structures (e.g. from the lectures Algorithms 1 + 2) as well as basic knowledge of probability theory (e.g. from the lecture Introduction to Stochastics) are helpful.

*Below you will find excerpts from courses related to this module component:*

## V

**Probability and Computing**

2400153, WS 25/26, 3 SWS, Language: English, [Open in study portal](#)

Lecture / Practice (VÜ)  
On-Site

**Content**

Randomized algorithms and data structures rely on random experiments. While the design of deterministic algorithms is often driven by a pessimistic view of worst-case behavior, randomized algorithms employ approaches that occasionally fail but perform much better most of the time.

The running time of such algorithms, as well as the solution quality (in the case of optimization problems) and sometimes correctness (in the case of computation problems), are subject to randomness. Therefore, a formal analysis focuses on expected values and success probabilities. We will explore both classical examples and current research topics in the areas of hashing and graph theory. Specialised design methods (such as probability amplification) and advanced analysis tools from probability theory (such as coupling, Poissonization, and concentration bounds) will be applied. We will often see that randomized approaches are more efficient or simpler than all (or at least all known) deterministic approaches.

We will briefly address, on the theory side, how randomized complexity classes relate to well-known classes such as P and NP and, on the practical side, how to implement randomized algorithms on common (essentially deterministic) computers using pseudo-randomness.

**Competence Goals:**

Students will be able to:

- understand when and why randomization is useful or necessary to solve an algorithmic problem,
- explain central design methods and analysis tools in the context of randomized algorithms,
- design and explain simple randomized algorithms and data structures to solve a given problem,
- determine which tools are suitable for analyzing a given randomized algorithm or data structure, and apply them.

## T

**6.328 Module component: Production and Logistics Management [T-WIWI-102632]**

**Coordinators:** Prof. Dr. Frank Schultmann  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101412 - Industrial Production III](#)

| Type                | Credits | Grading | Term offered     | Version |
|---------------------|---------|---------|------------------|---------|
| Written examination | 5,5 CP  | Graded  | Each summer term | 1       |

| Courses  |         |                                                     |       |                                                                                                |                       |
|----------|---------|-----------------------------------------------------|-------|------------------------------------------------------------------------------------------------|-----------------------|
| ST 2026  | 2581954 | <a href="#">Production and Logistics Management</a> | 2 SWS | Lecture /   | Schultmann, Rosenberg |
| ST 2026  | 2581955 | <a href="#">Production and Logistics Management</a> | 2 SWS | Practice /  | Schultmann            |
| Exams    |         |                                                     |       |                                                                                                |                       |
| WT 25/26 | 7981954 | <a href="#">Production and Logistics Management</a> |       |                                                                                                | Schultmann            |
| ST 2026  | 7981954 | <a href="#">Production and Logistics Management</a> |       |                                                                                                | Schultmann            |

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

**Assessment**

The assessment consists of a written exam (90 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

**Recommendations**

None

*Below you will find excerpts from courses related to this module component:*

## V

**Production and Logistics Management**

2581954, SS 2026, 2 SWS, Language: German, [Open in study portal](#)

**Lecture (V)**  
On-Site

**Content**

This course covers central tasks and challenges of operative production and logistics management. Students get to know the set-up and mode of planning systems such as production planning and control systems, enterprise resource planning systems and advanced planning systems to cope with the accompanying planning tasks in supply chain management. Methods to solve these tasks from the field of operational research will be explored with respect to manufacturing program planning, material requirement planning, lot size problems and scheduling. Alongside to MRP II (Manufacturing Resources Planning), students will be introduced to integrated supply chain management approaches. Finally, commercially available planning systems will be presented and discussed.

**Literature**

Wird in der Veranstaltung bekannt gegeben.

**T****6.329 Module component: Project Lab Cognitive Automobiles and Robots [T-WIWI-109985]**

**Coordinators:** Prof. Dr.-Ing. Johann Marius Zöllner  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-103356 - Machine Learning](#)  
[M-WIWI-106491 - Project Lab Applied Machine Learning](#)

**Type**  
Examination of another type

**Credits**  
5 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
3

| Courses  |         |                                                                            |       |                                                                                                        |                    |
|----------|---------|----------------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------|--------------------|
| WT 25/26 | 2512501 | <a href="#">Practical Course Cognitive automobiles and robots (Master)</a> | 3 SWS | Practical course /  | Zöllner, Schneider |
| Exams    |         |                                                                            |       |                                                                                                        |                    |
| WT 25/26 | 7900107 | <a href="#">Advanced Lab Cognitive Automobile and Robots (Master)</a>      |       |                                                                                                        | Zöllner            |

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

**Assessment**

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

**Workload**

150 hours

Below you will find excerpts from courses related to this module component:

**V****Practical Course Cognitive automobiles and robots (Master)**

2512501, WS 25/26, 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.



**6.330 Module component: Project Lab Machine Learning [T-WIWI-109983]**

**Coordinators:** Prof. Dr.-Ing. Johann Marius Zöllner  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-103356 - Machine Learning](#)  
[M-WIWI-106491 - Project Lab Applied Machine Learning](#)

**Type**  
Examination of another type

**Credits**  
5 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
3

| Courses |         |                                              |         |                    |                    |
|---------|---------|----------------------------------------------|---------|--------------------|--------------------|
| ST 2026 | 2512500 | <a href="#">Project Lab Machine Learning</a> | 3 SWS   | Practical course / | Zöllner, Schneider |
| Exams   |         |                                              |         |                    |                    |
| ST 2026 | 7900086 | <a href="#">Project Lab Machine Learning</a> | Zöllner |                    |                    |

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

**Assessment**

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

**Workload**

150 hours

Below you will find excerpts from courses related to this module component:

**Project Lab Machine Learning**

2512500, SS 2026, 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 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.

## T

**6.331 Module component: Project Lab: Image Analysis and Fusion [T-INFO-104746]**

**Coordinators:** Prof. Dr.-Ing. Jürgen Beyerer  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-102383 - Project Lab: Image Analysis and Fusion](#)

**Type**  
Examination of another type

**Credits**  
6 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
1

| Courses  |         |                                                        |       |                  |         |
|----------|---------|--------------------------------------------------------|-------|------------------|---------|
| WT 25/26 | 2424299 | <a href="#">Project Lab: Image Analysis and Fusion</a> | 4 SWS | Practical course | Beyerer |
| Exams    |         |                                                        |       |                  |         |
| WT 25/26 | 7500101 | <a href="#">Project Lab: Image Analysis and Fusion</a> |       |                  | Beyerer |

Below you will find excerpts from courses related to this module component:

## V

**Project Lab: Image Analysis and Fusion**

2424299, WS 25/26, 4 SWS, [Open in study portal](#)

**Practical course (P)**

**Organizational issues**

Die Erfolgskontrolle erfolgt durch Bewertung der Projektdokumentation sowie der Präsentation der Projektergebnisse als Erfolgskontrolle anderer Art nach § 4 Abs. 2 Nr. 3 der SPO.

Die Note setzt sich zusammen aus der Note der schriftlichen Ausarbeitung und den Präsentationen.

Das Projektpraktikum Bildauswertung und-fusion findet im Fraunhofer IOSB, Fraunhoferstr. 1, 76131 KA statt.

Treffpunkt ist im Foyer.

Die 4 offiziellen Pflichttermine sowie der Termin für die Abschlusspräsentation werden noch bekanntgegeben.

Der Anmeldezeitraum steht noch nicht fest, voraussichtlich November-Dezember 2023.

Weitere Infos folgen.

**Literature****Empfehlungen:**

Hilfreich sind:

- Kenntnisse der Grundlagen der Stochastik und Signal- und Bildverarbeitung
- Kenntnisse der Vorlesungen Einführung in die Informationsfusion [IN4INEIF], Automatische Sichtprüfung und Bildverarbeitung [IN4INASB], Mustererkennung [IN4INME], Probabilistische Planung.

## T

**6.332 Module component: Project Management [T-WIWI-103134]**

**Coordinators:** Prof. Dr. Frank Schultmann  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101412 - Industrial Production III](#)  
[M-WIWI-101471 - Industrial Production II](#)

| Type                | Credits | Grading | Term offered     | Version |
|---------------------|---------|---------|------------------|---------|
| Written examination | 3,5 CP  | Graded  | Each winter term | 1       |

| Courses  |         |                                    |       |                                                                                               |            |
|----------|---------|------------------------------------|-------|-----------------------------------------------------------------------------------------------|------------|
| WT 25/26 | 2581963 | <a href="#">Project Management</a> | 2 SWS | Lecture /  | Schultmann |
| Exams    |         |                                    |       |                                                                                               |            |
| WT 25/26 | 7981963 | <a href="#">Project Management</a> |       |                                                                                               | Schultmann |
| ST 2026  | 7981963 | <a href="#">Project Management</a> |       |                                                                                               | Schultmann |

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

**Assessment**

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.

**Prerequisites**

None

**Recommendations**

None

Below you will find excerpts from courses related to this module component:

## V

**Project Management**

2581963, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
On-Site

**Content**

1. Introduction
2. Principles of Project Management
3. Project Scope Management
4. Time Management and Resource Scheduling
5. Cost Management
6. Quality Management
7. Risk Management
8. Stakeholder
9. Communication, Negotiation and Leadership
10. Project Controlling
11. Agile Project Management

**Literature**

Wird in der Veranstaltung bekannt gegeben.

## T

**6.333 Module component: Public International Law [T-INFO-113381]**

**Coordinators:** TT-Prof. Dr. Frederike Zufall  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-106754 - Public Economic and Technology Law](#)

| Type                | Credits | Grading | Term offered     | Version |
|---------------------|---------|---------|------------------|---------|
| Written examination | 3 CP    | Graded  | Each summer term | 2       |

| Courses  |         |                                                                     |       |                                                                                               |                  |
|----------|---------|---------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|------------------|
| ST 2026  | 2400172 | <a href="#">Public International Law with an Economic Law Focus</a> | 2 SWS | Lecture /  | Kasper-Schöniger |
| Exams    |         |                                                                     |       |                                                                                               |                  |
| WT 25/26 | 7500066 | <a href="#">Public International Law</a>                            |       |                                                                                               | Zufall           |
| ST 2026  | 7500182 | <a href="#">Public International Law with an Economic Law Focus</a> |       |                                                                                               | Zufall           |

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

**Assessment**

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 60 minutes.

Depending on the number of participants, it will be announced six weeks before the examination (§ 6 (3) SPO) whether the performance assessment is carried out

- as an oral examination (duration approx. 20 mins.) (§ 4 Abs. 2 Nr. 2 SPO) or
- as a written examination (lasting 60 mins.) (§ 4 Abs. 2 No. 1 SPO).

**Prerequisites**

None.

**Recommendations**

- General knowledge of (public) law (eg, through participating in public law or EU law modules) is helpful but not necessary.
- Interest in international affairs and politics is welcomed.

**Additional Information**

Competency Goals:

- Participating students will be able to navigate the plethora of multilateral treaties to detect relevant international law for specific cases.
- They can develop solutions for legal problems based on case law of international courts and tribunals.
- Students will be able to read and comprehend international treaties and case law.
- They will have a fundamental understand of the interplay between various subfields of public international law.
- Students can identify and explain current issues in public international law.

Content:

The lecture is designed to provide participating students with a general understanding of the foundations, subjects, and sources of public international law, its interplay with national legal regimes, and more detailed knowledge of particular subfields of public international law.

Since the lecture targets students of information systems, particular focus will be given to economic topics in international law, such as investment and trade law aspects. Due to the general importance of climate change for today's (economic) law, international climate change law and environmental law will form further focus areas.

In addition, a concise overview on human rights law, the law on State responsibility, and the peaceful settlement of disputes will be provided.

Throughout the lecture, important case law will be referenced and students are expected to read relevant cases in part to facilitate a discussion of such cases and their relevance for a subject field. Although the United Nations, including its principal judicial organ, the International Court of Justice, is one of the, if not the, key international organization in public international law, further international organizations (eg, Council of Europe, World Trade Organization) and their respective law(s) will also be touched.

Students are advised to have a statute book at hand that includes the most important international treaties and conventions (eg, Evans, Blackstone's International Law Documents, currently 15th ed 2021).

Conducting the lecture in English intends to facilitate students to link their ideas and arguments to current debates in international law.

Below you will find excerpts from courses related to this module component:



### Public International Law with an Economic Law Focus

2400172, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
On-Site

#### Content

The lecture is designed to provide participating students with a general understanding of the foundations, subjects, and sources of public international law with an economic law focus, its interplay with national legal regimes, and more detailed knowledge of particular subfields of public international law.

Since the lecture targets students of information systems, particular focus will be given to economic topics in international law, such as investment and trade law aspects. Due to the general importance of climate change for today's (economic) law, international climate change law and environmental law will form further focus areas.

In addition, a concise overview on human rights law, the law on State responsibility, and the peaceful settlement of disputes will be provided.

Throughout the lecture, important case law will be referenced and students are expected to read relevant cases in part to facilitate a discussion of such cases and their relevance for a subject field. Although the United Nations, including its principal judicial organ, the International Court of Justice, is one of the, if not the, key international organization in public international law, further international organizations (eg, Council of Europe, World Trade Organization) and their respective law(s) will also be touched.

Students are advised to have a statute book at hand that includes the most important international treaties and conventions (eg, Evans, Blackstone's International Law Documents, currently 15th ed 2021).

Conducting the lecture in English intends to facilitate students to link their ideas and arguments to current debates in international law.

#### Organizational issues

Lecture Dates:

- Friday, 26th June 2026, 9 - 17 h
- Saturday, 27th June 2026, 9-17 h
- Saturday, 25th July 2026, 9-17 h

The room will be announced in good time in the Campus System (as per 5th January 2026).

Lageplan:

<https://www.kit.edu/campusplan/>

## T

**6.334 Module component: Public Management [T-WIWI-102740]****Coordinators:** Prof. Dr. Berthold Wigger**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-101504 - Collective Decision Making](#)  
[M-WIWI-101511 - Advanced Topics in Public Finance](#)**Type**  
Written examination**Credits**  
4,5 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
1

| Courses  |         |                                   |       |                                                                                                         |        |
|----------|---------|-----------------------------------|-------|---------------------------------------------------------------------------------------------------------|--------|
| WT 25/26 | 2561127 | <a href="#">Public Management</a> | 3 SWS | Lecture / Practice /  | Wigger |
| Exams    |         |                                   |       |                                                                                                         |        |
| WT 25/26 | 790puma | <a href="#">Public Management</a> |       |                                                                                                         | Wigger |
| ST 2026  | 790puma | <a href="#">Public Management</a> |       |                                                                                                         | Wigger |

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

Success is assessed in the form of a written examination (90 minutes). The examination is offered every semester and can be repeated at any regular examination date.

**Prerequisites**

None

**Recommendations**

Basic knowledge of Public Finance is required.

Below you will find excerpts from courses related to this module component:

## V

**Public Management**2561127, WS 25/26, 3 SWS, Language: German, [Open in study portal](#)Lecture / Practice (VÜ)  
Blended (On-Site/Online)**Literature****Weiterführende Literatur:**

- Damkowski, W. und C. Precht (1995): Public Management; Kohlhammer
- Richter, R. und E.G. Furubotn (2003): Neue Institutionenökonomik; 3. Auflage, Mohr
- Schedler, K. und I. Proeller (2003): New Public Management; 2. Auflage; UTB
- Mueller, D.C. (2009): Public Choice III; Cambridge University Press
- Wigger, B.U. (2006): Grundzüge der Finanzwissenschaft; 2. Auflage; Springer

## T

**6.335 Module component: Public Revenues [T-WIWI-102739]**

**Coordinators:** Prof. Dr. Berthold Wigger  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101511 - Advanced Topics in Public Finance](#)

**Type**  
Written examination

**Credits**  
4,5 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
1

| Courses  |         |                                                |       |            |                   |
|----------|---------|------------------------------------------------|-------|------------|-------------------|
| ST 2026  | 2560120 | <a href="#">Public Revenues</a>                | 2 SWS | Lecture /  | Wigger            |
| ST 2026  | 2560121 | <a href="#">Übung zu Öffentliche Einnahmen</a> | 1 SWS | Practice / | Wigger, Schmelzer |
| Exams    |         |                                                |       |            |                   |
| WT 25/26 | 790oeff | <a href="#">Public Revenues</a>                |       |            | Wigger            |
| ST 2026  | 790oeff | <a href="#">Public Revenues</a>                |       |            | Wigger            |

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

**Assessment**

Success is assessed in the form of a written examination (60 minutes). The examination is offered every semester and can be repeated at any regular examination date.

**Prerequisites**

None

**Recommendations**

Basic knowledge of Public Finance is required.

Below you will find excerpts from courses related to this module component:

## V

**Public Revenues**

2560120, SS 2026, 2 SWS, Language: German, [Open in study portal](#)

**Lecture (V)**  
On-Site

**Content**

The *Public Revenues* lecture is concerned with the theory and policy of taxation and public dept. In the first chapter, fundamental concepts of taxation theory are introduced, whereas the second chapter deals with key elements of the German taxation system. The allocative and distributive effects of different taxation types are examined in chapter three and four. Chapter five integrates both allocative and distributive components in order to derive a theory of optimal taxation. The core of the sixth chapter is represented by international aspects of taxation. The debt part begins with a description of the extent and structure of public dept in chapter seven. In the following chapter, macroeconomic theories of national dept are evolved, while chapter nine is concerned with its long term consequences when employed as a regular instrument of budgeting. Finally, the tenth chapter deals with constitutional limits to public debt-incurring.

**Learning goals:**

See German version.

**Workload:**

The total workload for this course is approximately 135.0 hours. For further information see German version.

**Literature****Literatur:**

- Homburg, S.(2000): *Allgemeine Steuerlehre*, Vahlen
- Rosen, H.S.(1995): *Public Finance*; 4. Aufl., Irwin
- Wellisch, D.(2000): *Finanzwissenschaft I und Finanzwissenschaft III*, Vahlen
- Wigger, B. U.(2006): *Grundzüge der Finanzwissenschaft*; 2. Aufl., Springer



**T****6.336 Module component: Python for Computational Risk and Asset Management [T-WIWI-110213]**

**Coordinators:** Prof. Dr. Maxim Ulrich  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-105032 - Data Science for Finance](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 4,5 CP  | graded  | Each winter term | 3       |

**Assessment**

The examination takes the form of an alternative exam assessment.

The alternative exam assessment consists of a Python-based "Takehome Exam". At the end of the third week of January, the student is given a "Takehome Exam" which he processes and sends back independently within 4 hours using Python. Precise instructions will be announced at the beginning of the course. The alternative exam assessment can be repeated a maximum of once. A timely repeat option takes place at the end of the third week in March of the same year. More detailed instructions will be given at the beginning of the course.

**Prerequisites**

None.

**Recommendations**

Good knowledge of statistics and basic programming skills

**Workload**

135 hours

## T

**6.337 Module component: Quantitative Methods in Energy Economics [T-WIWI-107446]****Coordinators:** Patrick Plötz**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-101451 - Energy Economics and Energy Markets](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 3,5 CP  | Graded  | Each winter term | 3       |

| Courses  |         |                                                                     |       |                                                                                                |               |
|----------|---------|---------------------------------------------------------------------|-------|------------------------------------------------------------------------------------------------|---------------|
| WT 25/26 | 2581007 | <a href="#">Quantitative Methods in Energy Economics</a>            | 2 SWS | Lecture /   | Plötz         |
| WT 25/26 | 2581008 | <a href="#">Übungen zu Quantitative Methods in Energy Economics</a> | 1 SWS | Practice /  | Plötz, Britto |
| Exams    |         |                                                                     |       |                                                                                                |               |
| WT 25/26 | 7981007 | <a href="#">Quantitative Methods in Energy Economics</a>            |       |                                                                                                | Fichtner      |
| ST 2026  | 7981007 | <a href="#">Quantitative Methods in Energy Economics</a>            |       |                                                                                                | Fichtner      |

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

The assessment consists of an oral (app. 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.

**Prerequisites**

None

**Recommendations**

None

Below you will find excerpts from courses related to this module component:

## V

**Quantitative Methods in Energy Economics**2581007, WS 25/26, 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.

## T

**6.338 Module component: Recommender Systems [T-WIWI-102847]****Coordinators:** Prof. Dr. Andreas Geyer-Schulz**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-101410 - Business & Service Engineering](#)  
[M-WIWI-105661 - Data Science: Intelligent, Adaptive, and Learning Information Services](#)**Type**  
Written examination**Credits**  
4,5 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
1

| Courses  |         |                                                    |              |                                                                                                |                      |
|----------|---------|----------------------------------------------------|--------------|------------------------------------------------------------------------------------------------|----------------------|
| WT 25/26 | 2540506 | <a href="#">Recommender Systems</a>                | 2 SWS        | Lecture /   | Geyer-Schulz         |
| WT 25/26 | 2540507 | <a href="#">Exercise Recommender Systems</a>       | 1 SWS        | Practice /  | Geyer-Schulz, Nazemi |
| Exams    |         |                                                    |              |                                                                                                |                      |
| WT 25/26 | 7900310 | <a href="#">Recommender Systems (WS 2025/2026)</a> | Geyer-Schulz |                                                                                                |                      |
| ST 2026  | 7900138 | <a href="#">Recommender Systems</a>                | Geyer-Schulz |                                                                                                |                      |

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

Written examination (60 minutes) according to §4(2), 1 SPO. The exam is considered passed if at least 50 out of a maximum of 100 possible points are achieved. The grades are graded in five steps (best grade 1.0 from 95 points). Details of the grade formation and scale will be announced in the course. A bonus can be acquired through successful participation in the practice. If the grade of the written examination is between 4.0 and 1.3, the bonus improves the grade by one grade level (0.3 or 0.4). The exact criteria for awarding a bonus will be announced at the beginning of the course.

**Attention: Exams will not be offered after August 2026.****Prerequisites**

None

**Recommendations**

None

*Below you will find excerpts from courses related to this module component:*

## V

**Recommender Systems**2540506, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)**Lecture (V)**  
On-Site

**Content**

At first, an overview of general aspects and concepts of recommender systems and its relevance for service providers and customers is given. Next, different categories of recommender systems are discussed. This includes explicit recommendations like customer reviews as well as implicit services based on behavioral data. Furthermore, the course gives a detailed view of the current research on recommender systems at the Chair of Information Services and Electronic Markets.

**Learning objectives:**

The student

- is proficient in different statistical, data-mining, and game theory methods of computing implicit and explicit recommendations
- evaluates recommender systems and compares these with related services

**Workload:**

The total workload for this course is approximately 135 hours (4.5 credits):

Time of attendance

- Attending the lecture: 15 x 90min = 22h 30m
- Attending the exercise classes: 7 x 90min = 10h 30m
- Examination: 1h 00m

Self-study

- Preparation and wrap-up of the lecture: 15 x 180min = 45h 00m
- Preparing the exercises: 25h 00m
- Preparation of the examination: 31h 00m

**Sum: 135h 00m**

**Exam:**

Assessment consists of a written exam of 1 hour length following §4 (2), 1 of the examination regulation and by submitting written papers as part of the exercise following §4 (2), 3 of the examination regulation.

The course is considered successfully taken, if at least 50 out of 100 points are acquired in the written exam. In this case, all additional points (up to 10) from exercise work will be added.

**Grade: Minimum points**

- 1,0: 95
- 1,3: 90
- 1,7: 85
- 2,0: 80
- 2,3: 75
- 2,7: 70
- 3,0: 65
- 3,3: 60
- 3,7: 55
- 4,0: 50
- 5,0: 0

**Organizational issues**

Geb. 10.11, Raum 223

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## T

**6.339 Module component: Regulation Theory and Practice [T-WIWI-102712]****Coordinators:** Prof. Dr. Kay Mitusch**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-101406 - Network Economics](#)  
[M-WIWI-101451 - Energy Economics and Energy Markets](#)

| Type             | Credits | Grading | Term offered    | Version |
|------------------|---------|---------|-----------------|---------|
| Oral examination | 4,5 CP  | graded  | see Annotations | 2       |

**Assessment**

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

**Recommendations**

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.

**Additional Information**

The lecture is not offered for an indefinite period of time.

## T

**6.340 Module component: Reinforcement Learning [T-INFO-111255]**

**Coordinators:** TT-Prof. Dr. Rudolf Lioutikov  
Prof. Dr. Gerhard Neumann

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-105623 - Reinforcement Learning](#)

| Type                | Credits | Grading | Term offered     | Version |
|---------------------|---------|---------|------------------|---------|
| Written examination | 6 CP    | Graded  | Each winter term | 2       |

| Courses  |         |                                        |  |                                                                                                         |                    |
|----------|---------|----------------------------------------|--|---------------------------------------------------------------------------------------------------------|--------------------|
| WT 25/26 | 2400163 | <a href="#">Reinforcement Learning</a> |  | Lecture / Practice /  | Neumann, Lioutikov |
| Exams    |         |                                        |  |                                                                                                         |                    |
| WT 25/26 | 7500293 | <a href="#">Reinforcement Learning</a> |  |                                                                                                         | Neumann, Lioutikov |
| ST 2026  | 7500221 | <a href="#">Reinforcement Learning</a> |  |                                                                                                         | Neumann, Lioutikov |

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

**Assessment**

The success control takes place in the form of a written exam, usually 90 minutes in length, according to § 4 Abs. 2 Nr. 1 SPO.

A bonus can be acquired through successful participation in the exercise as a success control of a different kind (§4(2), 3 SPO 2008) or study performance (§4(3) SPO 2015). The exact criteria for awarding a bonus will be announced at the beginning of the lecture. 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). The bonus is only valid for the main and post exams of the semester in which it was earned. After that, the grade bonus expires.

**Prerequisites**

None.

**Recommendations**

- It is recommended that students are familiar with the content of the "Foundations of Artificial Intelligence" lecture.
- Good Python knowledge is recommended.
- Good mathematical background knowledge is recommended.

Below you will find excerpts from courses related to this module component:

## V

**Reinforcement Learning**

2400163, WS 25/26, SWS, Language: English, [Open in study portal](#)

Lecture / Practice (VÜ)  
On-Site



**Content**

Reinforcement Learning (RL) is a sub-field of machine learning in which an artificial agent has to interact with its environment and learn how to improve its behaviour by trial and error. For doing so, the agent is provided with an evaluative feedback signal, called reward, that he perceives for each action performed in its environment. RL is one of the hardest machine learning problems, as, in contrast to standard supervised learning, we do not know the targets (i.e. the optimal actions) for our inputs (i.e. the state of the environment) and we also need to consider the long-term effects of the agent's actions on the state of the environment. Due to recent successes, RL has gained a lot of popularity with applications in robotics, automation, health care, trading and finance, natural language processing, autonomous driving and computer games. This lecture will introduce the concepts and theory of RL and review current state of the art methods with a particular focus on RL applications in robotics. An exemplary list of topics is given below:

- Primer in Machine Learning and Deep Learning
- Supervised Learning of Behaviour
- Introduction in Reinforcement Learning
- Dynamic Programming
- Value Based Methods
- Policy Optimization and Trust Regions
- Episodic Reinforcement Learning and Skill Learning
- Bayesian Optimization
- Variational Inference, Max-Entropy RL and Versatility
- Model-based Reinforcement Learning
- Offline Reinforcement Learning
- Inverse Reinforcement Learning
- Hierarchical Reinforcement Learning
- Exploration and Artificial Curiosity
- Meta Reinforcement Learning

**Lernziele:**

- Students are able to understand the RL problem and challenges.
- Students can differentiate between different RL algorithm and understand their underlying theory
- Students will know the mathematical tools necessary to understand RL algorithms
- Students can implement RL algorithms for various tasks
- Students understand current research questions in RL

**Empfehlungen:**

- Der Vorlesungsinhalt von Maschinelles Lernen – Grundverfahren wird vorausgesetzt
- Gute Python Kenntnisse erforderlich
- Gute mathematische Grundkenntnisse

Erfolgskontrolle: Siehe Modulhandbuch!

Arbeitsaufwand:

180h, aufgeteilt in:

- ca 45h Vorlesungsbesuch
- ca 15h Übungsbesuch
- ca 90h Nachbearbeitung und Bearbeitung der Übungsblätter

ca 30h Prüfungsvorbereitung

**Organizational issues**

**6 ECTS**

Vorlesungs-und Übungsturnus: Siehe ILIAS

## T

**6.341 Module component: Reliable Computing I [T-INFO-101387]**

**Coordinators:** Prof. Dr. Mehdi Baradaran Tahoori  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-100850 - Reliable Computing I](#)

| Type             | Credits | Grading | Term offered | Version |
|------------------|---------|---------|--------------|---------|
| Oral examination | 3 CP    | graded  | Irregular    | 1       |

| Exams    |         |                                      |         |  |
|----------|---------|--------------------------------------|---------|--|
| WT 25/26 | 7500167 | <a href="#">Reliable Computing I</a> | Tahoori |  |

**Assessment**

The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting 20 minutes.

**Prerequisites**

None.

**Recommendations**

Knowledge of Digital Design and Computer Architecture is helpful.

**T****6.342 Module component: Research Focus Class: Blockchain & Cryptocurrencies [T-INFO-113400]****Coordinators:** Prof. Dr. Hannes Hartenstein**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106654 - Research Focus Class: Blockchain & Cryptocurrencies](#)

| Type       | Credits | Grading   | Term offered | Version |
|------------|---------|-----------|--------------|---------|
| Coursework | 3 CP    | pass/fail | Irregular    | 1       |

| Courses |         |                                                                                 |       |                                                                                               |                                     |
|---------|---------|---------------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|-------------------------------------|
| ST 2026 | 2400184 | <a href="#">Research Focus Class: Blockchain &amp; Cryptocurrencies Seminar</a> | 2 SWS | Seminar /  | Hartenstein, Spiesberger, Grundmann |
| ST 2026 | 2400185 | <a href="#">Research Focus Class: Blockchain &amp; Cryptocurrencies</a>         | 1 SWS | Lecture /  | Hartenstein, Spiesberger, Grundmann |

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

The assessment is carried out in form of course work (German Studienleistung, § 4 Abs. 3 SPO). A presentation must be given.

**Prerequisites**

None.

Below you will find excerpts from courses related to this module component:

**V****Research Focus Class: Blockchain & Cryptocurrencies**2400185, SS 2026, 1 SWS, Language: English, [Open in study portal](#)**Lecture (V)  
On-Site**

**Content****Content:**

Blockchains such as Ethereum are decentralized systems that are currently receiving a lot of attention both in practice and in research. These systems can not only be used to carry out payment transactions in a decentralized manner, but also to programmatically record and enforce processes between mutually distrustful parties in so-called smart contracts. In particular, security and fairness properties as well as scalability in terms of transaction throughput play a key role.

This course begins with a lecture in which the basics of blockchains and Ethereum in particular are taught and current problems are introduced. After an introduction to the structure and functionality of Ethereum, advanced aspects that are necessary to address current research questions will be covered. The basics of scientific methodology in dealing with decentralized systems are also covered. The basic knowledge imparted in the lecture will be applied and consolidated in the seminar - the second part of the course - through the students' own research work.

The seminar offers the opportunity to work on a self-chosen topic in the field of blockchains and cryptocurrencies, which is facilitated by the previous lecture and direct consultation. The students' task is to find and process literature on the chosen topic and to work on the chosen topic. The results are documented in a paper according to scientific standards and presented in a colloquium.

**Competency Goals:**

- Students are familiar with current issues in the field of blockchain and cryptocurrencies and can identify specific research questions.
- Students have the necessary basic knowledge to identify, discuss and scientifically address current issues in the subject area.
- Students are able to independently develop a research topic and find and process related literature.
- Students are familiar with research methods in the field of decentralized systems and have gained initial experience in a specific research topic.
- Students can write a paper according to scientific standards.
- Students can present and discuss a research topic in a colloquium.

**Workload:**

6 ECTS = 180 hours

- Lecture attendance and discussion (20 hours)
- Lecture preparation and follow-up (20 hours)
- Literature research (20 hours)
- Implementation of self-chosen project (60 hours)
  - Writing a scientific report (60 hours)

**Credit points:**

6 = 3 + 3 ECTS

**Competency certificate:**

Lecture:

Success is assessed in the form of coursework in accordance with Section 4 Paragraph 3 SPO. A presentation must be given.

Seminar:

Success is assessed in the form of an examination of a different type in accordance with Section 4 Paragraph 2 Number 3 SPO. A written paper must be prepared and a presentation given. Withdrawal is possible within two weeks of the topic being assigned.

**Recommendations:**

Knowledge from 'Decentralized Systems: Fundamentals, Modeling, and Applications' [M-INFO-105334] and skills from 'Scientific Methods to Design and Analyze Secure Decentralized Systems' [M-INFO-105780] are of advantage.

**T****6.343 Module component: Research Focus Class: Blockchain & Cryptocurrencies - Seminar [T-INFO-113401]****Coordinators:** Prof. Dr. Hannes Hartenstein**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106654 - Research Focus Class: Blockchain & Cryptocurrencies](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 3 CP    | graded  | Irregular    | 1       |

| Courses |         |                                                                                 |       |                                                                                               |                                     |
|---------|---------|---------------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|-------------------------------------|
| ST 2026 | 2400184 | <a href="#">Research Focus Class: Blockchain &amp; Cryptocurrencies Seminar</a> | 2 SWS | Seminar /  | Hartenstein, Spiesberger, Grundmann |
| ST 2026 | 2400185 | <a href="#">Research Focus Class: Blockchain &amp; Cryptocurrencies</a>         | 1 SWS | Lecture /  | Hartenstein, Spiesberger, Grundmann |

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

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

A written paper must be prepared and a presentation given. Withdrawal is possible within two weeks of the topic being assigned.

**Prerequisites**

None.

*Below you will find excerpts from courses related to this module component:***V****Research Focus Class: Blockchain & Cryptocurrencies**2400185, SS 2026, 1 SWS, Language: English, [Open in study portal](#)**Lecture (V)**  
**On-Site**

**Content****Content:**

Blockchains such as Ethereum are decentralized systems that are currently receiving a lot of attention both in practice and in research. These systems can not only be used to carry out payment transactions in a decentralized manner, but also to programmatically record and enforce processes between mutually distrustful parties in so-called smart contracts. In particular, security and fairness properties as well as scalability in terms of transaction throughput play a key role.

This course begins with a lecture in which the basics of blockchains and Ethereum in particular are taught and current problems are introduced. After an introduction to the structure and functionality of Ethereum, advanced aspects that are necessary to address current research questions will be covered. The basics of scientific methodology in dealing with decentralized systems are also covered. The basic knowledge imparted in the lecture will be applied and consolidated in the seminar - the second part of the course - through the students' own research work.

The seminar offers the opportunity to work on a self-chosen topic in the field of blockchains and cryptocurrencies, which is facilitated by the previous lecture and direct consultation. The students' task is to find and process literature on the chosen topic and to work on the chosen topic. The results are documented in a paper according to scientific standards and presented in a colloquium.

**Competency Goals:**

- Students are familiar with current issues in the field of blockchain and cryptocurrencies and can identify specific research questions.
- Students have the necessary basic knowledge to identify, discuss and scientifically address current issues in the subject area.
- Students are able to independently develop a research topic and find and process related literature.
- Students are familiar with research methods in the field of decentralized systems and have gained initial experience in a specific research topic.
- Students can write a paper according to scientific standards.
- Students can present and discuss a research topic in a colloquium.

**Workload:**

6 ECTS = 180 hours

- Lecture attendance and discussion (20 hours)
- Lecture preparation and follow-up (20 hours)
- Literature research (20 hours)
- Implementation of self-chosen project (60 hours)
  - Writing a scientific report (60 hours)

**Credit points:**

6 = 3 + 3 ECTS

**Competency certificate:**

Lecture:

Success is assessed in the form of coursework in accordance with Section 4 Paragraph 3 SPO. A presentation must be given.

Seminar:

Success is assessed in the form of an examination of a different type in accordance with Section 4 Paragraph 2 Number 3 SPO. A written paper must be prepared and a presentation given. Withdrawal is possible within two weeks of the topic being assigned.

**Recommendations:**

Knowledge from 'Decentralized Systems: Fundamentals, Modeling, and Applications' [M-INFO-105334] and skills from 'Scientific Methods to Design and Analyze Secure Decentralized Systems' [M-INFO-105780] are of advantage.

**T****6.344 Module component: Research Practical Course: Artificial Intelligence & Security [T-INFO-113759]****Coordinators:** Prof. Dr. Christian Wressnegger**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106866 - Research Practical Course: Artificial Intelligence & Security](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 6 CP    | Graded  | Each term    | 1       |

| Courses  |         |                                                                                   |       |                                                                                                        |             |
|----------|---------|-----------------------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------|-------------|
| WT 25/26 | 24042   | <a href="#">Research Lab: Artificial Intelligence &amp; Security</a>              | 4 SWS | Practical course /  | Wressnegger |
| Exams    |         |                                                                                   |       |                                                                                                        |             |
| WT 25/26 | 7500397 | <a href="#">Research Practical Course: Artificial Intelligence &amp; Security</a> |       |                                                                                                        | Wressnegger |

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

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

**Prerequisites**

None.

**Recommendations**

The basics of IT security and artificial intelligence are a prerequisite.

*Below you will find excerpts from courses related to this module component:***V****Research Lab: Artificial Intelligence & Security**24042, WS 25/26, 4 SWS, Language: English, [Open in study portal](#)**Practical course (P)  
Blended (On-Site/Online)****Content**

In this practical course, the students work on a project at the intersection of artificial intelligence, machine learning, and computer security. They come in contact with and participate in timely and state-of-the-art research in this exciting field. In this scope, the students read up on a sub-field, design and implement a learning-based system, and conduct evaluations on real-world data.

Topics include but are not limited to adversarial machine learning, explainability of machine learning in computer security, learning-based attack detection, and vulnerability discovery.

**Organizational issues**

English Course

## T

**6.345 Module component: Research Practical Course: Explainable Artificial Intelligence [T-INFO-113114]****Coordinators:** TT-Prof. Dr. Rudolf Lioutikov**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106495 - Research Practical Course: Explainable Artificial Intelligence](#)**Type**  
Examination of another type**Credits**  
6 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
1

| Courses  |         |                                                                                |       |                                                                                                        |                       |
|----------|---------|--------------------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------|-----------------------|
| WT 25/26 | 2400142 | <a href="#">Forschungspraktikum: Explainable Artificial Intelligence</a>       | 4 SWS | Practical course /  | Lioutikov, Li, Mattes |
| Exams    |         |                                                                                |       |                                                                                                        |                       |
| WT 25/26 | 7500360 | <a href="#">Research Practical Course: Explainable Artificial Intelligence</a> |       |                                                                                                        | Lioutikov             |

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

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO). The overall impression is evaluated. The following partial aspects are included in the grading: Term paper (approx. 10 pages), Presentation (duration approx. 20 min.), Practical training (protocols)

Presentation on the chosen topic at the end of the semester and written paper.

**Prerequisites**

None

**Recommendations**

We recommend taking this Praktikum after attending the “Explainable Artificial Intelligence” lecture in the summer semester.

We highly recommend to take this research project in combination with the “Explainable Artificial Intelligence” seminar.

- Experience in Machine Learning is recommended, e.g. through prior coursework.
- The Computer Science Department offers several great lectures e.g., “Maschinelles Lernen - Grundlagen und Algorithmen” and “Deep Learning”
- A good mathematical background will be beneficial
- Python experience is recommended
- We might use the PyTorch deep learning library In the exercises. Some prior knowledge in this is helpful but not necessary.

**Additional Information**

It is only possible to resign within two weeks after assignment of the topic.



**T****6.346 Module component: Research Practical Course: Interactive Learning [T-INFO-112772]**

**Coordinators:** TT-Prof. Dr. Rudolf Lioutikov  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-106300 - Research Practical Course: Interactive Learning](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 6 CP    | graded  | Each summer term | 3       |

| Courses |         |                                                                         |       |                                                                                                        |           |
|---------|---------|-------------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------|-----------|
| ST 2026 | 2400139 | <a href="#">Research Practical Course on Behavior Foundation Models</a> | 4 SWS | Practical course /  | Lioutikov |

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

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).  
 Presentation on the chosen topic at the end of the semester and written elaboration.

**Prerequisites**

None.

**Recommendations**

We highly recommend to take this research project in combination with the “Interactive Learning” seminar.

It is highly recommended to attend the “Explainable Artificial Intelligence” lecture in parallel or prior to this project.

- Experience in Machine Learning is recommended, e.g. through prior coursework.
  - The Computer Science Department offers several great lectures e.g., “Maschinelles Lernen - Grundlagen und Algorithmen” and “Deep Learning”
- A good mathematical background will be beneficial
- Python experience is recommended
- We might use the PyTorch deep learning library In the exercises. Some prior knowledge in this is helpful but not necessary.

**T****6.347 Module component: Research Project (Project, 1st Semester) - Oral Exam [T-INFO-110218]****Coordinators:** Prof. Dr. Bernhard Beckert**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-105037 - Research Project \(Project, 1st Semester\)](#)

| Type             | Credits | Grading | Term offered | Version |
|------------------|---------|---------|--------------|---------|
| Oral examination | 3 CP    | Graded  | Each term    | 2       |

| Courses  |         |                                                                      |         |                                                                                      |                                   |
|----------|---------|----------------------------------------------------------------------|---------|--------------------------------------------------------------------------------------|-----------------------------------|
| WT 25/26 | 2400068 | <a href="#">Research Project (Project, first semester)</a>           | 6.5 SWS | /  | Beckert, Kirsten, Ulbrich         |
| ST 2026  | 2400047 | <a href="#">Research Project (Project, first semester)</a>           | 6.5 SWS | /  | Beckert, Ulbrich                  |
| Exams    |         |                                                                      |         |                                                                                      |                                   |
| WT 25/26 | 7500079 | <a href="#">Research Project (Project, 1st Semester) - Oral Exam</a> |         |                                                                                      | Beckert, Beigl, Reussner, Ulbrich |
| ST 2026  | 7500114 | <a href="#">Research Project (Project, 1st Semester) - Oral Exam</a> |         |                                                                                      | Beckert, Beigl, Reussner          |

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

Below you will find excerpts from courses related to this module component:

**V****Research Project (Project, first semester)**2400068, WS 25/26, 6.5 SWS, Language: German/English, [Open in study portal](#)**Blended (On-Site/Online)**

**Content****Dates**

The date will be announced in the information event (Course no.: 2400064) in the first lecture week.

**Choice of Topic and Registration**

Possible project topics are presented in an information event at the beginning of each semester. The dates of this event are published on the website

<https://informatik.kit.edu/projektgruppe>

The registration and refinement of the topic takes place in close consultation with the advisor.

**Conditions**

The module "Research Project (Methods, first semester)" must be taken in the same semester.

**Remark**

- This module forms a unit with the modules "Research Project (Project, second semester)", "Research Project (Methods, first semester)" and "Research Project (Methods, second semester)". In all four modules combined, a uniform student research project is carried out over a period of two semesters.
- This module can be credited either in a specialization or in the elective area. The respective allocation of the projects which are offered for specific specializations is announced at the beginning of the semester.
- This module includes lecture credit points, practical credit points and seminar credit points. The practical part comprises practical scientific work under supervision; the seminar part comprises independent development and (written and oral) presentation of scientific work by others; the lecture part comprises acquisition of foundational knowledge through reading, listening, etc. The distribution of the module's credit points into the different types of credit points will be announced at the beginning of the semester for each project (where the modules "Research Project (Project, first semester)" and "Research Project (Project, second semester)" together amount to at least 5 lecture CPs, at least 3 seminar CPs and at least 3 practical CPs).

**Course Content**

The content of "Research Project" is the guided conduct of a scientific research project. Over a period of two semesters, students work intensively and continuously on the project. As part of the course "Research Project", students acquire both specialist knowledge and methodological skills for scientific work.

The central questions of the projects on which the participants work originate from the research areas of the respective advisor(s). Usually, the project takes place within a current research project, which establishes a strong link between research and teaching.

The focus of the first semester is on planning the project and carrying out the preliminary work. The focus of the second semester is on carrying out the project and presenting the results.

At the end of the course "Research Project" (at the end of the second semester), participants write a scientific paper on the results of their project. This paper should meet the quality standards of a scientific publication and, if possible, be published.

Participation in the course "Research Project" also serves as preparation for a Master's thesis, the scientific nature of which goes beyond the normal level.

In addition to the project work, there are accompanying courses in which competences for scientific and project-oriented work are taught (these are credited as interdisciplinary qualifications; see the modules "Research Project (Methods, first semester)" and "Research Project (Methods, second semester)").

**Workload**

The total workload for this module is 300 hours (the total workload for all four modules of "Research Project" is 720 hours).

The allocation of the workload to the various phases and work steps depends on the project and will be announced at the beginning of the first semester.

**Qualification Goals**

The objective of "Research Project" is to acquire both specialist knowledge and methodological skills in scientific work and to test them on the basis of the students' own project.

After completing all four modules of "Research Project", participants will be able to ...

- carry out a literature search based on a given topic, independently identify, locate, classify, assess and evaluate the relevant literature,
- present and critically discuss the results of the literature research in their own words and with the aid of self-prepared presentation slides to a specialist audience,
- formulate and delimit the content of a research question or research problem, and present the relevance of the question or problem,
- explain the foundations of philosophy of science and relate them to their project,
- discuss the foundation of the used research approach, such as experiment design and experiment implementation, and apply them to their project,
- design, justify, evaluate and classify their own (partial) research approach,
- develop concrete work steps and a project plan from the research question and the research approach,
- determine workloads, coordinate work steps and, if necessary, allocate them in a team,
- identify and analyze risk factors and develop and plan countermeasures,

- identify, plan and carry out the preparatory work required for the project to be carried out,
- work scientifically in the research area of the project,
- know and apply the fundamental contents relevant to the project, and assess their relevance to the research question,
- document, summarize and present their planning and the progress of the project,
- recognize and evaluate progress, and develop and apply control measures,
- name, explain and apply techniques of scientific work and scientific writing,
- plan, prepare and evaluate scientific publications,
- document, summarize and illustrate the project process and results,
- work scientifically in collaboration with others in a team.

**Associated Events**

Information Event "Research Project"

Research Project (Project, first semester)

Research Project (Project, second semester)

Research Project (Methods, first semester)

Research Project (Methods, second semester)

**Organizational issues**

Siehe Bemerkungen. / See remarks.

**Research Project (Project, first semester)**

2400047, SS 2026, 6.5 SWS, Language: German/English, [Open in study portal](#)

**Blended (On-Site/Online)**

**Content****Dates**

The date will be announced in the information event (Course no.: 2400064) in the first lecture week.

**Choice of Topic and Registration**

Possible project topics are presented in an information event at the beginning of each semester. The dates of this event are published on the website

<https://informatik.kit.edu/projektgruppe>

The registration and refinement of the topic takes place in close consultation with the advisor.

**Conditions**

The module "Research Project (Methods, first semester)" must be taken in the same semester.

**Remark**

- This module forms a unit with the modules "Research Project (Project, second semester)", "Research Project (Methods, first semester)" and "Research Project (Methods, second semester)". In all four modules combined, a uniform student research project is carried out over a period of two semesters.
- This module can be credited either in a specialization or in the elective area. The respective allocation of the projects which are offered for specific specializations is announced at the beginning of the semester.
- This module includes lecture credit points, practical credit points and seminar credit points. The practical part comprises practical scientific work under supervision; the seminar part comprises independent development and (written and oral) presentation of scientific work by others; the lecture part comprises acquisition of foundational knowledge through reading, listening, etc. The distribution of the module's credit points into the different types of credit points will be announced at the beginning of the semester for each project (where the modules "Research Project (Project, first semester)" and "Research Project (Project, second semester)" together amount to at least 5 lecture CPs, at least 3 seminar CPs and at least 3 practical CPs).

**Course Content**

The content of "Research Project" is the guided conduct of a scientific research project. Over a period of two semesters, students work intensively and continuously on the project. As part of the course "Research Project", students acquire both specialist knowledge and methodological skills for scientific work.

The central questions of the projects on which the participants work originate from the research areas of the respective advisor(s). Usually, the project takes place within a current research project, which establishes a strong link between research and teaching.

The focus of the first semester is on planning the project and carrying out the preliminary work. The focus of the second semester is on carrying out the project and presenting the results.

At the end of the course "Research Project" (at the end of the second semester), participants write a scientific paper on the results of their project. This paper should meet the quality standards of a scientific publication and, if possible, be published.

Participation in the course "Research Project" also serves as preparation for a Master's thesis, the scientific nature of which goes beyond the normal level.

In addition to the project work, there are accompanying courses in which competences for scientific and project-oriented work are taught (these are credited as interdisciplinary qualifications; see the modules "Research Project (Methods, first semester)" and "Research Project (Methods, second semester)").

**Workload**

The total workload for this module is 300 hours (the total workload for all four modules of "Research Project" is 720 hours).

The allocation of the workload to the various phases and work steps depends on the project and will be announced at the beginning of the first semester.

**Qualification Goals**

The objective of "Research Project" is to acquire both specialist knowledge and methodological skills in scientific work and to test them on the basis of the students' own project.

After completing all four modules of "Research Project", participants will be able to ...

- carry out a literature search based on a given topic, independently identify, locate, classify, assess and evaluate the relevant literature,
- present and critically discuss the results of the literature research in their own words and with the aid of self-prepared presentation slides to a specialist audience,
- formulate and delimit the content of a research question or research problem, and present the relevance of the question or problem,
- explain the foundations of philosophy of science and relate them to their project,
- discuss the foundation of the used research approach, such as experiment design and experiment implementation, and apply them to their project,
- design, justify, evaluate and classify their own (partial) research approach,
- develop concrete work steps and a project plan from the research question and the research approach,
- determine workloads, coordinate work steps and, if necessary, allocate them in a team,
- identify and analyze risk factors and develop and plan countermeasures,

- identify, plan and carry out the preparatory work required for the project to be carried out,
- work scientifically in the research area of the project,
- know and apply the fundamental contents relevant to the project, and assess their relevance to the research question,
- document, summarize and present their planning and the progress of the project,
- recognize and evaluate progress, and develop and apply control measures,
- name, explain and apply techniques of scientific work and scientific writing,
- plan, prepare and evaluate scientific publications,
- document, summarize and illustrate the project process and results,
- work scientifically in collaboration with others in a team.

**Associated Events**

Information Event "Research Project"

Research Project (Project, first semester)

Research Project (Project, second semester)

Research Project (Methods, first semester)

Research Project (Methods, second semester)

**Organizational issues**

Siehe Bemerkungen. / See remarks.

**T****6.348 Module component: Research Project (Project, 1st Semester) - Presentation [T-INFO-110219]****Coordinators:** Prof. Dr. Bernhard Beckert**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-105037 - Research Project \(Project, 1st Semester\)](#)**Type**  
Examination of another type**Credits**  
3 CP**Grading**  
graded**Term offered**  
Each term**Version**  
1

| Courses  |         |                                                                         |         |   |                                   |
|----------|---------|-------------------------------------------------------------------------|---------|---|-----------------------------------|
| WT 25/26 | 2400068 | <a href="#">Research Project (Project, first semester)</a>              | 6.5 SWS | / | Beckert, Kirsten, Ulbrich         |
| ST 2026  | 2400047 | <a href="#">Research Project (Project, first semester)</a>              | 6.5 SWS | / | Beckert, Ulbrich                  |
| Exams    |         |                                                                         |         |   |                                   |
| WT 25/26 | 7500080 | <a href="#">Research Project (Project, 1st Semester) - Presentation</a> |         |   | Beckert, Beigl, Reussner, Ulbrich |
| ST 2026  | 7500130 | <a href="#">Research Project (Project, 1st Semester) - Presentation</a> |         |   | Beckert, Beigl, Reussner          |

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

Below you will find excerpts from courses related to this module component:

**V****Research Project (Project, first semester)**2400068, WS 25/26, 6.5 SWS, Language: German/English, [Open in study portal](#)**Blended (On-Site/Online)**

**Content****Dates**

The date will be announced in the information event (Course no.: 2400064) in the first lecture week.

**Choice of Topic and Registration**

Possible project topics are presented in an information event at the beginning of each semester. The dates of this event are published on the website

<https://informatik.kit.edu/projektgruppe>

The registration and refinement of the topic takes place in close consultation with the advisor.

**Conditions**

The module "Research Project (Methods, first semester)" must be taken in the same semester.

**Remark**

- This module forms a unit with the modules "Research Project (Project, second semester)", "Research Project (Methods, first semester)" and "Research Project (Methods, second semester)". In all four modules combined, a uniform student research project is carried out over a period of two semesters.
- This module can be credited either in a specialization or in the elective area. The respective allocation of the projects which are offered for specific specializations is announced at the beginning of the semester.
- This module includes lecture credit points, practical credit points and seminar credit points. The practical part comprises practical scientific work under supervision; the seminar part comprises independent development and (written and oral) presentation of scientific work by others; the lecture part comprises acquisition of foundational knowledge through reading, listening, etc. The distribution of the module's credit points into the different types of credit points will be announced at the beginning of the semester for each project (where the modules "Research Project (Project, first semester)" and "Research Project (Project, second semester)" together amount to at least 5 lecture CPs, at least 3 seminar CPs and at least 3 practical CPs).

**Course Content**

The content of "Research Project" is the guided conduct of a scientific research project. Over a period of two semesters, students work intensively and continuously on the project. As part of the course "Research Project", students acquire both specialist knowledge and methodological skills for scientific work.

The central questions of the projects on which the participants work originate from the research areas of the respective advisor(s). Usually, the project takes place within a current research project, which establishes a strong link between research and teaching.

The focus of the first semester is on planning the project and carrying out the preliminary work. The focus of the second semester is on carrying out the project and presenting the results.

At the end of the course "Research Project" (at the end of the second semester), participants write a scientific paper on the results of their project. This paper should meet the quality standards of a scientific publication and, if possible, be published.

Participation in the course "Research Project" also serves as preparation for a Master's thesis, the scientific nature of which goes beyond the normal level.

In addition to the project work, there are accompanying courses in which competences for scientific and project-oriented work are taught (these are credited as interdisciplinary qualifications; see the modules "Research Project (Methods, first semester)" and "Research Project (Methods, second semester)").

**Workload**

The total workload for this module is 300 hours (the total workload for all four modules of "Research Project" is 720 hours).

The allocation of the workload to the various phases and work steps depends on the project and will be announced at the beginning of the first semester.

**Qualification Goals**

The objective of "Research Project" is to acquire both specialist knowledge and methodological skills in scientific work and to test them on the basis of the students' own project.

After completing all four modules of "Research Project", participants will be able to ...

- carry out a literature search based on a given topic, independently identify, locate, classify, assess and evaluate the relevant literature,
- present and critically discuss the results of the literature research in their own words and with the aid of self-prepared presentation slides to a specialist audience,
- formulate and delimit the content of a research question or research problem, and present the relevance of the question or problem,
- explain the foundations of philosophy of science and relate them to their project,
- discuss the foundation of the used research approach, such as experiment design and experiment implementation, and apply them to their project,
- design, justify, evaluate and classify their own (partial) research approach,
- develop concrete work steps and a project plan from the research question and the research approach,
- determine workloads, coordinate work steps and, if necessary, allocate them in a team,
- identify and analyze risk factors and develop and plan countermeasures,



- identify, plan and carry out the preparatory work required for the project to be carried out,
- work scientifically in the research area of the project,
- know and apply the fundamental contents relevant to the project, and assess their relevance to the research question,
- document, summarize and present their planning and the progress of the project,
- recognize and evaluate progress, and develop and apply control measures,
- name, explain and apply techniques of scientific work and scientific writing,
- plan, prepare and evaluate scientific publications,
- document, summarize and illustrate the project process and results,
- work scientifically in collaboration with others in a team.

**Associated Events**

Information Event "Research Project"

Research Project (Project, first semester)

Research Project (Project, second semester)

Research Project (Methods, first semester)

Research Project (Methods, second semester)

**Organizational issues**

Siehe Bemerkungen. / See remarks.

**Research Project (Project, first semester)**

2400047, SS 2026, 6.5 SWS, Language: German/English, [Open in study portal](#)

**Blended (On-Site/Online)**

**Content****Dates**

The date will be announced in the information event (Course no.: 2400064) in the first lecture week.

**Choice of Topic and Registration**

Possible project topics are presented in an information event at the beginning of each semester. The dates of this event are published on the website

<https://informatik.kit.edu/projektgruppe>

The registration and refinement of the topic takes place in close consultation with the advisor.

**Conditions**

The module "Research Project (Methods, first semester)" must be taken in the same semester.

**Remark**

- This module forms a unit with the modules "Research Project (Project, second semester)", "Research Project (Methods, first semester)" and "Research Project (Methods, second semester)". In all four modules combined, a uniform student research project is carried out over a period of two semesters.
- This module can be credited either in a specialization or in the elective area. The respective allocation of the projects which are offered for specific specializations is announced at the beginning of the semester.
- This module includes lecture credit points, practical credit points and seminar credit points. The practical part comprises practical scientific work under supervision; the seminar part comprises independent development and (written and oral) presentation of scientific work by others; the lecture part comprises acquisition of foundational knowledge through reading, listening, etc. The distribution of the module's credit points into the different types of credit points will be announced at the beginning of the semester for each project (where the modules "Research Project (Project, first semester)" and "Research Project (Project, second semester)" together amount to at least 5 lecture CPs, at least 3 seminar CPs and at least 3 practical CPs).

**Course Content**

The content of "Research Project" is the guided conduct of a scientific research project. Over a period of two semesters, students work intensively and continuously on the project. As part of the course "Research Project", students acquire both specialist knowledge and methodological skills for scientific work.

The central questions of the projects on which the participants work originate from the research areas of the respective advisor(s). Usually, the project takes place within a current research project, which establishes a strong link between research and teaching.

The focus of the first semester is on planning the project and carrying out the preliminary work. The focus of the second semester is on carrying out the project and presenting the results.

At the end of the course "Research Project" (at the end of the second semester), participants write a scientific paper on the results of their project. This paper should meet the quality standards of a scientific publication and, if possible, be published.

Participation in the course "Research Project" also serves as preparation for a Master's thesis, the scientific nature of which goes beyond the normal level.

In addition to the project work, there are accompanying courses in which competences for scientific and project-oriented work are taught (these are credited as interdisciplinary qualifications; see the modules "Research Project (Methods, first semester)" and "Research Project (Methods, second semester)").

**Workload**

The total workload for this module is 300 hours (the total workload for all four modules of "Research Project" is 720 hours).

The allocation of the workload to the various phases and work steps depends on the project and will be announced at the beginning of the first semester.

**Qualification Goals**

The objective of "Research Project" is to acquire both specialist knowledge and methodological skills in scientific work and to test them on the basis of the students' own project.

After completing all four modules of "Research Project", participants will be able to ...

- carry out a literature search based on a given topic, independently identify, locate, classify, assess and evaluate the relevant literature,
- present and critically discuss the results of the literature research in their own words and with the aid of self-prepared presentation slides to a specialist audience,
- formulate and delimit the content of a research question or research problem, and present the relevance of the question or problem,
- explain the foundations of philosophy of science and relate them to their project,
- discuss the foundation of the used research approach, such as experiment design and experiment implementation, and apply them to their project,
- design, justify, evaluate and classify their own (partial) research approach,
- develop concrete work steps and a project plan from the research question and the research approach,
- determine workloads, coordinate work steps and, if necessary, allocate them in a team,
- identify and analyze risk factors and develop and plan countermeasures,

- identify, plan and carry out the preparatory work required for the project to be carried out,
- work scientifically in the research area of the project,
- know and apply the fundamental contents relevant to the project, and assess their relevance to the research question,
- document, summarize and present their planning and the progress of the project,
- recognize and evaluate progress, and develop and apply control measures,
- name, explain and apply techniques of scientific work and scientific writing,
- plan, prepare and evaluate scientific publications,
- document, summarize and illustrate the project process and results,
- work scientifically in collaboration with others in a team.

**Associated Events**

Information Event "Research Project"

Research Project (Project, first semester)

Research Project (Project, second semester)

Research Project (Methods, first semester)

Research Project (Methods, second semester)

**Organizational issues**

Siehe Bemerkungen. / See remarks.

**T****6.349 Module component: Research Project (Project, 1st Semester) - Project Proposal [T-INFO-110220]****Coordinators:** Prof. Dr. Bernhard Beckert**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-105037 - Research Project \(Project, 1st Semester\)](#)**Type**  
Examination of another type**Credits**  
4 CP**Grading**  
graded**Term offered**  
Each term**Version**  
1

| Courses  |         |                                                                             |         |                                                                                      |                                   |
|----------|---------|-----------------------------------------------------------------------------|---------|--------------------------------------------------------------------------------------|-----------------------------------|
| WT 25/26 | 2400068 | <a href="#">Research Project (Project, first semester)</a>                  | 6.5 SWS | /  | Beckert, Kirsten, Ulbrich         |
| ST 2026  | 2400047 | <a href="#">Research Project (Project, first semester)</a>                  | 6.5 SWS | /  | Beckert, Ulbrich                  |
| Exams    |         |                                                                             |         |                                                                                      |                                   |
| WT 25/26 | 7500081 | <a href="#">Research Project (Project, 1st Semester) - Written Exam</a>     |         |                                                                                      | Beckert, Beigl, Reussner, Ulbrich |
| ST 2026  | 7500131 | <a href="#">Research Project (Project, 1st Semester) - Project Proposal</a> |         |                                                                                      | Beckert, Beigl, Reussner          |

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

Below you will find excerpts from courses related to this module component:

**V****Research Project (Project, first semester)**2400068, WS 25/26, 6.5 SWS, Language: German/English, [Open in study portal](#)**Blended (On-Site/Online)**

**Content****Dates**

The date will be announced in the information event (Course no.: 2400064) in the first lecture week.

**Choice of Topic and Registration**

Possible project topics are presented in an information event at the beginning of each semester. The dates of this event are published on the website

<https://informatik.kit.edu/projektgruppe>

The registration and refinement of the topic takes place in close consultation with the advisor.

**Conditions**

The module "Research Project (Methods, first semester)" must be taken in the same semester.

**Remark**

- This module forms a unit with the modules "Research Project (Project, second semester)", "Research Project (Methods, first semester)" and "Research Project (Methods, second semester)". In all four modules combined, a uniform student research project is carried out over a period of two semesters.
- This module can be credited either in a specialization or in the elective area. The respective allocation of the projects which are offered for specific specializations is announced at the beginning of the semester.
- This module includes lecture credit points, practical credit points and seminar credit points. The practical part comprises practical scientific work under supervision; the seminar part comprises independent development and (written and oral) presentation of scientific work by others; the lecture part comprises acquisition of foundational knowledge through reading, listening, etc. The distribution of the module's credit points into the different types of credit points will be announced at the beginning of the semester for each project (where the modules "Research Project (Project, first semester)" and "Research Project (Project, second semester)" together amount to at least 5 lecture CPs, at least 3 seminar CPs and at least 3 practical CPs).

**Course Content**

The content of "Research Project" is the guided conduct of a scientific research project. Over a period of two semesters, students work intensively and continuously on the project. As part of the course "Research Project", students acquire both specialist knowledge and methodological skills for scientific work.

The central questions of the projects on which the participants work originate from the research areas of the respective advisor(s). Usually, the project takes place within a current research project, which establishes a strong link between research and teaching.

The focus of the first semester is on planning the project and carrying out the preliminary work. The focus of the second semester is on carrying out the project and presenting the results.

At the end of the course "Research Project" (at the end of the second semester), participants write a scientific paper on the results of their project. This paper should meet the quality standards of a scientific publication and, if possible, be published.

Participation in the course "Research Project" also serves as preparation for a Master's thesis, the scientific nature of which goes beyond the normal level.

In addition to the project work, there are accompanying courses in which competences for scientific and project-oriented work are taught (these are credited as interdisciplinary qualifications; see the modules "Research Project (Methods, first semester)" and "Research Project (Methods, second semester)").

**Workload**

The total workload for this module is 300 hours (the total workload for all four modules of "Research Project" is 720 hours).

The allocation of the workload to the various phases and work steps depends on the project and will be announced at the beginning of the first semester.

**Qualification Goals**

The objective of "Research Project" is to acquire both specialist knowledge and methodological skills in scientific work and to test them on the basis of the students' own project.

After completing all four modules of "Research Project", participants will be able to ...

- carry out a literature search based on a given topic, independently identify, locate, classify, assess and evaluate the relevant literature,
- present and critically discuss the results of the literature research in their own words and with the aid of self-prepared presentation slides to a specialist audience,
- formulate and delimit the content of a research question or research problem, and present the relevance of the question or problem,
- explain the foundations of philosophy of science and relate them to their project,
- discuss the foundation of the used research approach, such as experiment design and experiment implementation, and apply them to their project,
- design, justify, evaluate and classify their own (partial) research approach,
- develop concrete work steps and a project plan from the research question and the research approach,
- determine workloads, coordinate work steps and, if necessary, allocate them in a team,
- identify and analyze risk factors and develop and plan countermeasures,

- identify, plan and carry out the preparatory work required for the project to be carried out,
- work scientifically in the research area of the project,
- know and apply the fundamental contents relevant to the project, and assess their relevance to the research question,
- document, summarize and present their planning and the progress of the project,
- recognize and evaluate progress, and develop and apply control measures,
- name, explain and apply techniques of scientific work and scientific writing,
- plan, prepare and evaluate scientific publications,
- document, summarize and illustrate the project process and results,
- work scientifically in collaboration with others in a team.

#### Associated Events

Information Event "Research Project"

Research Project (Project, first semester)

Research Project (Project, second semester)

Research Project (Methods, first semester)

Research Project (Methods, second semester)

#### Organizational issues

Siehe Bemerkungen. / See remarks.



#### Research Project (Project, first semester)

2400047, SS 2026, 6.5 SWS, Language: German/English, [Open in study portal](#)

Blended (On-Site/Online)

**Content****Dates**

The date will be announced in the information event (Course no.: 2400064) in the first lecture week.

**Choice of Topic and Registration**

Possible project topics are presented in an information event at the beginning of each semester. The dates of this event are published on the website

<https://informatik.kit.edu/projektgruppe>

The registration and refinement of the topic takes place in close consultation with the advisor.

**Conditions**

The module "Research Project (Methods, first semester)" must be taken in the same semester.

**Remark**

- This module forms a unit with the modules "Research Project (Project, second semester)", "Research Project (Methods, first semester)" and "Research Project (Methods, second semester)". In all four modules combined, a uniform student research project is carried out over a period of two semesters.
- This module can be credited either in a specialization or in the elective area. The respective allocation of the projects which are offered for specific specializations is announced at the beginning of the semester.
- This module includes lecture credit points, practical credit points and seminar credit points. The practical part comprises practical scientific work under supervision; the seminar part comprises independent development and (written and oral) presentation of scientific work by others; the lecture part comprises acquisition of foundational knowledge through reading, listening, etc. The distribution of the module's credit points into the different types of credit points will be announced at the beginning of the semester for each project (where the modules "Research Project (Project, first semester)" and "Research Project (Project, second semester)" together amount to at least 5 lecture CPs, at least 3 seminar CPs and at least 3 practical CPs).

**Course Content**

The content of "Research Project" is the guided conduct of a scientific research project. Over a period of two semesters, students work intensively and continuously on the project. As part of the course "Research Project", students acquire both specialist knowledge and methodological skills for scientific work.

The central questions of the projects on which the participants work originate from the research areas of the respective advisor(s). Usually, the project takes place within a current research project, which establishes a strong link between research and teaching.

The focus of the first semester is on planning the project and carrying out the preliminary work. The focus of the second semester is on carrying out the project and presenting the results.

At the end of the course "Research Project" (at the end of the second semester), participants write a scientific paper on the results of their project. This paper should meet the quality standards of a scientific publication and, if possible, be published.

Participation in the course "Research Project" also serves as preparation for a Master's thesis, the scientific nature of which goes beyond the normal level.

In addition to the project work, there are accompanying courses in which competences for scientific and project-oriented work are taught (these are credited as interdisciplinary qualifications; see the modules "Research Project (Methods, first semester)" and "Research Project (Methods, second semester)").

**Workload**

The total workload for this module is 300 hours (the total workload for all four modules of "Research Project" is 720 hours).

The allocation of the workload to the various phases and work steps depends on the project and will be announced at the beginning of the first semester.

**Qualification Goals**

The objective of "Research Project" is to acquire both specialist knowledge and methodological skills in scientific work and to test them on the basis of the students' own project.

After completing all four modules of "Research Project", participants will be able to ...

- carry out a literature search based on a given topic, independently identify, locate, classify, assess and evaluate the relevant literature,
- present and critically discuss the results of the literature research in their own words and with the aid of self-prepared presentation slides to a specialist audience,
- formulate and delimit the content of a research question or research problem, and present the relevance of the question or problem,
- explain the foundations of philosophy of science and relate them to their project,
- discuss the foundation of the used research approach, such as experiment design and experiment implementation, and apply them to their project,
- design, justify, evaluate and classify their own (partial) research approach,
- develop concrete work steps and a project plan from the research question and the research approach,
- determine workloads, coordinate work steps and, if necessary, allocate them in a team,
- identify and analyze risk factors and develop and plan countermeasures,

- identify, plan and carry out the preparatory work required for the project to be carried out,
- work scientifically in the research area of the project,
- know and apply the fundamental contents relevant to the project, and assess their relevance to the research question,
- document, summarize and present their planning and the progress of the project,
- recognize and evaluate progress, and develop and apply control measures,
- name, explain and apply techniques of scientific work and scientific writing,
- plan, prepare and evaluate scientific publications,
- document, summarize and illustrate the project process and results,
- work scientifically in collaboration with others in a team.

#### **Associated Events**

Information Event "Research Project"

Research Project (Project, first semester)

Research Project (Project, second semester)

Research Project (Methods, first semester)

Research Project (Methods, second semester)

#### **Organizational issues**

Siehe Bemerkungen. / See remarks.



**T****6.350 Module component: Research Project (Project, 2nd Semester) - Oral Exam [T-INFO-110221]****Coordinators:** Prof. Dr. Bernhard Beckert**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-105038 - Research Project \(Project, 2nd Semester\)](#)**Type**  
Oral examination**Credits**  
3 CP**Grading**  
graded**Term offered**  
Each term**Version**  
2

| Courses  |         |                                                                      |         |   |                                   |
|----------|---------|----------------------------------------------------------------------|---------|---|-----------------------------------|
| WT 25/26 | 2400070 | <a href="#">Research Project (Project, second semester)</a>          | 6.5 SWS | / | Beckert, Kirsten, Ulbrich         |
| ST 2026  | 2400053 | <a href="#">Research Project (Project, second semester)</a>          | 6.5 SWS | / | Beckert, Ulbrich                  |
| Exams    |         |                                                                      |         |   |                                   |
| WT 25/26 | 7500171 | <a href="#">Research Project (Project, 2nd Semester) - Oral Exam</a> |         |   | Beckert, Beigl, Reussner, Ulbrich |
| ST 2026  | 7500126 | <a href="#">Research Project (Project, 2nd Semester) - Oral Exam</a> |         |   | Beckert, Beigl, Reussner          |

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

Below you will find excerpts from courses related to this module component:

**V****Research Project (Project, second semester)**2400070, WS 25/26, 6.5 SWS, Language: German/English, [Open in study portal](#)**Blended (On-Site/Online)**

**Content****Dates**

The dates will be announced in the beginning of the semester.

**Registration**

Registration for this module is only possible together with registration for the module "Research Project (Project, first semester)"; see the information there.

**Conditions**

- Successful participation in the modules "Research Project (Project, first semester)" and "Research Project (Methods, first semester)" in the preceding semester is a prerequisite for participation.
- The module "Research Project (Methods, second semester)" must be taken in the same semester.

**Remark**

- This module forms a unit with the modules "Research Project (Project, first semester)", "Research Project (Project, second semester)" and "Research Project (Methods, first semester)". In all four modules combined, a uniform student research project is carried out over a period of two semesters.
- This module can be credited either in a specialization or in the elective area. The respective allocation of the projects which are offered for specific specializations is announced at the beginning of the semester.
- This module includes lecture credit points, practical credit points and seminar credit points. The practical part comprises practical scientific work under supervision; the seminar part comprises independent development and (written and oral) presentation of scientific work by others; the lecture part comprises acquisition of foundational knowledge through reading, listening, etc. The distribution of the module's credit points into the different types of credit points will be announced at the beginning of the semester for each project (where the modules "Research Project (Project, first semester)" and "Research Project (Project, second semester)" together amount to at least 5 lecture CPs, at least 3 seminar CPs and at least 3 practical CPs).

**Course Content**

The content of "Research Project" is the guided conduct of a scientific research project. Over a period of two semesters, students work intensively and continuously on the project. As part of the course "Research Project", students acquire both specialist knowledge and methodological skills for scientific work.

The central questions of the projects on which the participants work originate from the research areas of the respective advisor(s). Usually, the project takes place within a current research project, which establishes a strong link between research and teaching.

The focus of the first semester is on planning the project and carrying out the preliminary work. The focus of the second semester is on carrying out the project and presenting the results.

At the end of the course "Research Project" (at the end of the second semester), participants write a scientific paper on the results of their project. This paper should meet the quality standards of a scientific publication and, if possible, be published.

Participation in the course "Research Project" also serves as preparation for a Master's thesis, the scientific nature of which goes beyond the normal level.

In addition to the project work, there are accompanying courses in which competences for scientific and project-oriented work are taught (these are credited as interdisciplinary qualifications; see the modules "Research Project (Methods, first semester)" and "Research Project (Methods, second semester)").

**Workload**

The total workload for this module is 300 hours (the total workload for all four modules of "Research Project" is 720 hours).

The allocation of the workload to the various phases and work steps depends on the project and will be announced at the beginning of the first semester.

**Qualification Goals**

The objective of "Research Project" is to acquire both specialist knowledge and methodological skills in scientific work and to test them on the basis of the students' own project.

After completing all four modules of "Research Project", participants will be able to ...

- carry out a literature search based on a given topic, independently identify, locate, classify, assess and evaluate the relevant literature,
- present and critically discuss the results of the literature research in their own words and with the aid of self-prepared presentation slides to a specialist audience,
- formulate and delimit the content of a research question or research problem, and present the relevance of the question or problem,
- explain the foundations of philosophy of science and relate them to their project,
- discuss the foundation of the used research approach, such as experiment design and experiment implementation, and apply them to their project,
- design, justify, evaluate and classify their own (partial) research approach,
- develop concrete work steps and a project plan from the research question and the research approach,
- determine workloads, coordinate work steps and, if necessary, allocate them in a team,
- identify and analyze risk factors and develop and plan countermeasures,

- identify, plan and carry out the preparatory work required for the project to be carried out,
- work scientifically in the research area of the project,
- know and apply the fundamental contents relevant to the project, and assess their relevance to the research question,
- document, summarize and present their planning and the progress of the project,
- recognize and evaluate progress, and develop and apply control measures,
- name, explain and apply techniques of scientific work and scientific writing,
- plan, prepare and evaluate scientific publications,
- document, summarize and illustrate the project process and results,
- work scientifically in collaboration with others in a team.

**Associated Events**

Information Event "Research Project"

Research Project (Project, first semester)

Research Project (Project, second semester)

Research Project (Methods, first semester)

Research Project (Methods, second semester)

**Organizational issues**

Siehe Bemerkungen. / See remarks.

**Research Project (Project, second semester)**

2400053, SS 2026, 6.5 SWS, Language: German/English, [Open in study portal](#)

**Blended (On-Site/Online)**

**Content****Dates**

The dates will be announced in the beginning of the semester.

**Registration**

Registration for this module is only possible together with registration for the module "Research Project (Project, first semester)"; see the information there.

**Conditions**

- Successful participation in the modules "Research Project (Project, first semester)" and "Research Project (Methods, first semester)" in the preceding semester is a prerequisite for participation.
- The module "Research Project (Methods, second semester)" must be taken in the same semester.

**Remark**

- This module forms a unit with the modules "Research Project (Project, first semester)", "Research Project (Project, second semester)" and "Research Project (Methods, first semester)". In all four modules combined, a uniform student research project is carried out over a period of two semesters.
- This module can be credited either in a specialization or in the elective area. The respective allocation of the projects which are offered for specific specializations is announced at the beginning of the semester.
- This module includes lecture credit points, practical credit points and seminar credit points. The practical part comprises practical scientific work under supervision; the seminar part comprises independent development and (written and oral) presentation of scientific work by others; the lecture part comprises acquisition of foundational knowledge through reading, listening, etc. The distribution of the module's credit points into the different types of credit points will be announced at the beginning of the semester for each project (where the modules "Research Project (Project, first semester)" and "Research Project (Project, second semester)" together amount to at least 5 lecture CPs, at least 3 seminar CPs and at least 3 practical CPs).

**Course Content**

The content of "Research Project" is the guided conduct of a scientific research project. Over a period of two semesters, students work intensively and continuously on the project. As part of the course "Research Project", students acquire both specialist knowledge and methodological skills for scientific work.

The central questions of the projects on which the participants work originate from the research areas of the respective advisor(s). Usually, the project takes place within a current research project, which establishes a strong link between research and teaching.

The focus of the first semester is on planning the project and carrying out the preliminary work. The focus of the second semester is on carrying out the project and presenting the results.

At the end of the course "Research Project" (at the end of the second semester), participants write a scientific paper on the results of their project. This paper should meet the quality standards of a scientific publication and, if possible, be published.

Participation in the course "Research Project" also serves as preparation for a Master's thesis, the scientific nature of which goes beyond the normal level.

In addition to the project work, there are accompanying courses in which competences for scientific and project-oriented work are taught (these are credited as interdisciplinary qualifications; see the modules "Research Project (Methods, first semester)" and "Research Project (Methods, second semester)").

**Workload**

The total workload for this module is 300 hours (the total workload for all four modules of "Research Project" is 720 hours).

The allocation of the workload to the various phases and work steps depends on the project and will be announced at the beginning of the first semester.

**Qualification Goals**

The objective of "Research Project" is to acquire both specialist knowledge and methodological skills in scientific work and to test them on the basis of the students' own project.

After completing all four modules of "Research Project", participants will be able to ...

- carry out a literature search based on a given topic, independently identify, locate, classify, assess and evaluate the relevant literature,
- present and critically discuss the results of the literature research in their own words and with the aid of self-prepared presentation slides to a specialist audience,
- formulate and delimit the content of a research question or research problem, and present the relevance of the question or problem,
- explain the foundations of philosophy of science and relate them to their project,
- discuss the foundation of the used research approach, such as experiment design and experiment implementation, and apply them to their project,
- design, justify, evaluate and classify their own (partial) research approach,
- develop concrete work steps and a project plan from the research question and the research approach,
- determine workloads, coordinate work steps and, if necessary, allocate them in a team,
- identify and analyze risk factors and develop and plan countermeasures,

- identify, plan and carry out the preparatory work required for the project to be carried out,
- work scientifically in the research area of the project,
- know and apply the fundamental contents relevant to the project, and assess their relevance to the research question,
- document, summarize and present their planning and the progress of the project,
- recognize and evaluate progress, and develop and apply control measures,
- name, explain and apply techniques of scientific work and scientific writing,
- plan, prepare and evaluate scientific publications,
- document, summarize and illustrate the project process and results,
- work scientifically in collaboration with others in a team.

**Associated Events**

Information Event "Research Project"

Research Project (Project, first semester)

Research Project (Project, second semester)

Research Project (Methods, first semester)

Research Project (Methods, second semester)

**Organizational issues**

Siehe Bemerkungen. / See remarks.

**T****6.351 Module component: Research Project (Project, 2nd Semester) - Presentation [T-INFO-110222]****Coordinators:** Prof. Dr. Bernhard Beckert**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-105038 - Research Project \(Project, 2nd Semester\)](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 3 CP    | graded  | Each term    | 1       |

| Courses  |         |                                                                         |                                   |                                                                                      |                           |
|----------|---------|-------------------------------------------------------------------------|-----------------------------------|--------------------------------------------------------------------------------------|---------------------------|
| WT 25/26 | 2400070 | <a href="#">Research Project (Project, second semester)</a>             | 6.5 SWS                           | /  | Beckert, Kirsten, Ulbrich |
| ST 2026  | 2400053 | <a href="#">Research Project (Project, second semester)</a>             | 6.5 SWS                           | /  | Beckert, Ulbrich          |
| Exams    |         |                                                                         |                                   |                                                                                      |                           |
| WT 25/26 | 7500077 | <a href="#">Research Project (Project, 2nd Semester) - Presentation</a> | Beckert, Beigl, Reussner, Ulbrich |                                                                                      |                           |
| ST 2026  | 7500132 | <a href="#">Research Project (Project, 2nd Semester) - Presentation</a> | Beckert, Beigl, Reussner          |                                                                                      |                           |

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

Below you will find excerpts from courses related to this module component:

**V****Research Project (Project, second semester)**2400070, WS 25/26, 6.5 SWS, Language: German/English, [Open in study portal](#)**Blended (On-Site/Online)**

**Content****Dates**

The dates will be announced in the beginning of the semester.

**Registration**

Registration for this module is only possible together with registration for the module "Research Project (Project, first semester)"; see the information there.

**Conditions**

- Successful participation in the modules "Research Project (Project, first semester)" and "Research Project (Methods, first semester)" in the preceding semester is a prerequisite for participation.
- The module "Research Project (Methods, second semester)" must be taken in the same semester.

**Remark**

- This module forms a unit with the modules "Research Project (Project, first semester)", "Research Project (Project, second semester)" and "Research Project (Methods, first semester)". In all four modules combined, a uniform student research project is carried out over a period of two semesters.
- This module can be credited either in a specialization or in the elective area. The respective allocation of the projects which are offered for specific specializations is announced at the beginning of the semester.
- This module includes lecture credit points, practical credit points and seminar credit points. The practical part comprises practical scientific work under supervision; the seminar part comprises independent development and (written and oral) presentation of scientific work by others; the lecture part comprises acquisition of foundational knowledge through reading, listening, etc. The distribution of the module's credit points into the different types of credit points will be announced at the beginning of the semester for each project (where the modules "Research Project (Project, first semester)" and "Research Project (Project, second semester)" together amount to at least 5 lecture CPs, at least 3 seminar CPs and at least 3 practical CPs).

**Course Content**

The content of "Research Project" is the guided conduct of a scientific research project. Over a period of two semesters, students work intensively and continuously on the project. As part of the course "Research Project", students acquire both specialist knowledge and methodological skills for scientific work.

The central questions of the projects on which the participants work originate from the research areas of the respective advisor(s). Usually, the project takes place within a current research project, which establishes a strong link between research and teaching.

The focus of the first semester is on planning the project and carrying out the preliminary work. The focus of the second semester is on carrying out the project and presenting the results.

At the end of the course "Research Project" (at the end of the second semester), participants write a scientific paper on the results of their project. This paper should meet the quality standards of a scientific publication and, if possible, be published.

Participation in the course "Research Project" also serves as preparation for a Master's thesis, the scientific nature of which goes beyond the normal level.

In addition to the project work, there are accompanying courses in which competences for scientific and project-oriented work are taught (these are credited as interdisciplinary qualifications; see the modules "Research Project (Methods, first semester)" and "Research Project (Methods, second semester)").

**Workload**

The total workload for this module is 300 hours (the total workload for all four modules of "Research Project" is 720 hours).

The allocation of the workload to the various phases and work steps depends on the project and will be announced at the beginning of the first semester.

**Qualification Goals**

The objective of "Research Project" is to acquire both specialist knowledge and methodological skills in scientific work and to test them on the basis of the students' own project.

After completing all four modules of "Research Project", participants will be able to ...

- carry out a literature search based on a given topic, independently identify, locate, classify, assess and evaluate the relevant literature,
- present and critically discuss the results of the literature research in their own words and with the aid of self-prepared presentation slides to a specialist audience,
- formulate and delimit the content of a research question or research problem, and present the relevance of the question or problem,
- explain the foundations of philosophy of science and relate them to their project,
- discuss the foundation of the used research approach, such as experiment design and experiment implementation, and apply them to their project,
- design, justify, evaluate and classify their own (partial) research approach,
- develop concrete work steps and a project plan from the research question and the research approach,
- determine workloads, coordinate work steps and, if necessary, allocate them in a team,
- identify and analyze risk factors and develop and plan countermeasures,

- identify, plan and carry out the preparatory work required for the project to be carried out,
- work scientifically in the research area of the project,
- know and apply the fundamental contents relevant to the project, and assess their relevance to the research question,
- document, summarize and present their planning and the progress of the project,
- recognize and evaluate progress, and develop and apply control measures,
- name, explain and apply techniques of scientific work and scientific writing,
- plan, prepare and evaluate scientific publications,
- document, summarize and illustrate the project process and results,
- work scientifically in collaboration with others in a team.

**Associated Events**

Information Event "Research Project"

Research Project (Project, first semester)

Research Project (Project, second semester)

Research Project (Methods, first semester)

Research Project (Methods, second semester)

**Organizational issues**

Siehe Bemerkungen. / See remarks.

**Research Project (Project, second semester)**

2400053, SS 2026, 6.5 SWS, Language: German/English, [Open in study portal](#)

**Blended (On-Site/Online)**



**Content****Dates**

The dates will be announced in the beginning of the semester.

**Registration**

Registration for this module is only possible together with registration for the module "Research Project (Project, first semester)"; see the information there.

**Conditions**

- Successful participation in the modules "Research Project (Project, first semester)" and "Research Project (Methods, first semester)" in the preceding semester is a prerequisite for participation.
- The module "Research Project (Methods, second semester)" must be taken in the same semester.

**Remark**

- This module forms a unit with the modules "Research Project (Project, first semester)", "Research Project (Project, second semester)" and "Research Project (Methods, first semester)". In all four modules combined, a uniform student research project is carried out over a period of two semesters.
- This module can be credited either in a specialization or in the elective area. The respective allocation of the projects which are offered for specific specializations is announced at the beginning of the semester.
- This module includes lecture credit points, practical credit points and seminar credit points. The practical part comprises practical scientific work under supervision; the seminar part comprises independent development and (written and oral) presentation of scientific work by others; the lecture part comprises acquisition of foundational knowledge through reading, listening, etc. The distribution of the module's credit points into the different types of credit points will be announced at the beginning of the semester for each project (where the modules "Research Project (Project, first semester)" and "Research Project (Project, second semester)" together amount to at least 5 lecture CPs, at least 3 seminar CPs and at least 3 practical CPs).

**Course Content**

The content of "Research Project" is the guided conduct of a scientific research project. Over a period of two semesters, students work intensively and continuously on the project. As part of the course "Research Project", students acquire both specialist knowledge and methodological skills for scientific work.

The central questions of the projects on which the participants work originate from the research areas of the respective advisor(s). Usually, the project takes place within a current research project, which establishes a strong link between research and teaching.

The focus of the first semester is on planning the project and carrying out the preliminary work. The focus of the second semester is on carrying out the project and presenting the results.

At the end of the course "Research Project" (at the end of the second semester), participants write a scientific paper on the results of their project. This paper should meet the quality standards of a scientific publication and, if possible, be published.

Participation in the course "Research Project" also serves as preparation for a Master's thesis, the scientific nature of which goes beyond the normal level.

In addition to the project work, there are accompanying courses in which competences for scientific and project-oriented work are taught (these are credited as interdisciplinary qualifications; see the modules "Research Project (Methods, first semester)" and "Research Project (Methods, second semester)").

**Workload**

The total workload for this module is 300 hours (the total workload for all four modules of "Research Project" is 720 hours).

The allocation of the workload to the various phases and work steps depends on the project and will be announced at the beginning of the first semester.

**Qualification Goals**

The objective of "Research Project" is to acquire both specialist knowledge and methodological skills in scientific work and to test them on the basis of the students' own project.

After completing all four modules of "Research Project", participants will be able to ...

- carry out a literature search based on a given topic, independently identify, locate, classify, assess and evaluate the relevant literature,
- present and critically discuss the results of the literature research in their own words and with the aid of self-prepared presentation slides to a specialist audience,
- formulate and delimit the content of a research question or research problem, and present the relevance of the question or problem,
- explain the foundations of philosophy of science and relate them to their project,
- discuss the foundation of the used research approach, such as experiment design and experiment implementation, and apply them to their project,
- design, justify, evaluate and classify their own (partial) research approach,
- develop concrete work steps and a project plan from the research question and the research approach,
- determine workloads, coordinate work steps and, if necessary, allocate them in a team,
- identify and analyze risk factors and develop and plan countermeasures,

- identify, plan and carry out the preparatory work required for the project to be carried out,
- work scientifically in the research area of the project,
- know and apply the fundamental contents relevant to the project, and assess their relevance to the research question,
- document, summarize and present their planning and the progress of the project,
- recognize and evaluate progress, and develop and apply control measures,
- name, explain and apply techniques of scientific work and scientific writing,
- plan, prepare and evaluate scientific publications,
- document, summarize and illustrate the project process and results,
- work scientifically in collaboration with others in a team.

**Associated Events**

Information Event "Research Project"

Research Project (Project, first semester)

Research Project (Project, second semester)

Research Project (Methods, first semester)

Research Project (Methods, second semester)

**Organizational issues**

Siehe Bemerkungen. / See remarks.

**T****6.352 Module component: Research Project (Project, 2nd Semester) - Scientific Report [T-INFO-110223]****Coordinators:** Prof. Dr. Bernhard Beckert**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-105038 - Research Project \(Project, 2nd Semester\)](#)**Type**  
Examination of another type**Credits**  
4 CP**Grading**  
graded**Term offered**  
Each term**Version**  
1

| Courses  |         |                                                                              |         |                                                                                      |                                   |
|----------|---------|------------------------------------------------------------------------------|---------|--------------------------------------------------------------------------------------|-----------------------------------|
| WT 25/26 | 2400070 | <a href="#">Research Project (Project, second semester)</a>                  | 6.5 SWS | /  | Beckert, Kirsten, Ulbrich         |
| ST 2026  | 2400053 | <a href="#">Research Project (Project, second semester)</a>                  | 6.5 SWS | /  | Beckert, Ulbrich                  |
| Exams    |         |                                                                              |         |                                                                                      |                                   |
| WT 25/26 | 7500078 | <a href="#">Research Project (Project, 2nd Semester) - Written Exam</a>      |         |                                                                                      | Beckert, Beigl, Reussner, Ulbrich |
| ST 2026  | 7500133 | <a href="#">Research Project (Project, 2nd Semester) - Scientific Report</a> |         |                                                                                      | Beckert, Beigl, Reussner          |

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

Below you will find excerpts from courses related to this module component:

**V****Research Project (Project, second semester)**2400070, WS 25/26, 6.5 SWS, Language: German/English, [Open in study portal](#)**Blended (On-Site/Online)**

**Content****Dates**

The dates will be announced in the beginning of the semester.

**Registration**

Registration for this module is only possible together with registration for the module "Research Project (Project, first semester)"; see the information there.

**Conditions**

- Successful participation in the modules "Research Project (Project, first semester)" and "Research Project (Methods, first semester)" in the preceding semester is a prerequisite for participation.
- The module "Research Project (Methods, second semester)" must be taken in the same semester.

**Remark**

- This module forms a unit with the modules "Research Project (Project, first semester)", "Research Project (Project, second semester)" and "Research Project (Methods, first semester)". In all four modules combined, a uniform student research project is carried out over a period of two semesters.
- This module can be credited either in a specialization or in the elective area. The respective allocation of the projects which are offered for specific specializations is announced at the beginning of the semester.
- This module includes lecture credit points, practical credit points and seminar credit points. The practical part comprises practical scientific work under supervision; the seminar part comprises independent development and (written and oral) presentation of scientific work by others; the lecture part comprises acquisition of foundational knowledge through reading, listening, etc. The distribution of the module's credit points into the different types of credit points will be announced at the beginning of the semester for each project (where the modules "Research Project (Project, first semester)" and "Research Project (Project, second semester)" together amount to at least 5 lecture CPs, at least 3 seminar CPs and at least 3 practical CPs).

**Course Content**

The content of "Research Project" is the guided conduct of a scientific research project. Over a period of two semesters, students work intensively and continuously on the project. As part of the course "Research Project", students acquire both specialist knowledge and methodological skills for scientific work.

The central questions of the projects on which the participants work originate from the research areas of the respective advisor(s). Usually, the project takes place within a current research project, which establishes a strong link between research and teaching.

The focus of the first semester is on planning the project and carrying out the preliminary work. The focus of the second semester is on carrying out the project and presenting the results.

At the end of the course "Research Project" (at the end of the second semester), participants write a scientific paper on the results of their project. This paper should meet the quality standards of a scientific publication and, if possible, be published.

Participation in the course "Research Project" also serves as preparation for a Master's thesis, the scientific nature of which goes beyond the normal level.

In addition to the project work, there are accompanying courses in which competences for scientific and project-oriented work are taught (these are credited as interdisciplinary qualifications; see the modules "Research Project (Methods, first semester)" and "Research Project (Methods, second semester)").

**Workload**

The total workload for this module is 300 hours (the total workload for all four modules of "Research Project" is 720 hours).

The allocation of the workload to the various phases and work steps depends on the project and will be announced at the beginning of the first semester.

**Qualification Goals**

The objective of "Research Project" is to acquire both specialist knowledge and methodological skills in scientific work and to test them on the basis of the students' own project.

After completing all four modules of "Research Project", participants will be able to ...

- carry out a literature search based on a given topic, independently identify, locate, classify, assess and evaluate the relevant literature,
- present and critically discuss the results of the literature research in their own words and with the aid of self-prepared presentation slides to a specialist audience,
- formulate and delimit the content of a research question or research problem, and present the relevance of the question or problem,
- explain the foundations of philosophy of science and relate them to their project,
- discuss the foundation of the used research approach, such as experiment design and experiment implementation, and apply them to their project,
- design, justify, evaluate and classify their own (partial) research approach,
- develop concrete work steps and a project plan from the research question and the research approach,
- determine workloads, coordinate work steps and, if necessary, allocate them in a team,
- identify and analyze risk factors and develop and plan countermeasures,

- identify, plan and carry out the preparatory work required for the project to be carried out,
- work scientifically in the research area of the project,
- know and apply the fundamental contents relevant to the project, and assess their relevance to the research question,
- document, summarize and present their planning and the progress of the project,
- recognize and evaluate progress, and develop and apply control measures,
- name, explain and apply techniques of scientific work and scientific writing,
- plan, prepare and evaluate scientific publications,
- document, summarize and illustrate the project process and results,
- work scientifically in collaboration with others in a team.

#### Associated Events

Information Event "Research Project"

Research Project (Project, first semester)

Research Project (Project, second semester)

Research Project (Methods, first semester)

Research Project (Methods, second semester)

#### Organizational issues

Siehe Bemerkungen. / See remarks.



#### Research Project (Project, second semester)

2400053, SS 2026, 6.5 SWS, Language: German/English, [Open in study portal](#)

Blended (On-Site/Online)

**Content****Dates**

The dates will be announced in the beginning of the semester.

**Registration**

Registration for this module is only possible together with registration for the module "Research Project (Project, first semester)"; see the information there.

**Conditions**

- Successful participation in the modules "Research Project (Project, first semester)" and "Research Project (Methods, first semester)" in the preceding semester is a prerequisite for participation.
- The module "Research Project (Methods, second semester)" must be taken in the same semester.

**Remark**

- This module forms a unit with the modules "Research Project (Project, first semester)", "Research Project (Project, second semester)" and "Research Project (Methods, first semester)". In all four modules combined, a uniform student research project is carried out over a period of two semesters.
- This module can be credited either in a specialization or in the elective area. The respective allocation of the projects which are offered for specific specializations is announced at the beginning of the semester.
- This module includes lecture credit points, practical credit points and seminar credit points. The practical part comprises practical scientific work under supervision; the seminar part comprises independent development and (written and oral) presentation of scientific work by others; the lecture part comprises acquisition of foundational knowledge through reading, listening, etc. The distribution of the module's credit points into the different types of credit points will be announced at the beginning of the semester for each project (where the modules "Research Project (Project, first semester)" and "Research Project (Project, second semester)" together amount to at least 5 lecture CPs, at least 3 seminar CPs and at least 3 practical CPs).

**Course Content**

The content of "Research Project" is the guided conduct of a scientific research project. Over a period of two semesters, students work intensively and continuously on the project. As part of the course "Research Project", students acquire both specialist knowledge and methodological skills for scientific work.

The central questions of the projects on which the participants work originate from the research areas of the respective advisor(s). Usually, the project takes place within a current research project, which establishes a strong link between research and teaching.

The focus of the first semester is on planning the project and carrying out the preliminary work. The focus of the second semester is on carrying out the project and presenting the results.

At the end of the course "Research Project" (at the end of the second semester), participants write a scientific paper on the results of their project. This paper should meet the quality standards of a scientific publication and, if possible, be published.

Participation in the course "Research Project" also serves as preparation for a Master's thesis, the scientific nature of which goes beyond the normal level.

In addition to the project work, there are accompanying courses in which competences for scientific and project-oriented work are taught (these are credited as interdisciplinary qualifications; see the modules "Research Project (Methods, first semester)" and "Research Project (Methods, second semester)").

**Workload**

The total workload for this module is 300 hours (the total workload for all four modules of "Research Project" is 720 hours).

The allocation of the workload to the various phases and work steps depends on the project and will be announced at the beginning of the first semester.

**Qualification Goals**

The objective of "Research Project" is to acquire both specialist knowledge and methodological skills in scientific work and to test them on the basis of the students' own project.

After completing all four modules of "Research Project", participants will be able to ...

- carry out a literature search based on a given topic, independently identify, locate, classify, assess and evaluate the relevant literature,
- present and critically discuss the results of the literature research in their own words and with the aid of self-prepared presentation slides to a specialist audience,
- formulate and delimit the content of a research question or research problem, and present the relevance of the question or problem,
- explain the foundations of philosophy of science and relate them to their project,
- discuss the foundation of the used research approach, such as experiment design and experiment implementation, and apply them to their project,
- design, justify, evaluate and classify their own (partial) research approach,
- develop concrete work steps and a project plan from the research question and the research approach,
- determine workloads, coordinate work steps and, if necessary, allocate them in a team,
- identify and analyze risk factors and develop and plan countermeasures,

- identify, plan and carry out the preparatory work required for the project to be carried out,
- work scientifically in the research area of the project,
- know and apply the fundamental contents relevant to the project, and assess their relevance to the research question,
- document, summarize and present their planning and the progress of the project,
- recognize and evaluate progress, and develop and apply control measures,
- name, explain and apply techniques of scientific work and scientific writing,
- plan, prepare and evaluate scientific publications,
- document, summarize and illustrate the project process and results,
- work scientifically in collaboration with others in a team.

#### **Associated Events**

Information Event "Research Project"

Research Project (Project, first semester)

Research Project (Project, second semester)

Research Project (Methods, first semester)

Research Project (Methods, second semester)

#### **Organizational issues**

Siehe Bemerkungen. / See remarks.

**T****6.353 Module component: Research Project Autonomous Learning Robots [T-INFO-110861]****Coordinators:** Prof. Dr. Gerhard Neumann**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-105378 - Research Project Autonomous Learning Robots](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 6 CP    | Graded  | Each summer term | 1       |

| Courses |         |                                                                |       |                                                                                                        |         |
|---------|---------|----------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------|---------|
| ST 2026 | 2400112 | <a href="#">Research Laboratory Autonomous Learning Robots</a> | 4 SWS | Practical course /  | Neumann |

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

- The discussed algorithms have to be implemented successfully.
- The experiments need to be conducted scientifically and need to be well documented.
- The final report is well written and well structured

Below you will find excerpts from courses related to this module component:

**V****Research Laboratory Autonomous Learning Robots**2400112, SS 2026, 4 SWS, Language: German/English, [Open in study portal](#)**Practical course (P)  
On-Site****Content****Inhalt**

Each student has to choose one of the offered topics from the area of robot learning / reinforcement learning / imitation learning or deep learning for robotics. The students will conduct a literature survey to acquire an understanding of the field and then implement one or several algorithms. The algorithms need to be evaluated against available baselines on standard benchmark tasks as well as on (custom-made) physically realistic simulations and/or a real robot platform. The experiments have to be documented in a report

Experience in Machine Learning is recommended

**Organizational issues**

Ein Rücktritt ist innerhalb von zwei Wochen nach Vergabe des Themas möglich.

Arbeitsaufwand 180h



**T****6.354 Module component: Research Project Deep Learning for Robotics [T-INFO-114203]**

**Coordinators:** Prof. Dr. Gerhard Neumann  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-107174 - Research Project Deep Learning for Robotics](#)

**Type**  
Examination of another type

**Credits**  
6 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
1

| Courses  |         |                                                             |       |                                                                                                        |         |
|----------|---------|-------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------|---------|
| WT 25/26 | 2400091 | <a href="#">Deep Learning for Robotics</a>                  | 4 SWS | Practical course /  | Neumann |
| Exams    |         |                                                             |       |                                                                                                        |         |
| WT 25/26 | 7500305 | <a href="#">Research Project Deep Learning for Robotics</a> |       |                                                                                                        | Neumann |

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

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

It is only possible to resign within two weeks after assignment of the topic.

Es müssen eine schriftliche Ausarbeitung erstellt und eine Präsentation gehalten werden.

- The discussed algorithms have to be implemented successfully.
- The experiments need to be conducted scientifically and need to be well documented.
- The final report is well written and well structured
- The final presentation is well prepared

**Prerequisites**

None.

**Recommendations**

- Experience in Machine Learning is recommended.
- Python experience is recommended
- We will use the PyTorch deep learning library. Some prior knowledge in this is helpful but not necessary.

*Below you will find excerpts from courses related to this module component:*

**V****Deep Learning for Robotics**

2400091, WS 25/26, 4 SWS, Language: English, [Open in study portal](#)

**Practical course (P)**  
**On-Site**

**Content**

Each student has to choose one of the offered topics from the area of deep learning / robot learning / deep reinforcement learning / deep imitation learning.

The students need to implement one or several algorithms and evaluate them against available baselines on standard benchmark tasks as well as on (custom-made) physically realistic simulations and/or a real robot platform.

The experiments have to be documented in a report.

Students will work in teams of 2.

**It is recommended to take this course together with the seminar “Deep learning for robotics” where the students will acquire the required background on the literature.**

**Organizational issues**

Arbeitsaufwand: 180h

Präsenzzeit: 15h

Projektarbeit: 135h

Report schreiben + Präsentation vorbereiten: 30h

[Ein Rücktritt ist innerhalb von zwei Wochen nach Vergabe des Themas möglich.](#)

[Weitere Infos in ILIAS](#)

**T****6.355 Module component: Research Project: Generative AI for Autonomous Agents [T-INFO-114189]****Coordinators:** Prof. Dr. Gerhard Neumann**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107163 - Research Project: Generative AI for Autonomous Agents](#)

| Type                        | Credits | Grading        | Term offered     | Version |
|-----------------------------|---------|----------------|------------------|---------|
| Examination of another type | 6 CP    | Grading graded | Each summer term | 1       |

| Courses |         |                                                                       |       |                                                                                                        |         |
|---------|---------|-----------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------|---------|
| ST 2026 | 2400049 | <a href="#">Research Project: Generative AI for Autonomous Agents</a> | 4 SWS | Practical course /  | Neumann |

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

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

- The discussed algorithms have to be implemented successfully.
- The experiments need to be conducted scientifically and need to be well documented.
- The final report is well written and well structured
- The final presentation is well prepared

**Prerequisites**

None.

**Recommendations**

- Experience in Machine Learning is recommended.
- Python experience is recommended
- We will use the PyTorch deep learning library. Some prior knowledge in this is helpful but not necessary.

Below you will find excerpts from courses related to this module component:

**V****Research Project: Generative AI for Autonomous Agents**2400049, SS 2026, 4 SWS, Language: German/English, [Open in study portal](#)**Practical course (P)  
On-Site****Content****Organizational issues**[KIT-Fakultät für Informatik/1. Informatik Lehrveranstaltungen/1.8 Praktika](#)

## T

**6.356 Module component: Research Project: Machine Learning for Autonomous Agents and Decision Making [T-INFO-113765]****Coordinators:** Prof. Dr. Gerhard Neumann**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106871 - Research Project: Machine Learning for Autonomous Agents and Decision Making](#)**Type**  
Examination of another type**Credits**  
6 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
1

| Courses  |         |                                                                                              |       |                  |         |
|----------|---------|----------------------------------------------------------------------------------------------|-------|------------------|---------|
| WT 25/26 | 2400240 | <a href="#">Machine Learning for Autonomous Agents and Decision Making</a>                   | 4 SWS | Practical course | Neumann |
| Exams    |         |                                                                                              |       |                  |         |
| WT 25/26 | 7500364 | <a href="#">Research Project: Machine Learning for Autonomous Agents and Decision Making</a> |       |                  | Neumann |

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

- The discussed algorithms have to be implemented successfully.
- The experiments need to be conducted scientifically and need to be well documented.
- The final report is well written and well structured
- The final presentation is well prepared

**Prerequisites**

None.

**Recommendations**

- Experience in Machine Learning is recommended.
- Python experience is recommended
- We will use the PyTorch deep learning library. Some prior knowledge in this is helpful but not necessary.

**T****6.357 Module component: Research Seminar in Selected Topics in Statistical Learning and Data Science [T-INFO-113674]****Coordinators:** Prof. Dr. Nadja Klein**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106813 - Research Seminar in Selected Topics in Statistical Learning and Data Science](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 3 CP    | graded  | Irregular    | 1       |

| Courses |          |                                                                                              |       |                                                                                               |       |
|---------|----------|----------------------------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|-------|
| ST 2026 | 24106813 | <a href="#">Research Seminar in Selected Topics in Statistical Learning and Data Science</a> | 2 SWS | Seminar /  | Klein |

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

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

Elaboration of the topic and presentation on the chosen topic at the end of the semester.

**Prerequisites**

Knowledge in Bayesian methods, uncertainty quantification and statistical learning or related methods for big data

**Recommendations**

Certified knowledge in Bayesian methods, uncertainty quantification and statistical learning or related methods for big data

*Below you will find excerpts from courses related to this module component:***V****Research Seminar in Selected Topics in Statistical Learning and Data Science**24106813, SS 2026, 2 SWS, Language: English, [Open in study portal](#)**Seminar (S)  
Blended (On-Site/Online)****Content**

Welcome to the Research Seminar in Selected Topics in Statistical Learning and Data Science!

The seminar will focus on methods for Bayesian computation.

**REGISTRATION:** Please send an informal email asking for registration with your certificate of "Advanced Bayesian Data Analysis" or an equivalent course with a grade of 3.7 or better to: guillermo . briseno-sanchez at kit edu

You will receive a decision regarding your registration to the seminar shortly afterward.

Please keep in mind that **registration closes on March 14, 2025.**

## T

**6.358 Module component: Responsible Artificial Intelligence [T-WIWI-111385]**

**Coordinators:** Dr. Rainer Hoffmann  
Prof. Dr. Jella Pfeiffer

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

**Part of:** [M-WIWI-103117 - Data Science: Data-Driven Information Systems](#)  
[M-WIWI-103118 - Data Science: Data-Driven User Modeling](#)  
[M-WIWI-105923 - Incentives, Interactivity & Decisions in Organizations](#)  
[M-WIWI-107530 - Information Systems: AI & Data Science](#)  
[M-WIWI-107601 - Ethics of Information Technology](#)

| Type                | Credits | Grading | Term offered     | Version |
|---------------------|---------|---------|------------------|---------|
| Written examination | 4,5 CP  | Graded  | Each winter term | 2       |

| Courses  |         |                                                                   |       |                                                                                                         |                              |
|----------|---------|-------------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------|------------------------------|
| WT 25/26 | 2545164 | <a href="#">Responsible Artificial Intelligence</a>               | 3 SWS | Lecture / Practice /  | Hoffmann, Gutschow, Bennardo |
| Exams    |         |                                                                   |       |                                                                                                         |                              |
| WT 25/26 | 7900031 | <a href="#">Responsible Artificial Intelligence</a>               |       |                                                                                                         | Pfeiffer                     |
| ST 2026  | 7900038 | <a href="#">Responsible Artificial Intelligence (Nachklausur)</a> |       |                                                                                                         | Pfeiffer                     |

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

### Assessment

The assessment consists of a written exam (60 min.) according to § 4 paragraph 2 Nr. 1 of the examination regulation.

### Prerequisites

Prior to the start of the lecture, introductory materials will be provided for self-study. The lecture has a limitation of participants. Therefore, prior registration via the Wiwi-Portal is mandatory.

### Additional Information

Can a technology really be trustworthy or even responsible? Since the success of LLMs at the latest, this question has been increasingly asked in society. With the increasing use of artificial intelligence, terms such as "Trustworthy AI", "Responsible AI" or "Ethical AI" are therefore gaining in importance. But what exactly is behind them? Technology is only ever used by people for specific purposes. So if we want to "trust" an AI solution, we need to understand how the people and organizations involved develop AI responsibly. According to the European Commission's HLEG AI, trustworthy AI must be lawful, ethical and robust.

This lecture sheds light on all these areas and thus provides an answer to the question of what a responsible and thus sustainable approach to AI can look like. After an introduction to AI and data, various approaches will be discussed with which actions and technology applications can be morally evaluated. The aim of this ethical reflection is to find out what we should do with AI instead of limiting ourselves to what we can do with AI.

In the context of robustness, vulnerabilities of AI and measures to address them will be discussed. The lecture will cover other topics such as bias, adversarial attacks, transparency, privacy and human-computer interaction. Current developments in regulatory requirements at European level will also be discussed. Guest lectures and continuous insights into business practice complement the foundations laid.

After successfully completing the course, students should be able

- to classify and evaluate the scientific discussion on ethics in artificial intelligence systems,
- understand the concept of trust and responsibility in the context of artificial intelligence and apply the relevant knowledge to change processes in companies,
- shape the social and entrepreneurial discussion on the use of AI themselves and
- know the legal requirements for AI and implement them in the corporate context.

### Workload

135 hours

*Below you will find excerpts from courses related to this module component:*

**Responsible Artificial Intelligence**2545164, WS 25/26, 3 SWS, Language: German, [Open in study portal](#)**Lecture / Practice (VÜ)  
On-Site****Content**

Can a technology really be trustworthy or even responsible? Since the success of LLMs at the latest, this question has been increasingly asked in society. With the increasing use of artificial intelligence, terms such as "Trustworthy AI", "Responsible AI" or "Ethical AI" are therefore gaining in importance. But what exactly is behind them? Technology is only ever used by people for specific purposes. So if we want to "trust" an AI solution, we need to understand how the people and organizations involved develop AI responsibly. According to the European Commission's HLEG AI, trustworthy AI must be lawful, ethical and robust.

This lecture sheds light on all these areas and thus provides an answer to the question of what a responsible and thus sustainable approach to AI can look like. After an introduction to AI and **data**, various approaches will be discussed with which actions and technology applications can be morally evaluated. The aim of this ethical reflection is to find out what we should do with AI instead of limiting ourselves to what we can do with AI.

In the context of robustness, vulnerabilities of AI and measures to address them will be discussed. The lecture will cover other topics such as bias, adversarial attacks, transparency, privacy and human-computer interaction. Current developments in regulatory requirements at European level will also be discussed. Guest lectures and continuous insights into business practice complement the foundations laid.

**After successfully completing the course, students should be able to:**

- classify and evaluate the scientific discussion on ethics in artificial intelligence systems,
- understand the concept of trust and responsibility in the context of artificial intelligence and apply the relevant knowledge to change processes in companies,
- shape the social and entrepreneurial discussion on the use of AI themselves and
- know the legal requirements for AI and implement them in the corporate context.

**Organizational issues**

Die Vorlesung und die Übung wechseln sich im zweiwöchentlichen Rhythmus ab: In den Vorlesungswochen liegt die Veranstaltung von 15:45 – 19:00 Uhr (2 SWS), in den Übungswochen von 15:45 – 17:15 Uhr (1 SWS).

Die Übung findet planmäßig online statt.

## T

**6.359 Module component: Risk Management in Industrial Supply Networks [T-WIWI-102826]**

**Coordinators:** Prof. Dr. Frank Schultmann  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101412 - Industrial Production III](#)  
[M-WIWI-101471 - Industrial Production II](#)

| Type                | Credits | Grading | Term offered     | Version |
|---------------------|---------|---------|------------------|---------|
| Written examination | 3,5 CP  | Graded  | Each winter term | 1       |

| Courses  |         |                                                               |       |                                                                                               |                       |
|----------|---------|---------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|-----------------------|
| WT 25/26 | 2581992 | <a href="#">Risk Management in Industrial Supply Networks</a> | 2 SWS | Lecture /  | Schultmann, Rosenberg |
| Exams    |         |                                                               |       |                                                                                               |                       |
| WT 25/26 | 7981992 | <a href="#">Risk Management in Industrial Supply Networks</a> |       |                                                                                               | Schultmann            |
| ST 2026  | 7981992 | <a href="#">Risk Management in Industrial Supply Networks</a> |       |                                                                                               | Schultmann            |

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

**Assessment**

The assessment consists of an oral (30 minutes) or 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.

**Prerequisites**

None

**Recommendations**

None

Below you will find excerpts from courses related to this module component:

## V

**Risk Management in Industrial Supply Networks**

2581992, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
On-Site

**Content**

Students learn methods and tools to manage risks in complex and dynamically evolving supply chain networks. In the first part of the lectures, students are introduced to the key terms and concepts of risk management and decision theory for industrial application. Based on the theoretic prerequisites, students are able to determine and analyze risk diversification, risk pooling and insurance mechanisms in supply chain network management. Lastly the lectures cover the differences and connection between risk management and resilience in industrial networks.

**Literature**

Wird in der Veranstaltung bekannt gegeben.



## T

**6.360 Module component: Robotics I - Introduction to Robotics [T-INFO-114190]**

**Coordinators:** Prof. Dr.-Ing. Tamim Asfour  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-107162 - Robotics I - Introduction to Robotics](#)

**Type**  
Written examination

**Credits**  
6 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
1

| Courses  |         |                                                       |       |                                                                                               |                 |
|----------|---------|-------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|-----------------|
| WT 25/26 | 2424152 | <a href="#">Robotics I - Introduction to Robotics</a> | 4 SWS | Lecture /  | Asfour, Mombaur |
| Exams    |         |                                                       |       |                                                                                               |                 |
| WT 25/26 | 7500106 | <a href="#">Robotics I - Introduction to Robotics</a> |       |                                                                                               | Asfour          |
| ST 2026  | 7500218 | <a href="#">Robotics I - Introduction to Robotics</a> |       |                                                                                               | Asfour          |

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

**Assessment**

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 120 minutes.

**Prerequisites**

none.

Below you will find excerpts from courses related to this module component:

## V

**Robotics I - Introduction to Robotics**

2424152, WS 25/26, 4 SWS, Language: English, [Open in study portal](#)

**Lecture (V)**  
On-Site

**Content**

The lecture provides an overview of the fundamentals of robotics using the examples of industrial robots, service robots and autonomous humanoid robots. An insight into all relevant topics is given. This includes methods and algorithms for robot modeling, control and motion planning, image processing and robot programming. First, mathematical basics and methods for kinematic and dynamic robot modeling, trajectory planning and control as well as algorithms for collision-free motion planning and grasp planning are covered. Subsequently, basics of image processing, intuitive robot programming especially by human demonstration and symbolic planning are presented.

In the exercise, the theoretical contents of the lecture are further illustrated with examples. Students deepen their knowledge of the methods and algorithms by independently working on problems and discussing them in the exercise. In particular, students can gain practical programming experience with tools and software libraries commonly used in robotics.

**Workload:**

Lecture with 3 SWS + 1 SWS Tutorial, 6 LP

6 LP corresponds to 180 hours, including

15 \* 3 = 45 hours attendance time (lecture)

15 \* 1 = 15 hours attendance time (tutorial)

15 \* 6 = 90 hours self-study and exercise sheets

30 hours preparation for the exam

**Competency Goals:**

The students are able to apply the presented concepts to simple and realistic tasks from robotics. This includes mastering and deriving the mathematical concepts relevant for robot modeling. Furthermore, the students master the kinematic and dynamic modeling of robot systems, as well as the modeling and design of simple controllers. The students know the algorithmic basics of motion and grasp planning and can apply these algorithms to problems in robotics. They know algorithms from the field of image processing and are able to apply them to problems in robotics. They are able to model and solve tasks as a symbolic planning problem. The students have knowledge about intuitive programming procedures for robots and know procedures for programming and learning by demonstration.

**Organizational issues**

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) usually lasting 120 minutes.

**Module for the bachelor and master courses in Informatics, Mechanical Engineering, Mechatronics and Information Technology, Electrical Engineering and Information Technology**

**Literature****Additional literature:**

Fu, Gonzalez, Lee: Robotics - Control, Sensing, Vision, and Intelligence

Russel, Norvig: Artificial Intelligence - A Modern Approach, 2nd. Ed.

## T

**6.361 Module component: Robotics II - Humanoid Robotics [T-INFO-114152]**

**Coordinators:** Prof. Dr.-Ing. Tamim Asfour  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-107123 - Robotics II - Humanoid Robotics](#)

**Type**  
Written examination

**Credits**  
3 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
1

| Courses  |         |                                                |       |                                                                                               |        |
|----------|---------|------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|--------|
| ST 2026  | 2400074 | <a href="#">Robotics II: Humanoid Robotics</a> | 2 SWS | Lecture /  | Asfour |
| Exams    |         |                                                |       |                                                                                               |        |
| WT 25/26 | 7500211 | <a href="#">Robotics II: Humanoid Robotics</a> |       |                                                                                               | Asfour |
| ST 2026  | 7500086 | <a href="#">Robotics II: Humanoid Robotics</a> |       |                                                                                               | Asfour |

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

**Assessment**

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 60 minutes.

**Prerequisites**

- M-INFO-100816 - Robotics II - Learning and planning robots Module must not have been started.
- T-INFO-101391 - Anthropomatics: Humanoid Robotics Partial work must not have been started.

**Recommendations**

Having visited the lecture on Robotics I – Introduction to Robotics is recommended

*Below you will find excerpts from courses related to this module component:*

## V

**Robotics II: Humanoid Robotics**

2400074, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

**Lecture (V)**  
On-Site

**Content**

This lecture addresses the implementation of complex sensorimotor and cognitive abilities in humanoid robots, with humans serving as inspiration. The lecture begins by addressing the motivation for humanoid robotics.

The history of humanoid robotics and biomechanical models of the human body that inform robot design are covered, along with some mechatronic principles underlying humanoid robot systems.

The first main topic comprehensively addresses grasping and manipulation. After covering fundamentals, the lecture discusses neuroscientific insights and concepts like grasp phases and grasping synergies to reduce control complexity. Taxonomies are presented as structured frameworks for understanding the space of possible constraints in grasping and manipulation. The lecture addresses computational approaches for grasping known, familiar, and unknown objects, covering both classical methods and modern learning-based approaches using deep learning and vision-language-action models.

The second main topic covers learning from demonstration and imitation learning. After introducing the topic, fundamentals are presented including the learning from demonstration cycle. The lecture emphasizes learning task models on both symbolic/semantic and subsymbolic/sensorimotor levels. While methods for capturing human demonstrations are briefly covered, the focus is on semantic segmentation of human demonstrations and learning of task constraints that capture the task and allow generalization. Movement primitives are presented as efficient representations that allow robots to generalize learned behaviors to new situations.

The lecture concludes with cognitive and AI-based architectures for humanoid robots, discussing state-of-the-art approaches, methods to address the signal-to-symbol gap, and human-inspired memory architectures that enable intelligent robot behavior.

**Learning Objectives:**

Students can explain the challenges and goals of humanoid robotics research, particularly regarding the implementation of complex sensorimotor and cognitive abilities in humanoid robots. They are familiar with the history of the field and understand how biomechanical models of the human body inform humanoid robot design.

Students have comprehensive knowledge of human and robotic grasping and manipulation. They can analyze human grasping and manipulation strategies, understand taxonomies, and evaluate different computational approaches for grasping and manipulation. They understand the challenges in transferring concepts from human studies to humanoid robots.

Students understand fundamentals of learning from human demonstration and imitation learning. They can explain the learning from demonstration cycle and methods for learning generalized task representation, especially task constraints from demonstrations, and how learned behaviors are reproduced on robots.

Students can describe cognitive and AI-based architectures for humanoid robots, including approaches to address the signal-to-symbol gap and human-inspired memory architectures that enable intelligent robot behavior.

**Organizational issues**

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) of, in general, 60 minutes.

**Recommendations**

Having visited the lectures on *Robotics I – Introduction to Robotics* is recommended.

**Workload:**

90 h

- approx. 15 \* 2 h = 30 h attendance time
- approx. 15 \* 2 h = 30 h self-study prior/after the lecture
- approx. 30 h preparation for the exam and exam itself

**Literature****Additional literature**

Scientific publications on the topic are made available on the lecture website.

**T****6.362 Module component: Robotics III - Sensors and Perception in Robotics [T-INFO-114155]****Coordinators:** Prof. Dr.-Ing. Tamim Asfour**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107130 - Robotics III - Sensors and Perception in Robotics](#)**Type**  
Written examination**Credits**  
3 CP**Grading**  
graded**Term offered**  
Each summer term**Version**  
1

| Courses  |         |                                                                   |       |                                                                                               |                 |
|----------|---------|-------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|-----------------|
| ST 2026  | 2400067 | <a href="#">Robotics III: Sensors and Perception in Robotics</a>  | 2 SWS | Lecture /  | Asfour, Triebel |
| Exams    |         |                                                                   |       |                                                                                               |                 |
| WT 25/26 | 7500207 | <a href="#">Robotics III - Sensors and Perception in Robotics</a> |       |                                                                                               | Asfour          |
| ST 2026  | 7500242 | <a href="#">Robotics III - Sensors and Perception in Robotics</a> |       |                                                                                               | Asfour          |

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

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 60 minutes.

**Prerequisites**

none.

**Recommendations**

Having visited the lectures on Robotics I – Introduction to Robotics is recommended.

Below you will find excerpts from courses related to this module component:

**V****Robotics III: Sensors and Perception in Robotics**2400067, SS 2026, 2 SWS, Language: English, [Open in study portal](#)**Lecture (V)**  
On-Site

**Content**

This lecture complements the lecture “Robotics I” and provides a comprehensive overview of sensors and perception methods in robotics. It is divided into two main parts.

The first part introduces fundamental concepts of perception in robotics, including the distinction between sensation and perception within the perception-cognition-action loop. It covers sensor fundamentals, such as sensor characteristics (resolution, range, accuracy, bandwidth), analog-to-digital conversion, and common sensor classification schemes. Proprioceptive sensors for measuring the robot's internal state are discussed, including encoders (optical, magnetic, absolute, and incremental), force/torque sensors, and inertial measurement units (IMUs). The lecture then covers exteroceptive sensors, including proximity sensors, range sensors (LiDAR, time-of-flight cameras, ultrasonic sensors), visual sensors (monocular, stereo, RGB-D cameras), and tactile sensing technologies (capacitive, resistive, and optical).

The second part focuses on processing and interpreting sensor data. Topics in robot vision include image representation, feature detection and matching, object detection and recognition, semantic segmentation, and corresponding deep learning approaches. Point cloud processing is covered with emphasis on data structures, registration, surface reconstruction, and semantic segmentation. The lecture also addresses perception for manipulation, covering object pose estimation, grasp detection, visual servoing, active vision, and haptic exploration. It concludes with the simultaneous localization and mapping (SLAM) problem, including EKF SLAM, Graph SLAM, and FastSLAM.

**Learning Objectives:**

Students can explain the main sensor principles used in robotics and distinguish between proprioceptive sensors (encoders, force/torque sensors, IMUs) and exteroceptive sensors (proximity, range, visual, and tactile sensors). They understand and can characterize sensor properties such as resolution, range, accuracy, and bandwidth, and can explain the principles of analog-to-digital conversion. Students are able to propose, analyze, and justify suitable sensor concepts for specific robotic tasks, taking into account trade-offs between different sensor modalities.

Students can apply fundamental perception methods for robotic applications. This includes robot vision techniques such as feature detection and matching, object detection and recognition, and semantic segmentation, including deep learning-based approaches. They can describe and analyze perception methods for manipulation tasks, including object pose estimation, grasp detection, active vision strategies, and haptic exploration. In addition, students can explain point cloud processing methods for registration and surface reconstruction, as well as principles of simultaneous localization and mapping (SLAM).

**Organizational issues**

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) of, in general, 60 minutes.

**Recommendations**

Having visited the lecture *Robotics I – Introduction to Robotics* is recommended.

**Workload:**

90 h

- approx. 15 \* 2 h = 30 h attendance time
- approx. 15 \* 2 h = 30 h self-study prior/after the lecture
- approx. 30 h preparation for the exam and exam itself

**Literature**

Lecture slides will be provided during the course.

Accompanying literature references regarding the individual topics of the lecture will be provided.

## T

**6.363 Module component: Robotics Institute Germany - Lecture Series [T-INFO-114895]**

**Coordinators:** Prof. Dr.-Ing. Tamim Asfour  
TT-Prof. Dr. Barbara Bruno  
Prof. Dr. Jan Niehues

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-107598 - Robotics Institute Germany - Lecture Series](#)

| Type             | Credits | Grading | Expansion   | Version |
|------------------|---------|---------|-------------|---------|
| Oral examination | 3 CP    | Graded  | 1 semesters | 1       |

| Courses  |         |                                                             |       |                                                                                               |                        |
|----------|---------|-------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|------------------------|
| WT 25/26 | 2400246 | <a href="#">RIG Lecture Series</a>                          | 2 SWS | Lecture /  | Bruno, Niehues, Asfour |
| Exams    |         |                                                             |       |                                                                                               |                        |
| WT 25/26 | 7500401 | <a href="#">Robotics Institute Germany - Lecture Series</a> |       |                                                                                               | Bruno, Asfour          |

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

**Assessment**

Depending on the number of attending students, the assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting approx. 20 minutes or as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting approx. 120 minutes. The art of assessment will be announced at least six weeks before the end of the course. The default type of examination is oral.

**Prerequisites**

None.

**Recommendations**

Knowledge of the content of module Robotics I - Introduction to Robotics is helpful.

*Below you will find excerpts from courses related to this module component:*

## V

**RIG Lecture Series**

2400246, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

**Lecture (V)**  
**Blended (On-Site/Online)**

**Content**

The course is structured as an inter-institutional lecture series, concurrently offered by various German institutions affiliated with the Robotics Institute Germany (RIG). In the lecture series students are offered an overview of significant open research directions related to AI-powered robotics by leading figures in the field. The lecturers are affiliated with various RIG partner institutions and students from various RIG partner institutions attend the lectures remotely. The lectures cover topics such as cognitive robotics, robot learning, robot perception, manipulation, natural interaction and communication with robots, human-robot interaction, soft robotics and responsible robotics. The exposure to top researchers in the field from different German institutions and the possibility of exchanges with students from other German universities are unique opportunities offered by this lecture series

**Organizational issues**

**Recommendations:** Knowledge of the content of module Robotics I - Introduction to Robotics is helpful.

Depending on the number of attending students, the assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting 20 minutes or as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 120 minute.

The art of assessment will be announced at least six weeks before the end of the course. The default type of examination is oral.

**Workload:**

Lecture series with 2 SWS, 3 LP.

3 LP corresponds to approx. 90 hours, of which:

approx. 22.5 hrs of compulsory attendance

approx. 45 hours of literature research

approx. 22.5 hrs. exam preparation

T6.364 Module component: Safe Human-Robot-Collaboration [T-INFO-109911]

**Coordinators:** Dr.-Ing. Johannes Kurth  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-104877 - Safe Human-Robot-Collaboration](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 3 CP    | Graded  | Each winter term | 1       |

| Courses  |         |                                                |       |                                                                                             |       |
|----------|---------|------------------------------------------------|-------|---------------------------------------------------------------------------------------------|-------|
| WT 25/26 | 2400236 | <a href="#">Safe Human-Robot-Collaboration</a> | 2 SWS | Block /  | Kurth |
| Exams    |         |                                                |       |                                                                                             |       |
| WT 25/26 | 7500290 | <a href="#">Safe Human-Robot-Collaboration</a> |       |                                                                                             | Kurth |

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



## T

**6.365 Module component: Sampling Methods for Machine Learning [T-INFO-114133]****Coordinators:** Prof. Dr.-Ing. Uwe Hanebeck**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107090 - Sampling Methods for Machine Learning](#)**Type**  
Oral examination**Credits**  
6 CP**Grading**  
graded**Term offered**  
Each summer term**Version**  
1

| Courses  |         |                                                       |       |                                                                                                         |                  |
|----------|---------|-------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------|------------------|
| ST 2026  | 2400194 | <a href="#">Sampling Methods for Machine Learning</a> | 3 SWS | Lecture / Practice /  | Hanebeck, Frisch |
| Exams    |         |                                                       |       |                                                                                                         |                  |
| WT 25/26 | 7500533 | <a href="#">Sampling Methods for Machine Learning</a> |       |                                                                                                         | Hanebeck         |
| ST 2026  | 7500391 | <a href="#">Sampling Methods for Machine Learning</a> |       |                                                                                                         | Hanebeck         |

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

The assessment is carried out as an oral examination, lasting 20 minutes in accordance with Section 4 (2) No. 2 SPO.

**Prerequisites**

Additional certificate for digital exercise (Übungsschein)

**Recommendations**

Knowledge of a higher programming language with sophisticated libraries for scientific-numerical computing (e.g. Julia, Matlab, Python) is advantageous.

Below you will find excerpts from courses related to this module component:

## V

**Sampling Methods for Machine Learning**2400194, SS 2026, 3 SWS, Language: English, [Open in study portal](#)**Lecture / Practice (VÜ)**  
**Blended (On-Site/Online)****Content**

Sample-based inference is the de-facto standard for solving otherwise infeasible problems in machine learning, estimation, and control under (unavoidable) uncertainties. Thus, it is an important foundation for further studies. This lecture gives a thorough overview of state-of-the-art sampling methods and discusses current developments from the research frontier.

The first part shows how to efficiently sample large numbers of random samples from given densities starting with the special cases of uniform and Gaussian distributions. For sampling from arbitrary densities, important techniques such as inverse transform sampling, Knothe-Rosenblatt maps, Markov chain Monte Carlo, normalizing flows, and Langevin equations are introduced.

The second part is concerned with deterministic or low-discrepancy sampling, where the goal is to find a set of representative samples of a given density. These are usually obtained by optimization, which, in contrast to random samples, leads to good coverage, high homogeneity, and reproducible results. To analyze and synthesize such samples, various statistical tests and discrepancy measures are presented. This includes scalar tests such as the Cramér-von Mises test, Kolmogorov-Smirnov test, and multivariate generalizations based on Localized Cumulative Distributions and Stein discrepancy.

Finally, advanced topics such as importance sampling and sampling from the posterior density in a Bayesian update are discussed. Typical applications of sample-based inference include Bayesian neural networks, information fusion, and reinforcement learning.

**Organizational issues**

In-person lecture and digital/online exercise with ILIAS-Tests.

Appointments for oral exams (available year-round): [pruefung-isas@iar.kit.edu](mailto:pruefung-isas@iar.kit.edu)

## T

**6.366 Module component: Sampling Methods for Machine Learning - Pass [T-INFO-114134]**

**Coordinators:** Prof. Dr.-Ing. Uwe Hanebeck  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-107090 - Sampling Methods for Machine Learning](#)

| Type       | Credits | Grading   | Term offered     | Version |
|------------|---------|-----------|------------------|---------|
| Coursework | 0 CP    | pass/fail | Each summer term | 1       |

| Courses  |         |                                                              |       |                                                                                                         |                  |
|----------|---------|--------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------|------------------|
| ST 2026  | 2400194 | <a href="#">Sampling Methods for Machine Learning</a>        | 3 SWS | Lecture / Practice /  | Hanebeck, Frisch |
| Exams    |         |                                                              |       |                                                                                                         |                  |
| WT 25/26 | 7500534 | <a href="#">Sampling Methods for Machine Learning - Pass</a> |       |                                                                                                         | Hanebeck         |
| ST 2026  | 7500392 | <a href="#">Sampling Methods for Machine Learning - Pass</a> |       |                                                                                                         | Hanebeck         |

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

**Assessment**

Digital exercise:

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

**Recommendations**

Knowledge of a higher programming language with sophisticated libraries for scientific-numerical computing (e.g. Julia, Matlab, Python) is advantageous

*Below you will find excerpts from courses related to this module component:*

## V

**Sampling Methods for Machine Learning**

2400194, SS 2026, 3 SWS, Language: English, [Open in study portal](#)

Lecture / Practice (VÜ)  
Blended (On-Site/Online)

**Content**

Sample-based inference is the de-facto standard for solving otherwise infeasible problems in machine learning, estimation, and control under (unavoidable) uncertainties. Thus, it is an important foundation for further studies. This lecture gives a thorough overview of state-of-the-art sampling methods and discusses current developments from the research frontier.

The first part shows how to efficiently sample large numbers of random samples from given densities starting with the special cases of uniform and Gaussian distributions. For sampling from arbitrary densities, important techniques such as inverse transform sampling, Knothe-Rosenblatt maps, Markov chain Monte Carlo, normalizing flows, and Langevin equations are introduced.

The second part is concerned with deterministic or low-discrepancy sampling, where the goal is to find a set of representative samples of a given density. These are usually obtained by optimization, which, in contrast to random samples, leads to good coverage, high homogeneity, and reproducible results. To analyze and synthesize such samples, various statistical tests and discrepancy measures are presented. This includes scalar tests such as the Cramér-von Mises test, Kolmogorov-Smirnov test, and multivariate generalizations based on Localized Cumulative Distributions and Stein discrepancy.

Finally, advanced topics such as importance sampling and sampling from the posterior density in a Bayesian update are discussed. Typical applications of sample-based inference include Bayesian neural networks, information fusion, and reinforcement learning.

**Organizational issues**

In-person lecture and digital/online exercise with ILIAS-Tests.

Appointments for oral exams (available year-round): [pruefung-isas@iar.kit.edu](mailto:pruefung-isas@iar.kit.edu)

**T****6.367 Module component: Science Communication in the Innovation Process [T-WIWI-114748]**

**Coordinators:** Dr. Mara Schwind  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101507 - Innovation Management](#)  
[M-WIWI-101507 - Innovation Management](#)

**Type**  
Examination of another type

**Credits**  
3 CP

**Grading**  
graded

**Term offered**  
Irregular

**Version**  
1

| Courses  |         |                                                                 |       |                                                                                               |                                      |
|----------|---------|-----------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|--------------------------------------|
| WT 25/26 | 2500055 | <a href="#">Science communication in the innovation process</a> | 2 SWS | Seminar /  | Schwind, Weissenberger-Eibl, Schwind |
| Exams    |         |                                                                 |       |                                                                                               |                                      |
| WT 25/26 | 7900106 | <a href="#">Science Communication in the Innovation Process</a> |       |                                                                                               | Schwind                              |

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

**Assessment**

Alternative exam assessments. The grade consists of the following weighted components:

- 25% workshop
- 25% final presentation
- 50% seminar paper

Details will be announced at the beginning of the course.

**Prerequisites**

None

**Recommendations**

Prior attendance of the course Innovation Management [2545015] is recommended.

**Additional Information**

Teaching and learning format: Seminar

**Workload**

90 hours

*Below you will find excerpts from courses related to this module component:*

**V****Science communication in the innovation process**

2500055, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)

**Seminar (S)**  
On-Site

**Content**

This seminar explores the role of science communication in the innovation process. Students will learn the basic definitions, concepts and models of science communication and critically examine them. They also explore the landscape of science communication actors, the distinction between communication for the common good and strategic communication, and the role of science communication in the acceptance of radical innovations. Through the critical analysis and reflection of science communication formats and their modes of action, students gain an understanding of proven and innovative communication strategies, learning how to adapt different formats to specific target groups and innovation phases.

As part of the seminar, students examine current, research-oriented issues independently and on the basis of scientific criteria. They research, analyze, abstract and reflect on relevant information. They draw their own conclusions using their interdisciplinary knowledge and develop current research results further in certain areas. They know how to validate the results obtained and present them logically and systematically in written and oral form, taking into account scientific methods (structuring, specialist terminology, citing sources). In doing so, they are able to argue professionally and defend the results in discussions with experts. In addition, students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

**T****6.368 Module component: Scientific Methods to Design and Analyze Secure Decentralized Systems [T-INFO-111568]****Coordinators:** Prof. Dr. Hannes Hartenstein**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-105780 - Scientific Methods to Design and Analyze Secure Decentralized Systems](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 5 CP    | graded  | Each winter term | 1       |

**Assessment**

The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting 20 minutes.

*Depending on the number of participants, it will be announced six weeks before the examination (Section 6 (3) SPO) whether the assessment will take the form of an oral examination of approx.*

*- in the form of an oral examination of approx. 30 minutes in accordance with § 4 Para. 2 No. 2 SPO*

*or*

*- in the form of a written examination in accordance with § 4 Para. 2 No. 1 SPO*

*takes place.*

**Prerequisites**

None.

**Recommendations**

Prior knowledge on the abstract concepts as well as concrete use cases of decentralized systems is strongly recommended. The "Decentralized Systems: Fundamentals, Modeling, and Applications" lecture covers all necessary aspects, but equivalent lectures and / or self-study can also be sufficient.

**T****6.369 Module component: Selected Aspects in Real-time Systems [T-INFO-114599]****Coordinators:** Prof. Dr.-Ing. Thomas Längle**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107431 - Selected Aspects in Real-time Systems](#)**Type**  
Oral examination**Credits**  
3 CP**Grading**  
graded**Expansion**  
1 semesters**Version**  
2

| Courses  |         |                                                       |       |                                                                                               |        |
|----------|---------|-------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|--------|
| WT 25/26 | 2400164 | <a href="#">Selected aspects in Real-Time Systems</a> | 2 SWS | Lecture /  | Längle |
| Exams    |         |                                                       |       |                                                                                               |        |
| WT 25/26 | 7500229 | <a href="#">Selected Aspects in Real-time Systems</a> |       |                                                                                               | Längle |

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

## T

**6.370 Module component: Selected Legal Issues of Internet Law [T-INFO-108462]****Coordinators:** N.N.**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-101215 - Intellectual Property Law](#)

| Type                        | Credits | Grading        | Term offered     | Version |
|-----------------------------|---------|----------------|------------------|---------|
| Examination of another type | 3 CP    | Grading graded | Each summer term | 1       |

| Courses |         |                                                       |       |                                                                                                  |         |
|---------|---------|-------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------|---------|
| ST 2026 | 24821   | <a href="#">Selected legal issues of Internet law</a> | 2 SWS | Colloquium /  | Sattler |
| Exams   |         |                                                       |       |                                                                                                  |         |
| ST 2026 | 7500099 | <a href="#">Selected Legal Issues of Internet Law</a> |       |                                                                                                  | Sattler |

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

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

The overall impression is evaluated. The following partial aspects are included in the grading: oral presentation and discussion.

**Prerequisites**The course **Internet Law T-INFO-101307** must not have started.**Recommendations**

Keine.

**Additional Information**Lecture (with written exam) **Internet Law T-INFO-101307** is offered in the winter semester.Colloquium (other type of examination) **Selected Legal Issues of Internet Law T-INFO-108462** offered in the summer semester

**T****6.371 Module component: Selected Topics in Statistics and Analytics: Seminal Papers in Theory and Methods [T-WIWI-114746]**

**Coordinators:** Prof. Dr. Oliver Grothe  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101637 - Analytics and Statistics](#)

**Type**  
Examination of another type

**Credits**  
4,5 CP

**Grading**  
graded

**Term offered**  
Irregular

**Version**  
1

| Courses  |         |                                                                                                   |       |                                                                                                         |        |
|----------|---------|---------------------------------------------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------|--------|
| WT 25/26 | 2500005 | <a href="#">Selected Topics in Statistics and Analytics: Seminal Papers in Theory and Methods</a> | 3 SWS | Lecture / Practice /  | Grothe |
| Exams    |         |                                                                                                   |       |                                                                                                         |        |
| WT 25/26 | 7900044 | <a href="#">Selected Topics in Statistics and Analytics: Seminal Papers in Theory and Methods</a> |       |                                                                                                         | Grothe |

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

**Assessment**

Success is assessed in the form of an alternative exam assessment. The grade is composed of 30% active participation, 30% preparation of the sessions, and 40% written contributions during the semester (e.g. questions or reflections on the assigned papers).

Details on the structure of the performance assessment will be announced at the beginning of the course.

**Prerequisites**

None.

**Recommendations**

We recommend a sound statistical basis, such as that taught in the Advanced Statistics course.

**Workload**

135 hours

*Below you will find excerpts from courses related to this module component:*

**V****Selected Topics in Statistics and Analytics: Seminal Papers in Theory and Methods**

2500005, WS 25/26, 3 SWS, Language: German/English, [Open in study portal](#)

Lecture / Practice (VÜ)  
On-Site

**Content**

In this course, 6–8 key scientific papers ("seminal works") from various areas of statistics and data analysis are read, analyzed, discussed, and optionally implemented. The goal is to develop and reflect on both core statistical concepts and scientific reading and writing skills.

The course is intended for advanced students with a solid background in statistics.

## T

**6.372 Module component: Semantic Web Technologies [T-WIWI-110848]****Coordinators:** Dr.-Ing. Tobias Käfer**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-101456 - Intelligent Systems and Services](#)[M-WIWI-105366 - Artificial Intelligence](#)[M-WIWI-106803 - Advanced Topics in AI: Knowledge Graphs and the Web](#)**Type**  
Written examination**Credits**  
4,5 CP**Grading**  
graded**Term offered**  
Each summer term**Version**  
1

| Courses  |                   |                                                                                    |       |                                                                                                |                       |
|----------|-------------------|------------------------------------------------------------------------------------|-------|------------------------------------------------------------------------------------------------|-----------------------|
| ST 2026  | 2511310           | <a href="#">Semantic Web Technologies</a>                                          | 2 SWS | Lecture /   | Käfer, Braun, Kubelka |
| ST 2026  | 2511311           | <a href="#">Exercises to Semantic Web Technologies</a>                             | 1 SWS | Practice /  | Käfer, Braun, Kubelka |
| Exams    |                   |                                                                                    |       |                                                                                                |                       |
| WT 25/26 | 79AIFB_SWebT_A2   | <a href="#">Semantic Web Technologies (Registration extended until 16.02.2026)</a> |       |                                                                                                | Käfer                 |
| ST 2026  | 791-AIFB-SWebT-HK | <a href="#">Semantic Web Technologies (Registration until 20.07.2026)</a>          |       |                                                                                                | Käfer                 |

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

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

**Recommendations**

It is recommended that students have previously attended computer-science lectures from the Bachelor programmes Information Systems or Industrial Engineering and Management in semesters 1 – 4, or have taken equivalent courses.

Below you will find excerpts from courses related to this module component:

## V

**Semantic Web Technologies**2511310, SS 2026, 2 SWS, Language: English, [Open in study portal](#)**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**

- Pascal Hitzler, Markus Krötzsch, Sebastian Rudolph, York Sure: Semantic Web – Grundlagen. Springer, 2008.
- John Domingue, Dieter Fensel, James A. Hendler (Editors). Handbook of Semantic Web Technologies. Springer, 2011.

**Weitere Literatur**

- S. Staab, R. Studer (Editors). Handbook on Ontologies. International Handbooks in Information Systems. Springer, 2003.
- Tim Berners-Lee. Weaving the Web. Harper, 1999 geb. 2000 Taschenbuch.
- Ian Jacobs, Norman Walsh. Architecture of the World Wide Web, Volume One. W3C Recommendation 15 December 2004. <http://www.w3.org/TR/webarch/>
- Dean Allemang. Semantic Web for the Working Ontologist: Effective Modeling in RDFS and OWL. Morgan Kaufmann, 2008.
- Tom Heath and Chris Bizer. Linked Data: Evolving the Web into a Global Data Space. Synthesis Lectures on the Semantic Web: Theory and Technology, 2011.

**Exercises to Semantic Web Technologies**

2511311, SS 2026, 1 SWS, Language: English, [Open in study portal](#)

**Practice (Ü)  
On-Site**

**Content**

The exercises are related to the lecture Semantic Web Technologies.

Multiple exercises are held that capture the topics, held in the lecture Semantic Web Technologies, and discuss them in detail. Thereby, practical examples are given to the students in order to transfer theoretical aspects into practical implementation.

The following topics are covered:

- Resource Description Framework (RDF) and RDF Schema (RDFS)
- Web Architecture and Linked Data
- Web Ontology Language (OWL)
- Query language SPARQL
- Rule languages
- Applications

**Learning objectives:**

The student

- understands the motivation and foundational ideas behind Semantic Web and Linked Data technologies, and is able to analyse and realise systems
- demonstrates basic competency in the areas of data and system integration on the web
- masters advanced knowledge representation scenarios involving ontologies

**Recommendations:**

Lectures on Informatics of the Bachelor on Information Systems (Semester 1-4) or equivalent are required. Knowledge of modeling with UML is required.

**Literature**

- Pascal Hitzler, Markus Krötzsch, Sebastian Rudolph, York Sure: Semantic Web – Grundlagen. Springer, 2008.
- John Domingue, Dieter Fensel, James A. Hendler (Editors). Handbook of Semantic Web Technologies. Springer, 2011.

**Weitere Literatur**

- S. Staab, R. Studer (Editors). Handbook on Ontologies. International Handbooks in Information Systems. Springer, 2003.
- Tim Berners-Lee. Weaving the Web. Harper, 1999 geb. 2000 Taschenbuch.
- Ian Jacobs, Norman Walsh. Architecture of the World Wide Web, Volume One. W3C Recommendation 15 December 2004. <http://www.w3.org/TR/webarch/>
- Dean Allemang. Semantic Web for the Working Ontologist: Effective Modeling in RDFS and OWL. Morgan Kaufmann, 2008.
- Tom Heath and Chris Bizer. Linked Data: Evolving the Web into a Global Data Space. Synthesis Lectures on the Semantic Web: Theory and Technology, 2011.

**T****6.373 Module component: Seminar: Cryptanalysis [T-INFO-110823]**

**Coordinators:** Prof. Dr. Jörn Müller-Quade  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-105337 - Seminar: Cryptanalysis](#)

**Type**  
 Examination of another type

**Credits**  
 3 CP

**Grading**  
 graded

**Version**  
 1

| Courses |         |                                       |       |                                                                                               |                                    |
|---------|---------|---------------------------------------|-------|-----------------------------------------------------------------------------------------------|------------------------------------|
| ST 2026 | 2400134 | <a href="#">Seminar Cryptanalysis</a> | 2 SWS | Seminar /  | Müller-Quade,<br>Ottenhues, Martin |

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

**T****6.374 Module component: Seminar Decentralized Systems and Network Services [T-INFO-106064]****Coordinators:** Prof. Dr. Hannes Hartenstein**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-103048 - Seminar Decentralized Systems and Network Services](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 3 CP    | graded  | Irregular    | 1       |

## T

**6.375 Module component: Seminar Dependable Computing [T-INFO-105577]**

**Coordinators:** Prof. Dr. Mehdi Baradaran Tahoori  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-102662 - Seminar Dependable Computing](#)

**Type**  
Examination of another type

**Credits**  
3 CP

**Grading**  
graded

**Term offered**  
Each term

**Version**  
1

| Courses  |         |                                              |       |           |         |
|----------|---------|----------------------------------------------|-------|-----------|---------|
| WT 25/26 | 2400030 | <a href="#">Dependable Computing</a>         | 2 SWS | Seminar / | Tahoori |
| ST 2026  | 2400030 | <a href="#">Dependable Computing</a>         | 2 SWS | Seminar / | Tahoori |
| Exams    |         |                                              |       |           |         |
| WT 25/26 | 7500152 | <a href="#">Seminar Dependable Computing</a> |       |           | Tahoori |
| ST 2026  | 7500118 | <a href="#">Seminar Dependable Computing</a> |       |           | Tahoori |

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

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

A written paper must be prepared and a presentation given. Withdrawal is possible within two weeks of the topic being assigned. The module grade is made up of 50% of the presentation and 50% of the written paper.

**Prerequisites**

None.

**Recommendations**

Knowledge of "Dependable Computing" and "Fault Tolerant Computing" and computer architecture is helpful.

*Below you will find excerpts from courses related to this module component:*

## V

**Dependable Computing**

2400030, WS 25/26, 2 SWS, Language: German/English, [Open in study portal](#)

**Seminar (S)**  
On-Site

**Content**

Reliability and Security play a major role in design of contemporary and next generation electronics and memories. In many safety-critical application domains, reliability is considered as the main design criteria. With nanoscale technologies, the reliability of individual devices is decreasing, therefore reliable computing must be considered in the design flow in order to ensure correctness of computing.

The objective of this seminar is to become familiar with general and state of the art techniques used in design and analysis of fault-tolerant and security-driven digital systems. This seminar overviews reliable (fault-tolerant) computing, hardware security designs and emerging memory devices.

Various topics can be envisioned in the scope of this seminar and the prospective students can choose specific topic from a wide range of areas based on their interests and background.

**Organizational issues**

Bitte im Campussystem und per email unter [cdnc@itec.kit.edu](mailto:cdnc@itec.kit.edu) anmelden.

Beinhaltet ebenfalls die Seminare *Non-volatile Memory Technologies* und *Hardware Security*.

Auftaktveranstaltung "wird noch bekannt gegeben"

Building 07.21 -Technologiefabrik

## V

**Dependable Computing**

2400030, SS 2026, 2 SWS, Language: German/English, [Open in study portal](#)

**Seminar (S)**  
Blended (On-Site/Online)

**Content**

Reliability and Security play a major role in design of contemporary and next generation electronics and memories. In many safety-critical application domains, reliability is considered as the main design criteria. With nanoscale technologies, the reliability of individual devices is decreasing, therefore reliable computing must be considered in the design flow in order to ensure correctness of computing.

The objective of this seminar is to become familiar with general and state of the art techniques used in design and analysis of fault-tolerant and security-driven digital systems. This seminar overviews reliable (fault-tolerant) computing, hardware security designs and emerging memory devices.

Various topics can be envisioned in the scope of this seminar and the prospective students can choose specific topic from a wide range of areas based on their interests and background.

**Organizational issues**

Bitte im Campussystem und per email unter [cdnc@itec.kit.edu](mailto:cdnc@itec.kit.edu) anmelden.

Beinhaltet ebenfalls die Seminare *Non-volatile Memory Technologies* und *Hardware Security*.

## T

**6.376 Module component: Seminar Hot Topics in Networking [T-INFO-101283]**

**Coordinators:** Prof. Dr. Martina Zitterbart  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-100746 - Seminar Hot Topics in Networking](#)

**Type**  
Examination of another type

**Credits**  
3 CP

**Grading**  
graded

**Term offered**  
Each term

**Version**  
1

| Courses  |         |                                                  |       |                                                                                               |                   |
|----------|---------|--------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|-------------------|
| WT 25/26 | 2400040 | <a href="#">Hot Topics in Networking</a>         | 2 SWS | Seminar /  | Zitterbart, Bless |
| ST 2026  | 2400040 | <a href="#">Hot Topics in Networking</a>         | 2 SWS | Seminar /  | Bless, Zitterbart |
| Exams    |         |                                                  |       |                                                                                               |                   |
| WT 25/26 | 7500018 | <a href="#">Seminar Hot Topics in Networking</a> |       |                                                                                               | Zitterbart        |

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

Below you will find excerpts from courses related to this module component:

## V

**Hot Topics in Networking**

2400040, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

**Seminar (S)**  
On-Site

**Content**

The seminar deals with specific topics, some of which have been addressed in the corresponding lectures, and explores them in greater depth. For example, the main topics Future Internet, Security and Internet Performance will be covered. In these topics, the main focus is on highly distributed systems (peer-to-peer networks, cloud, social networks, traffic networks)

**Organizational issues**

nach Vereinbarung

**T****6.377 Module component: Seminar Image Analysis and Fusion [T-INFO-104743]**

**Coordinators:** Prof. Dr.-Ing. Jürgen Beyerer  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-102375 - Seminar Image Analysis and Fusion](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 3 CP    | Graded  | Each summer term | 1       |

| Courses |         |                                                   |       |                                                                                               |         |
|---------|---------|---------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|---------|
| ST 2026 | 2400035 | <a href="#">Seminar Image Analysis and Fusion</a> | 2 SWS | Seminar /  | Beyerer |
| Exams   |         |                                                   |       |                                                                                               |         |
| ST 2026 | 7500033 | <a href="#">Seminar Image Analysis and Fusion</a> |       |                                                                                               | Beyerer |

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

Below you will find excerpts from courses related to this module component:

**V****Seminar Image Analysis and Fusion**

2400035, SS 2026, 2 SWS, Language: German, [Open in study portal](#)

**Seminar (S)**  
On-Site

**Organizational issues**

Termin und Ort der Einführungsveranstaltung werden vor Semesterbeginn auf der Webseite bekannt gegeben.

Findet - sofern Präsenz-Veranstaltung erlaubt - im Fraunhofer IOSB statt.



**T****6.378 Module component: Seminar in Business Administration A (Master) [T-WIWI-103474]****Coordinators:** Professorenschaft des Fachbereichs Betriebswirtschaftslehre**Organisation:** KIT Department of Business and Economics**Part of:** M-WIWI-102736 - Seminar Module Economic Sciences

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 3 CP    | Graded  | Each term    | 1       |

| Courses  |         |                                                                                 |       |             |                                        |
|----------|---------|---------------------------------------------------------------------------------|-------|-------------|----------------------------------------|
| WT 25/26 | 2500045 | Digital Democracy - Challenges and Opportunities of the Digital Society         | 2 SWS | Seminar / 🌀 | Fegert, Stein, Bezzaoui                |
| WT 25/26 | 2500049 | Seminar in Cognition and Consumer Behavior                                      | 2 SWS | Seminar / 🌀 | Gradwohl                               |
| WT 25/26 | 2500055 | Science communication in the innovation process                                 | 2 SWS | Seminar / 🌀 | Schwind, Weissenberger-Eibl, Schwind   |
| WT 25/26 | 2500125 | Human-Centered Systems Seminar: Engineering                                     | 2 SWS | Seminar / 🌀 | Mädche                                 |
| WT 25/26 | 2530293 |                                                                                 | 2 SWS | Seminar / 📱 | Ruckes, Luedecke, Kohl, Sarac, Fkyerat |
| WT 25/26 | 2530586 |                                                                                 | 2 SWS | Seminar / 🌀 | Uhrig-Homburg, Molnar                  |
| WT 25/26 | 2540472 | Master Seminar (Information Systems III) – Future of Commerce / AI and Fairness | 2 SWS | Seminar / 🌀 | Bennardo, Gutschow, Heßler             |
| WT 25/26 | 2540473 | Business Data Analytics                                                         | 2 SWS | Seminar / 🌀 | Hariharan, Grote, Schulz, Motz         |
| WT 25/26 | 2540475 | Positive Information Systems                                                    | 2 SWS | Seminar / 🌀 | Knierim, del Puppo                     |
| WT 25/26 | 2540478 | Smart Grids and Energy Markets                                                  | 2 SWS | Seminar / 🌀 | Weinhardt, Semmelmann, Miskiw, Speck   |
| WT 25/26 | 2540510 | Master Seminar in Data Science and Machine Learning                             | 2 SWS | Seminar / 🌀 | Geyer-Schulz, Nazemi                   |
| WT 25/26 | 2540557 | Human-Centered Systems Seminar: Research                                        | 2 SWS | Seminar / 🌀 | Mädche                                 |
| WT 25/26 | 2545105 | Case studies seminar: Innovation management                                     | 2 SWS | Seminar / 🌀 | Weissenberger-Eibl                     |
| WT 25/26 | 2571181 | Seminar Digital Marketing (Master)                                              | 2 SWS | Seminar / 🌀 | Kupfer, Schmitt, Cinar                 |
| WT 25/26 | 2573012 | Seminar Human Resource Management (Master)                                      | 2 SWS | Seminar / 🌀 | Nieken, Mitarbeiter                    |
| WT 25/26 | 2573013 | Seminar Human Resources and Organizations (Master)                              | 2 SWS | Seminar / 🌀 | Nieken, Mitarbeiter                    |
| WT 25/26 | 2579919 | Seminar Management Accounting - Sustainability Topics                           | 2 SWS | Seminar / 🌀 | Wouters, Dickemann                     |
| WT 25/26 | 2581030 | Seminar in Energy Economics                                                     | 2 SWS | Seminar / 🌀 | Fichtner, Sloot                        |
| WT 25/26 | 2581032 | Seminar Energy Economics VI                                                     | 2 SWS | Seminar / 🌀 | Fichtner, Slednev                      |
| WT 25/26 | 2581976 | Seminar in Production and Operations Management I                               | 2 SWS | Seminar / 🌀 | Schultmann, Rudi                       |
| WT 25/26 | 2581977 | Seminar in Production and Operations Management II                              | 2 SWS | Seminar / 🌀 | Schultmann, Steins                     |
| WT 25/26 | 2581978 | Seminar in Production and Operations Management                                 | 2 SWS | Seminar / 🌀 | Schultmann, Rosenberg                  |
| WT 25/26 | 2581979 | Seminar in Energy Economics                                                     | 2 SWS | Seminar / 🌀 | Fichtner, Kleinebrahm                  |
| WT 25/26 | 2581980 | Seminar in Energy Economics                                                     | 2 SWS | Seminar / 🌀 | Fichtner, Sandmeier                    |

|              |         |                                                                         |       |                                                                                               |                             |
|--------------|---------|-------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|-----------------------------|
| WT 25/26     | 2581981 | Seminar in Energy Economics                                             | 2 SWS | Seminar /    | Ardone, Fichtner            |
| ST 2026      | 2500018 | Successful transformation through innovation                            | 2 SWS | Seminar /    | Busch                       |
| ST 2026      | 2500020 | Digital Democracy - Challenges and opportunities of the digital society | 2 SWS | Seminar /    | Fegert                      |
| ST 2026      | 2500125 | Human-Centered Systems Seminar: Engineering                             | 3 SWS | Seminar /    | Mädche                      |
| ST 2026      | 2530580 | Seminar in Finance (Master)                                             | 2 SWS | Seminar /    | Uhrig-Homburg               |
| ST 2026      | 2540469 | Master Seminar: Intelligent & Responsible Information Systems           | 2 SWS | Seminar /    | Bennardo, Gutschow, Heßler  |
| ST 2026      | 2540473 | Applied Responsible AI                                                  | 2 SWS | Seminar                                                                                       | Schulz, Weinhardt           |
| ST 2026      | 2540475 | Positive Information Systems                                            | 2 SWS | Seminar                                                                                       | Knierim                     |
| ST 2026      | 2540478 | Smart Grid Economics & Energy Markets                                   | 2 SWS | Seminar                                                                                       | Weinhardt                   |
| ST 2026      | 2540493 | Data Science for Industrial Applications                                | 2 SWS | Seminar /    | Spitzer, Holstein, Hendriks |
| ST 2026      | 2540510 | Master Seminar in Data Science and Machine Learning                     | 2 SWS | Seminar                                                                                       | Geyer-Schulz                |
| ST 2026      | 2540553 | Biosignal-Adaptive Systems Seminar                                      | 2 SWS | Seminar /    | Mädche, Beigl               |
| ST 2026      | 2540557 | Human-Centered Systems Seminar: Research                                | 3 SWS | Seminar /    | Mädche                      |
| ST 2026      | 2545002 | Entrepreneurship Research                                               | 2 SWS | Seminar /    | Kuschel, Malik              |
| ST 2026      | 2571180 | Seminar in Marketing and Sales (Master)                                 | 2 SWS | Seminar /    | Klarmann, Mitarbeiter       |
| ST 2026      | 2571182 | Seminar "The Future of Marketing" (Master)                              | 2 SWS | Seminar /  | Kupfer                      |
| ST 2026      | 2573012 | Seminar Human Resource Management (Master)                              | 2 SWS | Seminar /  | Nieken, Mitarbeiter, Gorny  |
| ST 2026      | 2573013 | Seminar Human Resources and Organizations (Master)                      | 2 SWS | Seminar /  | Nieken, Mitarbeiter         |
| ST 2026      | 2581030 | Seminar Energiewirtschaft IV                                            | 2 SWS | Seminar /  | Fichtner, Sloot             |
| ST 2026      | 2581031 | Seminar Energiewirtschaft V                                             | 2 SWS | Seminar /  | Plötz                       |
| ST 2026      | 2581032 | Seminar Energiewirtschaft VI                                            | 2 SWS | Seminar /  | Slednev, Fichtner           |
| ST 2026      | 2581978 | Seminar Produktionswirtschaft und Logistik III                          | 2 SWS | Seminar /  | Schultmann, Rosenberg       |
| ST 2026      | 2581979 | Seminar Energiewirtschaft I                                             | 2 SWS | Seminar /  | Fichtner, Kleinebrahm       |
| ST 2026      | 2581980 | Seminar Energiewirtschaft II                                            | 2 SWS | Seminar /  | Fichtner, Sandmeier         |
| ST 2026      | 2581981 | Seminar Energiewirtschaft III                                           | 2 SWS | Seminar /  | Ardone, Fichtner            |
| <b>Exams</b> |         |                                                                         |       |                                                                                               |                             |
| WT 25/26     | 00072   | Seminar Positive Information Systems                                    |       |                                                                                               | Weinhardt                   |
| WT 25/26     | 00074   | Seminar Business Data Analytics                                         |       |                                                                                               | Weinhardt                   |
| WT 25/26     | 7900017 | Seminar Smart Grid and Energy Markets                                   |       |                                                                                               | Weinhardt                   |
| WT 25/26     | 7900069 | Human-Centered Systems Seminar: Engineering                             |       |                                                                                               | Mädche                      |
| WT 25/26     | 7900106 | Science Communication in the Innovation Process                         |       |                                                                                               | Schwind                     |
| WT 25/26     | 7900151 | Master Seminar in Data Science and Machine Learning                     |       |                                                                                               | Geyer-Schulz                |
| WT 25/26     | 7900163 | Seminar Human Resource Management (Master)                              |       |                                                                                               | Nieken                      |
| WT 25/26     | 7900164 | Seminar Human Resources and Organizations (Master)                      |       |                                                                                               | Nieken                      |
| WT 25/26     | 7900184 | Seminar in Finance (Master)                                             |       |                                                                                               | Ruckes                      |
| WT 25/26     | 7900203 | Seminar "Finance in a nutshell"                                         |       |                                                                                               | Uhrig-Homburg               |
| WT 25/26     | 7900233 | Human-Centered Systems Seminar: Research                                |       |                                                                                               | Mädche                      |
| WT 25/26     | 7900237 | Case Studies Seminar: Innovation Management                             |       |                                                                                               | Weissenberger-Eibl          |
| WT 25/26     | 7900318 | Bond Markets - Models & Derivatives                                     |       |                                                                                               | Uhrig-Homburg               |
| WT 25/26     | 7900322 | Seminar in Cognition and Consumer Behavior (Master)                     |       |                                                                                               | Scheibehenne                |

|          |              |                                                                                            |                  |
|----------|--------------|--------------------------------------------------------------------------------------------|------------------|
| WT 25/26 | 7900328      | Seminar in Energy Economics VI                                                             | Fichtner         |
| WT 25/26 | 7900333      | Seminar Digital Marketing (Master)                                                         | Kupfer           |
| WT 25/26 | 7900335      | Seminar Energy Economics IV                                                                | Fichtner         |
| WT 25/26 | 79-2579919-M | Seminar Management Accounting - Sustainability Topics (Master)                             | Wouters          |
| WT 25/26 | 7940469      | Master Seminar: Information Systems III                                                    | Pfeiffer, Heßler |
| WT 25/26 | 7981976      | Seminar in Production and Operations Management I                                          | Schultmann       |
| WT 25/26 | 7981977      | Seminar in Production and Operations Management II                                         | Schultmann       |
| WT 25/26 | 7981978      | Seminar in Production and Operations Management III                                        | Schultmann       |
| WT 25/26 | 7981979      | Seminar Energy Economics I                                                                 | Fichtner         |
| WT 25/26 | 7981980      | Seminar Energy Economics II                                                                | Fichtner         |
| WT 25/26 | 7981981      | Seminar Energy Economics III                                                               | Fichtner         |
| ST 2026  | 7900052      | Entrepreneurship Research                                                                  | Terzidis         |
| ST 2026  | 7900101      | Seminar Human Resource Management (Master)                                                 | Nieken           |
| ST 2026  | 7900127      | Seminar in Finance: Structured Products –Pricing & Risk Management (Master)                | Uhrig-Homburg    |
| ST 2026  | 7900190      | Human-Centered Systems Seminar: Engineering                                                | Mädche           |
| ST 2026  | 7900231      | Seminar Human Resources and Organizations (Master)                                         | Nieken           |
| ST 2026  | 7900233      | Seminar in Marketing and Sales (Master)                                                    | Klarmann         |
| ST 2026  | 7900240      | Seminar "The Future of Marketing" (Master)                                                 | Kupfer           |
| ST 2026  | 7900261      | Human-Centered Systems Seminar: Research                                                   | Mädche           |
| ST 2026  | 7900265      | Biosignal-Adaptive Systems Seminar                                                         | Mädche           |
| ST 2026  | 7900326      | Seminar Energy Economics VI                                                                | Fichtner         |
| ST 2026  | 792581030    | Seminar Energy Economics IV                                                                | Fichtner         |
| ST 2026  | 792581031    | Seminar Energy Economics V                                                                 | Plötz            |
| ST 2026  | 7940469      | Master Seminar: Intelligent & Responsible Information Systems                              | Pfeiffer         |
| ST 2026  | 7981978      | Seminar in Production and Operations Management III                                        | Schultmann       |
| ST 2026  | 7981979      | Seminar Energy Economics I: A Real-Time Day-Ahead Energy Time Series Forecasting Challenge | Fichtner         |
| ST 2026  | 7981980      | Seminar Energy Economics II: Sustainable Transformation of Energy Infrastructures          | Fichtner         |
| ST 2026  | 7981981      | Seminar Energy Economics III                                                               | Fichtner         |

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

### Assessment

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.

### Recommendations

See seminar description in the course catalogue of the KIT (<https://campus.kit.edu/>)

### Additional Information

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

90 hours

Below you will find excerpts from courses related to this module component:



### Science communication in the innovation process

2500055, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)

Seminar (S)  
On-Site

#### Content

This seminar explores the role of science communication in the innovation process. Students will learn the basic definitions, concepts and models of science communication and critically examine them. They also explore the landscape of science communication actors, the distinction between communication for the common good and strategic communication, and the role of science communication in the acceptance of radical innovations. Through the critical analysis and reflection of science communication formats and their modes of action, students gain an understanding of proven and innovative communication strategies, learning how to adapt different formats to specific target groups and innovation phases.

As part of the seminar, students examine current, research-oriented issues independently and on the basis of scientific criteria. They research, analyze, abstract and reflect on relevant information. They draw their own conclusions using their interdisciplinary knowledge and develop current research results further in certain areas. They know how to validate the results obtained and present them logically and systematically in written and oral form, taking into account scientific methods (structuring, specialist terminology, citing sources). In doing so, they are able to argue professionally and defend the results in discussions with experts. In addition, students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.



2530586, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)

Seminar (S)  
On-Site

#### Content

Within this seminar eLearning videos are produced to different topics out of the contents of our lectures. The student gets in touch with scientific work. Through profound working on a specific scientific topic the student is meant to learn the foundations of scientific research and reasoning in particular in finance. Through conduction of the video the student becomes familiar with the fundamental techniques for presentations and foundations of scientific reasoning. In addition, the student earns rhetorical skills.

The success is monitored by the development of an eLearning video and by the writing of a project report (according to §4(2), 3 SPO).

The overall grade is made up of these partial performances.

#### Recommendations:

Knowledge of the content of the modules *Essentials of Finance* [WW3BWLFBV1] (for bachelor students) and *F1 (Finance)* [WW4BWLFBV1] (for master students) is assumed.

The total workload for this course is approximately 90 hours. For further information see German version.

#### Organizational issues

Kickoff am 27.10.25 um 16 Uhr, Zwischenpräsentation am 09.12.25, 16 Uhr und Abschlusspräsentation am 27.01.26, 17:30 Uhr am Campus B (Geb. 09.21), Raum 209



### Master Seminar (Information Systems III) – Future of Commerce / AI and Fairness

2540472, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

Seminar (S)  
On-Site

#### Content

This seminar is offered by the Information Systems III research group, which has been based at the Institute for Information Systems (WIN) since January 2025 and is led by [Prof. Dr. Jella Pfeiffer](#). Further information about us can be found on our website ([WIN - Information Systems III](#)).



### Business Data Analytics

2540473, WS 25/26, 2 SWS, Language: German/English, [Open in study portal](#)

Seminar (S)  
On-Site

#### Content

wird auf deutsch und englisch gehalten

#### Organizational issues

Blockveranstaltung, siehe WWW

**Master Seminar in Data Science and Machine Learning**2540510, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)**Seminar (S)**  
**Blended (On-Site/Online)****Case studies seminar: Innovation management**2545105, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)**Seminar (S)**  
**On-Site****Content**

The objective of the seminar is to acquire selected concepts and methods of innovation management and to apply these in a practical way. The focus is on working on specific issues using a case study from business practice. Students work in groups and transfer the content taught, for example from the areas of scenario development, to entrepreneurial challenges in the context of fictitious case studies. The course follows a didactic interplay of theoretical input and direct application of what has been learned. At the end, the groups present their results in a plenary presentation, which is prepared by a short introduction to presentation techniques. The joint discussion promotes the transfer of knowledge to different contexts and strengthens the participants' ability to reflect.

As part of the seminar, students deal independently with current, research-oriented issues and systematically apply scientific criteria. They research relevant information, analyze, abstract and critically evaluate it. They draw conclusions independently from poorly structured data, incorporate interdisciplinary knowledge and contribute selectively to the further development of existing research perspectives. The results are validated and systematically prepared both orally and in writing using scientific standards - particularly with regard to structuring, terminology and correct citation of sources. In doing so, students argue in a technically sound manner and defend their findings in discourse with other participants and lecturers. They are also familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and apply these standards consistently in the preparation of their scientific work.

**Literature**

Werden in der ersten Veranstaltung bekannt gegeben.

**Seminar Human Resource Management (Master)**2573012, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)**Seminar (S)**  
**On-Site****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 25/26, 2 SWS, Language: German, [Open in study portal](#)**Seminar (S)**  
**On-Site**

**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 - Sustainability Topics**

2579919, WS 25/26, 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).

**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 is made up of the grade of the seminar paper, the presentation and the contributions in the seminar sessions.

**Required prior Courses:**

- The course requires a basic knowledge of finance and accounting.

**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.

**Successful transformation through innovation**2500018, SS 2026, 2 SWS, Language: German, [Open in study portal](#)**Seminar (S)**  
**On-Site****Content**

This seminar uses strategic innovation management and concepts such as organizational ambidexterity, boundary spanning and stakeholder approaches to shed light on how companies can increase their innovative capacity through innovation. Students will use a core paper to understand the steps a company takes to become an innovative organization. The aim is to understand how medium-sized companies can develop into innovation-driven organizations in the context of organizational inertia and path dependency with the help of the aforementioned concepts. Part of the seminar will be to analyze the role of different stakeholders and how companies can become part of innovation ecosystems.

Based on the impulses and the core paper, students will apply the concepts they have learned to selected companies and present their results. These are also incorporated into academic seminar papers. As part of this work process, students deal independently with a current, research-oriented question and apply scientific criteria consistently. They research relevant information, analyze and abstract it critically and draw their own conclusions on this basis, reflecting their interdisciplinary knowledge and selectively developing current research findings.

The results obtained are systematically presented in written and oral form in compliance with academic standards - including structured presentation, correct specialist terminology and comprehensible references. In doing so, the students argue in a technically sound manner and are able to defend their positions in scientific discourse with experts. In addition, they are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

**Organizational issues**Weblink: [https://itm.entechnon.kit.edu/192\\_1281.php](https://itm.entechnon.kit.edu/192_1281.php)[https://itm.entechnon.kit.edu/192\\_1673.php](https://itm.entechnon.kit.edu/192_1673.php)**Human-Centered Systems Seminar: Engineering**2500125, SS 2026, 3 SWS, Language: English, [Open in study portal](#)**Seminar (S)**  
**Blended (On-Site/Online)****Content**

Formerly known as "Current Topics in Digital Transformation"

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 human-centered systems lab (Prof. Mädche). Students will work on a dedicated topic in the context of human-centered systems and apply a pre-defined research method. A broad spectrum of topics is offered every semester, topics may range from creating an experimental design, analyzing collected data, or systematically comparing existing software prototypes in a specific field of interest.

**Data Science for Industrial Applications**2540493, SS 2026, 2 SWS, Language: English, [Open in study portal](#)**Seminar (S)**  
**On-Site**



## Content

### Learning Objectives

This seminar will require you to screen, select, and apply information systems theories and methodologies to solve contemporary challenges in the manufacturing and adjacent industries. This will include both critical reviews of the literature state-of-the-art [1-2] as well as the systematic conduct of design science research and machine learning methods [3-4]. You will identify key problems in real-world use cases, derive relevant research questions, and systematically gather, choose, and apply academic knowledge to develop solutions in the form of proof-of-concepts or prototypes.

### Course Credits

The seminar can be credited as Seminar Betriebswirtschaftslehre A [T-WIWI-103474], Seminar Betriebswirtschaftslehre B [T-WIWI-103476] or Seminar Wirtschaftsinformatik [T-WIWI-109827] (3 ECTS). Other courses may be credited upon request.

### Seminar Description

The Internet of Things (IoT) is significantly transforming industries such as automotive, healthcare, and energy. With the rise of ubiquitous computing power, connectivity/internet access, and the economic application of sensors [5], physical products are providing vast amounts of data, enabling the development of smart services [6]. While such IoT use cases are projected to open a market potential valued at \$3.3 billion in 2030 [7], the industry is still far from exploiting its full capabilities. To solve this challenge, cutting-edge academic knowledge in information systems and machine learning is key to generating valuable insights from machine data.

The seminar is held in cooperation with international industry partners, who provide real-world datasets and ongoing access to subject matter experts. Students will work in teams of 2-4 on different topics and datasets. The assignments will be handed out in a joint kick-off event – to be scheduled once participating students have been selected. Attendance at this kick-off event is mandatory and a prerequisite for participation. Students are required to submit a seminar paper of 12-15 pages on an individual basis.

Expertise in Python and Data Science / Machine Learning as well as successful participation in the course “Artificial Intelligence in Service Systems” (T-WIWI-108715) are strongly recommended.

### Contact

Daniel Hendricks – daniel.hendriks@kit.edu

Philipp Spitzer - philipp.spitzer@kit.edu

Joshua Holstein – joshua.holstein@kit.edu

**The practical seminar will be held in English. Application documents can be handed in in English or German.**

[1] Webster, J., Watson, R. T. (2002). Analyzing the Past to Prepare for the Future: Writing a Literature Review. *MIS Quarterly*, 26 (2) xiii-xxiii.

[2] Brocke, J. v. et al. (2009), Reconstructing the Giant: On the Importance of Rigour in Documenting the Literature Search Process. *Proceedings of the European Conference on Information Systems*, paper 161.

[3] Wirth, R., Hipp, J. (2000). CRISP-DM: Towards a Standard Process Model for Data Mining. *Proceedings of the 4th International Conference on the Practical Applications of Knowledge Discovery and Data Mining*, 29-40.

[4] Peffers, K., Tuunanen, T., Rothenberger, M., Chatterjee, S. (2008). A Design Science Research Methodology for Information Systems Research. *Journal of Management Information Systems*, 24 (3) 45–78.

[5] Martin, D.; Kühl, N.; Satzger, G. (2021). Virtual Sensors. *Business & Information Systems Engineering*, 63 (3) 315-323.

[6] Hunke, F., Heinz, D. Satzger, G. (2022). Creating customer value from data: foundations and archetypes of analytics-based services. *Electronic Markets*, 32, 503–521.

[7] Chui, M., Collins, M., Patel, M. (2021). IoT value set to accelerate through 2030: Where and how to capture it. McKinsey & Company. URL: <https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/iot-value-set-to-accelerate-through-2030-where-and-how-to-capture-it>



### Master Seminar in Data Science and Machine Learning

2540510, SS 2026, 2 SWS, Language: German/English, [Open in study portal](#)

Seminar (S)



### Biosignal-Adaptive Systems Seminar

2540553, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

Seminar (S)  
Blended (On-Site/Online)



### Content

Biosignal-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 biosignal-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 (h-lab, 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 biosignal-adaptive system is and how it can be conceptualized
- Suggest and evaluate different design solutions for addressing the identified problem
- Build a biosignal-adaptive system prototype using state-of-the-art hard- and software
- Perform a user-centric evaluation of the biosignal-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.



### Human-Centered Systems Seminar: Research

2540557, SS 2026, 3 SWS, Language: English, [Open in study portal](#)

Seminar (S)  
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 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 2026, 2 SWS, Language: English, [Open in study portal](#)

**Seminar (S)**  
**On-Site**

**Content****Content**

In this course, the students choose from various relevant and current research topics in entrepreneurship and independently develop a topic that suits them in small teams. Initially, there is an introduction to standard methods such as systematic literature review, design science, qualitative and quantitative data analysis, and more. The seminar topic must be scientifically prepared and presented in 15-20 pages as part of a written elaboration. The seminar results are presented in a block event at the end of the semester (20 min + 10 min open discussion).

**Learning Objectives**

The foundations of independent scholarly work (literature review, argumentation + discussion, citation of literature sources, application of qualitative, quantitative, and simulation methods) are developed as part of the written elaboration. The competencies acquired in the seminar can be utilized in preparing for a potential master's thesis. Therefore, the seminar is mainly aimed at students who intend to write their thesis at the Chair of Entrepreneurship and Technology Management and wish to gain substantial experience in entrepreneurship research.

**Organizational issues**

Registration is via the Wiwi-Portal.

Seminar dates will probably be (as announced in Wiwi-Portal):

Wednesday, 29.04.2026, 10.00-16.00

Wednesday, 20.05.2026, 10.00-16.00

Wednesday, 24.06.2026, 09.00-12.00

**Literature**

Will be announced in the seminar.

**Seminar Human Resource Management (Master)**

2573012, SS 2026, 2 SWS, Language: German, [Open in study portal](#)

**Seminar (S)**  
**On-Site**

**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 2026, 2 SWS, Language: German, [Open in study portal](#)

**Seminar (S)**  
**On-Site**

**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

## T

**6.379 Module component: Seminar in Economic Policy [T-WIWI-102789]**

**Coordinators:** Prof. Dr. Ingrid Ott  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-107011 - Economics of Innovation and Growth](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 3 CP    | graded  | Each term    | 1       |

| Exams    |         |                                            |     |
|----------|---------|--------------------------------------------|-----|
| WT 25/26 | 7900212 | <a href="#">Seminar in Economic Policy</a> | Ott |
| ST 2026  | 7900051 | <a href="#">Seminar in Economic Policy</a> | Ott |

**Assessment**

The assessment is carried out through a term paper within the range of 12 to 15 pages, a presentation of the results of the work in a seminar meeting, and active participation in the discussions of the seminar meeting (§ 4 (2), 3 SPO).

The final grade is composed of the weighted scored examinations (Essay 50%, 40% oral presentation, active participation 10%).

**Prerequisites**

None

**Recommendations**

At least one of the lectures "Theory of Endogenous Growth" or "Innovation Theory and Policy" should be attended in advance, if possible.

## T

**6.380 Module component: Seminar in Economics A (Master) [T-WIWI-103478]****Coordinators:** Professorenschaft des Fachbereichs Volkswirtschaftslehre**Organisation:** KIT Department of Business and Economics**Part of:** M-WIWI-102736 - Seminar Module Economic Sciences

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 3 CP    | graded  | Each term    | 1       |

| Courses  |          |                                                                     |       |              |                                                                                  |
|----------|----------|---------------------------------------------------------------------|-------|--------------|----------------------------------------------------------------------------------|
| WT 25/26 | 25000111 | Statistics and Epidemics                                            | 2 SWS | Seminar / 🗣️ | Bracher, Nemcova                                                                 |
| WT 25/26 | 2500024  | Wirtschaftstheoretisches Seminar IV (Master)                        | 2 SWS | Seminar / 🗣️ | Puppe, Kretz, Ammann, Okulicz                                                    |
| WT 25/26 | 2500052  | Seminar on Topics in Digital Economics                              | 2 SWS | Seminar / 🗣️ | Reiß, Hillenbrand, Potarca                                                       |
| WT 25/26 | 2500064  | Economics of Crime                                                  | 2 SWS | Seminar / 🗣️ | Mill                                                                             |
| WT 25/26 | 2520500  | Workshop on Economics, Finance and Statistics                       | 2 SWS | Seminar      | Puppe, Brumm, Nieken, Ott, Reiß, Ruckes, Schienle, Uhrig-Homburg, Wigger, Krüger |
| WT 25/26 | 2520563  | Wirtschaftstheoretisches Seminar III (Master)                       | 2 SWS | Seminar / 🗣️ | Ammann, Kretz                                                                    |
| WT 25/26 | 2521310  | Topics in Econometrics                                              | 2 SWS | Seminar      | Schienle, Krüger, Bracher, Buse, Koster, Rüter, Leimenstoll, Renner, Pohle       |
| WT 25/26 | 2560130  | Seminar Public Finance                                              | 2 SWS | Seminar / 🗣️ | Wigger, Setio, Schmelzer                                                         |
| WT 25/26 | 2560142  | Seminar in Digital Economics (Master)                               | 2 SWS | Seminar / 🗣️ | Rosar                                                                            |
| WT 25/26 | 2560143  | Seminar Game Theory and Behavioral Economics (Master)               | 2 SWS | Seminar / 🗣️ | Rau                                                                              |
| WT 25/26 | 2560282  | Seminar in Economic Policy                                          | 2 SWS | Seminar / 🗣️ | Ott, Assistenten                                                                 |
| WT 25/26 | 2560400  | Seminar in Macroeconomics I                                         | 2 SWS | Seminar / 🗣️ | Brumm, Pegorari, Kissling, Schang                                                |
| WT 25/26 | 2561208  | Selected aspects of European transport planning and -modelling      | 2 SWS | Seminar      | Szimba, Sand                                                                     |
| ST 2026  | 2500012  | Making and Evaluating Predictions                                   | 2 SWS | Seminar      | Schienle, Allen, Zhang                                                           |
| ST 2026  | 2500035  | Efficiency analyses in network sectors                              | 2 SWS | Seminar / 🗣️ | Mitusch, Latsch                                                                  |
| ST 2026  | 2520536  | Seminar in Economic Theory II                                       | 2 SWS | Seminar / 🗣️ | Ammann, Kretz, Okulicz                                                           |
| ST 2026  | 2520563  | Seminar in Economic Theory III                                      | 2 SWS | Seminar / 🗣️ | Ammann, Kretz, Okulicz                                                           |
| ST 2026  | 2521310  | Advanced Topics in Econometrics                                     | 2 SWS | Seminar      | Schienle, Krüger, Bracher, Buse, Koster, Rüter, Leimenstoll, Renner              |
| ST 2026  | 2560130  | Seminar Public Finance                                              | 2 SWS | Block / 🗣️   | Wigger, Schmelzer                                                                |
| ST 2026  | 2560282  | Seminar in economic policy                                          | 2 SWS | Seminar / 🗣️ | Ott, Assistenten                                                                 |
| ST 2026  | 2560400  | Seminar in Macroeconomics I                                         | 2 SWS | Seminar / 🗣️ | Brumm, Frank                                                                     |
| ST 2026  | 2560554  | Seminar Lying and Cheating in Economic Decision Situations (Master) | 2 SWS | Seminar / 🗣️ | Rau                                                                              |

| Exams    |         |                                                                                     |                   |
|----------|---------|-------------------------------------------------------------------------------------|-------------------|
| WT 25/26 | 7900015 | Seminar Economics of Crime (Master)                                                 | Mill              |
| WT 25/26 | 7900115 | Seminar: How to Make Democracy Work? Voting Methods in Theory and Practice (Master) | Puppe             |
| WT 25/26 | 7900117 | Seminar in Economics A (Master)                                                     | Brumm             |
| WT 25/26 | 7900139 | Selected Aspects of European Transport Planning and Modelling                       | Mitusch           |
| WT 25/26 | 7900140 | Seminar in Digital Economics (Master)                                               | Puppe             |
| WT 25/26 | 7900212 | Seminar in Economic Policy                                                          | Ott               |
| WT 25/26 | 7900254 | Topics in Econometrics                                                              | Schienze, Bracher |
| WT 25/26 | 7900296 | Seminar Game Theory and Behavioral Economics (Master)                               | Mill              |
| WT 25/26 | 7900361 | Seminar on Topics in Digital Economics                                              | Reiß, Hillenbrand |
| WT 25/26 | 79sefi2 | Seminar Public Finance A (Master)                                                   | Wigger            |
| ST 2026  | 7900051 | Seminar in Economic Policy                                                          | Ott               |
| ST 2026  | 7900131 | Lying and Cheating in Economic Decision Situations (Master)                         | Rau               |
| ST 2026  | 7900164 | Seminar in Economics (Bachelor)                                                     | Mitusch           |

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

### Assessment

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

### Recommendations

See seminar description in the course catalogue of the KIT (<https://campus.kit.edu/>)

### Additional Information

**Note on Prof. Ingrid Ott's seminars:** Due to a research semester, no seminars will be offered in the summer semester 2026.

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

90 hours

Below you will find excerpts from courses related to this module component:

|  |                                                                                                                       |                                      |
|--|-----------------------------------------------------------------------------------------------------------------------|--------------------------------------|
|  | <b>Statistics and Epidemics</b><br>25000111, WS 25/26, 2 SWS, Language: English, <a href="#">Open in study portal</a> | <b>Seminar (S)</b><br><b>On-Site</b> |
|--|-----------------------------------------------------------------------------------------------------------------------|--------------------------------------|

**Content****Motivation**

Infectious disease epidemiology gives rise to a large variety of real-time data streams. During the COVID-19 pandemic, the interpretation and statistical analysis of these data has proven crucial, but also highly challenging. In this seminar, students will get to know central concepts of infectious disease surveillance and modelling from a statistical perspective. Following an overview of various aspects in the form of blocked lectures, students will choose a more specific topic for their seminar thesis.

**Learning Goals**

Students develop an understanding of central modeling tasks and methods, including

- estimation of reproductive numbers
- compartment models of disease spread
- nowcasting and short-term forecasting of disease spread
- detection of outbreaks
- diagnostic testing

Moreover, they get to know various data types commonly used in the analysis of disease spread.

**Logistics**

The project seminar is worth 4.5 credit points (Leistungspunkte). There will be three blocked lectures (approx. 135 minutes each) in the beginning of the lecture period. For the various topics covered, subjects for seminar theses will be proposed (and students are allowed to propose their own topics). Towards the end of the semester, students present their progress on the chosen topics to the group. Grades will be based on this presentation (25%) and the final report (75%).

**Organizational issues****Prerequisites**

Students should have a very good working knowledge of statistics, including proficiency in a programming language for applied data analysis. The lecture VWL3 Introduction to Econometrics is a prerequisite for the project seminar. Most available software in the field is in R, but in principle Python can be used as well. Advanced knowledge of biology, medicine or epidemiology is not required.

**Application Procedure**

Please submit a transcript of records as well as a short letter of motivation (roughly 200 words) via WIWI-Portal: <https://portal.wiwi.kit.edu/ys/8902>

Application time frame: September 5th, 2025 to October, 31th, 2025.

**Economics of Crime**

2500064, WS 25/26, 2 SWS, [Open in study portal](#)

**Seminar (S)**  
**On-Site**

**Content**

For Bachelor students of the fields Industrial Engineering and Management, Information Engineering and Management, Economics Engineering or Economathematics.

**Organizational issues**

Application is possible via <https://portal.wiwi.kit.edu/Seminare>

Kick-off: 29.10.2025, 11.00 - 12.30 h 01.85, KD2 Lab (1. floor über Außentreppe), Team Room(Raum tbc)

Presentations: 17.01.2026 09.00 - 18.00 h, 01.85, KD2 Lab (1. floor über Außentreppe), Team Room

**Topics in Econometrics**

2521310, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)

**Seminar (S)**

**Organizational issues**

Wöchentliche Veranstaltung, Donnerstags 13:00-14:30 Uhr in B17 - R320

**Seminar in Digital Economics (Master)**

2560142, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

**Seminar (S)**  
**On-Site**

**Content**

The seminar addresses issues in the digital economy from a game-theoretic perspective. All information about the seminar will be published on the Wiwi-Portal.

**Seminar Game Theory and Behavioral Economics (Master)**2560143, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)**Seminar (S)**  
**On-Site****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 <https://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: 29.10.2025, 14.00 - 15.30 h, Geb. 01.85, KD2Lab Team room (über Außentreppe)

Presentations: 19.01.2026, 14.00 - 18.00 h, Geb. 01.85, KD2Lab Team room (über Außentreppe)

**Making and Evaluating Predictions**2500012, SS 2026, 2 SWS, Language: German/English, [Open in study portal](#)**Seminar (S)****Content**

A key goal of statistics and data science is to make predictions. Good predictions are important for decision-making, allowing us to balance risks and mitigate the impacts of potentially damaging events. In this seminar, we will study theoretical questions regarding the evaluation of predictions, such as “What does it mean for a prediction to be good?”, before introducing statistical and machine learning methods to generate both point-valued and probabilistic predictions. We will discuss applications to economics, meteorology, and energy forecasting.

**Format:** The course will start with a short block course at the beginning of the lecture period. Evaluation will be based on a seminar thesis, which students are required to hand in at the end of the lecture period, and a short presentation. The presentations will also take place towards the end of the lecture period.

**Organizational issues**

Blockveranstaltung, Termine werden bekannt gegeben

**Advanced Topics in Econometrics**2521310, SS 2026, 2 SWS, Language: German/English, [Open in study portal](#)**Seminar (S)****Organizational issues**

wöchentlich, Donnerstags 11:00-12:30, B17, R320

**Seminar Public Finance**2560130, SS 2026, 2 SWS, Language: German, [Open in study portal](#)**Block (B)**  
**Blended (On-Site/Online)****Content**

See German version.

**Organizational issues**

Termine werden bekannt gegeben.

**Literature**

Literatur wird zu Beginn des jeweiligen Seminars vorgestellt.

**Seminar Lying and Cheating in Economic Decision Situations (Master)**2560554, SS 2026, 2 SWS, Language: English, [Open in study portal](#)**Seminar (S)**  
**On-Site**



**Content**

**Objective of the seminar:** 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 12–15 pages are to be handed in.

Students' grades will be based on the quality of presentations in the seminar (40%) and the seminar paper (60%). There may be a bonus on the grade for 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**

Obligatory: Application via WiWi-Portal during the seminar registration period

Seminar Kick-off: 28.04.2026, 14.00 - 14.45 h

Seminar Presentations: 30.06.2026 9.30 - 18.00 h

Hand-in Seminar Papers: 02.08.2026

## T

**6.381 Module component: Seminar in Informatics A (Master) [T-WIWI-103479]****Coordinators:** Professorenschaft des Instituts AIFB**Organisation:** KIT Department of Business and Economics**Part of:** M-WIWI-107692 - Seminar Module Applied Informatics**Type**  
Examination of another type**Credits**  
3 CP**Grading**  
graded**Term offered**  
Each term**Version**  
1

| Courses  |         |                                                                                                     |       |             |                                                                |
|----------|---------|-----------------------------------------------------------------------------------------------------|-------|-------------|----------------------------------------------------------------|
| WT 25/26 | 2400125 | Security and Privacy Awareness                                                                      | 2 SWS | Seminar / ☼ | Seidel-Saul, Volkamer, Boehm, Ballreich, Sikra, Veit           |
| WT 25/26 | 2512101 | Seminar: From Physical Models to Digital Twins: A Data-Driven Simulation Workshop (Master)          | 2 SWS | Seminar / ☼ | Lazarova-Molnar, Khodadadi, Daniel                             |
| WT 25/26 | 2513103 | Seminar: Applications of Digital Twins (Master)                                                     | 2 SWS | Seminar / ☼ | Lazarova-Molnar, Lee, Mahmoud                                  |
| WT 25/26 | 2513105 | Seminar: New Trends in Artificial Intelligence Techniques for Noise Prediction (Master)             | 2 SWS | Seminar / ☼ | Lazarova-Molnar, Demetgül                                      |
| WT 25/26 | 2513107 | Seminar: Data-Driven Reliability Modeling of Energy Systems (Master)                                | 2 SWS | Seminar     | Lazarova-Molnar, Mostafa                                       |
| WT 25/26 | 2513313 | Seminar Linked Data and the Semantic Web (Master)                                                   | 3 SWS | Seminar / ☼ | Käfer, Braun, Li, Kubelka                                      |
| WT 25/26 | 2513314 | Seminar Real-World Challenges in Data Science and Analytics (Bachelor)                              | 3 SWS | / ☼         | Hoellig, Käfer, Thoma                                          |
| WT 25/26 | 2513315 | Seminar Real-World Challenges in Data Science and Analytics (Master)                                | 3 SWS | / ☼         | Hoellig, Käfer, Thoma                                          |
| WT 25/26 | 2513451 | Seminar Cooperative Autonomous Vehicles (Master)                                                    | 2 SWS | Seminar / ☼ | Vinel                                                          |
| WT 25/26 | 2513458 | Seminar Artificial Intelligence for Autonomous Driving (Master)                                     | 2 SWS | Seminar / ☼ | Zhao, Vinel                                                    |
| WT 25/26 | 2513460 | Seminar Cooperative Robots (Master)                                                                 | 2 SWS | Seminar / ☼ | Vinel                                                          |
| WT 25/26 | 2513500 | Seminar Cognitive Automobiles and Robots (Master)                                                   | 2 SWS | Seminar / ☼ | Zöllner, Schneider                                             |
| ST 2026  | 2512101 | Seminar: From Physical Models to Digital Twins: A Data-Driven Simulation Workshop (Seminar/ Master) | 2 SWS | Seminar / ☼ | Lazarova-Molnar, Khodadadi, Lee, Daniel                        |
| ST 2026  | 2513103 | Seminar: Applications of Digital Twins (Master)                                                     | 2 SWS | Seminar / ☼ | Lazarova-Molnar, Lee, Mahmoud                                  |
| ST 2026  | 2513108 | Seminar: New Trends in Artificial Intelligence Techniques for Noise Prediction (Master)             | 2 SWS | Seminar / ☼ | Demetgül, Lazarova-Molnar                                      |
| ST 2026  | 2513109 | Seminar: Data-driven Agent-based Modeling and Simulation (Master)                                   | 2 SWS | Seminar     | Lazarova-Molnar, Lee                                           |
| ST 2026  | 2513211 | Seminar Business Information Systems (Master)                                                       | 2 SWS | Seminar / ☼ | Oberweis, Forell, Fritsch, Rybinski, Schreiber, Ullrich, König |

|              |                |                                                                                                                                       |       |                                                                                               |                               |
|--------------|----------------|---------------------------------------------------------------------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|-------------------------------|
| ST 2026      | 2513221        | Seminar Intelligente<br>Fahrzeugsysteme der nächsten<br>Generation: Kognition,<br>Personalisierung und adaptive<br>Mobilität (Master) | 2 SWS | Seminar                                                                                       | Ullrich, Schreiber            |
| ST 2026      | 2513309        | Seminar Knowledge Discovery and<br>Data Mining (Master)                                                                               | 2 SWS | Seminar /  | Käfer, Noullet, Kinder,<br>Li |
| ST 2026      | 2513311        | Seminar Data Science & Real-time<br>Big Data Analytics (Master)                                                                       | 2 SWS | Seminar /  | Käfer, Thoma,<br>Slobodyanik  |
| ST 2026      | 2513455        | Seminar Machine Learning in<br>Autonomous Driving (Master)                                                                            | 2 SWS | Seminar /  | Zhao, Vinel                   |
| ST 2026      | 2513459        | Seminar Vulnerable Road User<br>Technologies (Master)                                                                                 | 2 SWS | Seminar /  | Schrapel, Vinel               |
| ST 2026      | 2513500        | Cognitive Automobiles and Robots                                                                                                      | 2 SWS | Seminar /  | Zöllner, Schneider            |
| ST 2026      | 2513607        | Seminar Knowledge Graphs and<br>Large Language Models (Master)                                                                        | 2 SWS | Seminar /  | Sack, Gesese                  |
| <b>Exams</b> |                |                                                                                                                                       |       |                                                                                               |                               |
| WT 25/26     | 7900025        | Seminar "Applications of Digital Twins (Master)"                                                                                      |       |                                                                                               | Lazarova-Molnar               |
| WT 25/26     | 7900048        | Seminar New Trends in Artificial Intelligence Techniques for Noise<br>Prediction (Master)                                             |       |                                                                                               | Lazarova-Molnar               |
| WT 25/26     | 7900069        | Human-Centered Systems Seminar: Engineering                                                                                           |       |                                                                                               | Mädche                        |
| WT 25/26     | 7900102        | Advanced Lab Knowledge-driven Artificial Intelligence (Master)                                                                        |       |                                                                                               | Sack                          |
| WT 25/26     | 7900119        | Seminar Cognitive Automobiles and Robots                                                                                              |       |                                                                                               | Zöllner                       |
| WT 25/26     | 7900121        | Security and Privacy Awareness                                                                                                        |       |                                                                                               | Volkamer                      |
| WT 25/26     | 7900209        | Seminar "From Physical Models to Digital Twins: A Data-Driven<br>Simulation Workshop (Master)"                                        |       |                                                                                               | Lazarova-Molnar               |
| WT 25/26     | 7900226        | Seminar Modeling and Simulation for Energy Systems (Master)                                                                           |       |                                                                                               | Lazarova-Molnar               |
| WT 25/26     | 7900233        | Human-Centered Systems Seminar: Research                                                                                              |       |                                                                                               | Mädche                        |
| WT 25/26     | 7900245        | Seminar Cooperative Autonomous Vehicles (Master)                                                                                      |       |                                                                                               | Vinel                         |
| WT 25/26     | 7900274        | Seminar Real-World Challenges in Data Science and Analytics<br>(Master)                                                               |       |                                                                                               | Sure-Vetter, Färber           |
| WT 25/26     | 7900279        | Seminar Cooperative Robots (Master)                                                                                                   |       |                                                                                               | Vinel                         |
| WT 25/26     | 7900304        | Seminar Linked Data and the Semantic Web (Master)                                                                                     |       |                                                                                               | Färber                        |
| WT 25/26     | 7900356        | Seminar Real-World Challenges in Data Science and Analytics<br>(Master)                                                               |       |                                                                                               | Sure-Vetter, Färber           |
| WT 25/26     | 79AIFB_AIAD_C4 | Seminar Artificial Intelligence for Autonomous Driving (Master)                                                                       |       |                                                                                               | Vinel                         |
| ST 2026      | 7900062        | Seminar Data-driven Agent-based Modeling and Simulation (Master)                                                                      |       |                                                                                               | Lazarova-Molnar               |
| ST 2026      | 7900088        | Seminar Business Information Systems (Master)                                                                                         |       |                                                                                               | Oberweis                      |
| ST 2026      | 7900147        | Cognitive Automobiles and Robots                                                                                                      |       |                                                                                               | Zöllner                       |
| ST 2026      | 7900162        | Seminar: From Physical Models to Digital Twins: A Data-Driven<br>Simulation Workshop (Master)                                         |       |                                                                                               | Lazarova-Molnar               |
| ST 2026      | 7900190        | Human-Centered Systems Seminar: Engineering                                                                                           |       |                                                                                               | Mädche                        |
| ST 2026      | 7900191        | Seminar Vulnerable Road User Technologies (Master)                                                                                    |       |                                                                                               | Vinel                         |
| ST 2026      | 7900198        | Seminar Data Science & Real-Time Big Data Analytics (Master)                                                                          |       |                                                                                               | Käfer                         |
| ST 2026      | 7900199        | Seminar Large Language Model-Enhanced Representation Learning<br>for Knowledge Graphs (Master)                                        |       |                                                                                               | Sack                          |
| ST 2026      | 7900202        | Seminar Knowledge Discovery and Data Mining (Master)                                                                                  |       |                                                                                               | Käfer                         |
| ST 2026      | 7900203        | Seminar Machine Learning in Autonomous Driving (Master)                                                                               |       |                                                                                               | Vinel                         |
| ST 2026      | 7900206        | Seminar New Trends in Artificial Intelligence Techniques for Noise<br>Prediction (Master)                                             |       |                                                                                               | Lazarova-Molnar               |
| ST 2026      | 7900261        | Human-Centered Systems Seminar: Research                                                                                              |       |                                                                                               | Mädche                        |
| ST 2026      | 7900305        | Seminar: Applications of Digital Twins (Master)                                                                                       |       |                                                                                               | Lazarova-Molnar               |

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

**Assessment**

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.

**Recommendations**

See seminar description in the course catalogue of the KIT (<https://campus.kit.edu/>)

**Additional Information**

Placeholder for seminars offered by the Institute AIFB.

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

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

**Workload**

90 hours

*Below you will find excerpts from courses related to this module component:*

**Security and Privacy Awareness**

2400125, WS 25/26, 2 SWS, Language: German/English, [Open in study portal](#)

**Seminar (S)**  
**Blended (On-Site/Online)**

**Content**

Within the framework of this interdisciplinary seminar, the topics security awareness and privacy awareness are to be considered from different perspectives. It deals with legal, information technology, psychological, social as well as philosophical aspects.

**Important notes:**

- The seminar language is English. This means that English is the standard for the presentation and the seminar paper, and German is only permitted for the paper after consultation with the supervisor, for example, if the topic of the thesis requires it.
- The seminar is only for MASTER students (or Mastervorzug)
- The link to enrol is for every student, regardless of the study background

**Topics:**

The advertised topics can be found in the wiwi portal.

**Seminar: Applications of Digital Twins (Master)**

2513103, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

**Seminar (S)**  
**On-Site**

**Content****Seminar Name:** Applications of Digital Twins**Size:** 10 students (with 10 different topics)**Workload:**

- 2 Lectures:
  - o Introduction to Digital Twins and topic distribution
  - o "How to Give Effective Presentations" lecture
- 10 student presentations (each 45 minutes in total)
- 10 student reports

**Responsible Person:** Hui Min Lee, Sanja Lazarova-Molnar**Deliverables for Grade:**

- 1 Report per student and topic (8 pages, including references, IEEE Template, compulsory usage of Reference Manager – Zotero or EndNote)
- 25 mins presentation per student plus 20 min discussion (focus on the presentation topic + presentation skills) = 45 minutes for each student

**Credits:** 3 credits = 90 hours**Format/ Structure of the Seminar (Draft):**

- 2 Lectures at the beginning of the semester
- Students have 1 week time to provide a priority list of 5 topics, distribution will be decided based on first come – first serve, ensuring that core topics are covered
- Q&As can be asked and answered over mails or ad-hoc appointments
- Students have time to work on the report and presentation during the semester
- Submission of all reports will be required 2 months after the intro lecture for ensuring fairness
- Presentations are done in blocks of 2 students per class, starting mid-June, presentations will be submitted at the day of the scheduled presentation

**Approximate Time Consumption for Students (Draft):**

- Lectures: 3 hours
- Student Presentations: 7.5 hours
- Topic Subscription: 1 hour
- Presentation Preparation: 15 hours
- Paper Writing and Literature Review: 63.5 hours

**Description:**

The seminar focuses on applications of Digital Twins and data-driven modeling, with an additional goal of improving scientific research and presentation skills for Master students. The seminar covers the diverse applications and use cases of Digital Twins in different domains such as manufacturing, energy systems, healthcare and many more, offering students an in-depth understanding of the role of Digital Twins in transforming the industries.

The seminar is structured as a literature review seminar. Each student can select a topic out of a predefined set, conduct further research and then write a comprehensive research paper. Students will also deliver presentations, synthesizing insights from both the provided starting reference literature and their own additional research.

By the end of the course, students will not only have a solid understanding of the current applications of Digital Twins and emerging trends but also be well-prepared to present their findings in an academic setting.

**Topics:****1. Digital Twins for Manufacturing Systems**

References:

- Zhang, Chenyuan, et al. "A reconfigurable modeling approach for digital twin-based manufacturing system." *Procedia Cirp* 83 (2019): 118-125. (96 citations)
- Kritzinger, Werner, et al. "Digital Twin in manufacturing: A categorical literature review and classification." *Ifac-PapersOnline* 51.11 (2018): 1016-1022. (1934 citations)
- Jaensch, Florian, et al. "Digital twins of manufacturing systems as a base for machine learning." *2018 25th International conference on mechatronics and machine vision in practice (M2VIP)*. IEEE, 2018. (73 citations)

**2. Digital Twins for Energy Systems**

References:

- Steindl, Gernot, et al. "Generic digital twin architecture for industrial energy systems." *Applied Sciences* 10.24 (2020): 8903. (78 citations)

- Granacher, Julia, et al. "Overcoming decision paralysis—A digital twin for decision making in energy system design." *Applied Energy* 306 (2022): 117954. (33 citations) -> focus on interactive digital twins
- Palensky, Peter, et al. "Digital twins and their use in future power systems." *Digital Twin* 1 (2022): 4. (37 citations)

### 3. Digital Twins in Healthcare

References:

- Alazab, Mamoun, et al. "Digital twins for healthcare 4.0-recent advances, architecture, and open challenges." *IEEE Consumer Electronics Magazine* (2022). (26 citations)
- Croatti, Angelo, et al. "On the integration of agents and digital twins in healthcare." *Journal of Medical Systems* 44 (2020): 1-8. (163 citations)
- Erol, Tolga, Arif Furkan Mendi, and Dilara Doğan. "The digital twin revolution in healthcare." *2020 4th international symposium on multidisciplinary studies and innovative technologies (ISMSIT)*. IEEE, 2020. (106 citations)

### 4. Digital Twins of City Infrastructures (in Smart Cities)

References:

- Deren, Li, Yu Wenbo, and Shao Zhenfeng. "Smart city based on digital twins." *Computational Urban Science* 1 (2021): 1-11. (110 citations)
- Deng, Tianhu, Keren Zhang, and Zuo-Jun Max Shen. "A systematic review of a digital twin city: A new pattern of urban governance toward smart cities." *Journal of Management Science and Engineering* 6.2 (2021): 125-134. (192 citations)
- Mylonas, Georgios, et al. "Digital twins from smart manufacturing to smart cities: A survey." *Ieee Access* 9 (2021): 143222-143249. (99 citations)

### 5. Digital Twins in Logistics

References:

- Moshood, Taofeeq D., et al. "Digital twins driven supply chain visibility within logistics: A new paradigm for future logistics." *Applied System Innovation* 4.2 (2021): 29. (71 citations)
- Agalianos, K., et al. "Discrete event simulation and digital twins: review and challenges for logistics." *Procedia Manufacturing* 51 (2020): 1636-1641. (74 citations)
- Korth, Benjamin, Christian Schwede, and Markus Zajac. "Simulation-ready digital twin for realtime management of logistics systems." *2018 IEEE international conference on big data (big data)*. IEEE, 2018. (64 citations)

### 6. Cognitive Digital Twins

References:

- Al Faruque, Mohammad Abdullah, et al. "Cognitive digital twin for manufacturing systems." *2021 Design, Automation & Test in Europe Conference & Exhibition (DATE)*. IEEE, 2021. (28 citations)
- Zhang, Nan, Rami Bahsoon, and Georgios Theodoropoulos. "Towards engineering cognitive digital twins with self-awareness." *2020 IEEE International Conference on Systems, Man, and Cybernetics (SMC)*. IEEE, 2020. (22 citations)
- Zheng, Xiaochen, Jinzhi Lu, and Dimitris Kiritsis. "The emergence of cognitive digital twin: vision, challenges and opportunities." *International Journal of Production Research* 60.24 (2022): 7610-7632. (92 citations)

### 7. Fusing Data and Human Expert Knowledge in Digital Twins

References:

- Kulkarni, Vinay, Souvik Barat, and Tony Clark. "Towards adaptive enterprises using digital twins." *2019 winter simulation conference (WSC)*. IEEE, 2019. (22 citations)
- Vogel-Heuser, Birgit, et al. "Potential for combining semantics and data analysis in the context of digital twins." *Philosophical Transactions of the Royal Society A* 379.2207 (2021): 20200368. (16 citations)
- Todorovski, Ljupčo, and Sašo Džeroski. "Integrating knowledge-driven and data-driven approaches to modeling." *ecological modelling* 194.1-3 (2006): 3-13. (80 citations)

### 8. Digital Twins for Multi-agent / Complex Systems

References:

- Pretel, Elena, Alejandro Moya, Elena Navarro, Víctor López-Jaquero, and Pascual González. "Analysing the synergies between Multi-agent Systems and Digital Twins: A systematic literature review." *Information and Software Technology* (2024): 107503. (2 citations)
- Mariani, S., Picone, M., Ricci, A. (2022). About Digital Twins, Agents, and Multiagent Systems: A Cross-Fertilisation Journey. In: Melo, F.S., Fang, F. (eds) *Autonomous Agents and Multiagent Systems. Best and Visionary Papers. AAMAS 2022*. Lecture Notes in Computer Science, vol 13441. (11 citations)
- Marah H, Challenger M. Adaptive hybrid reasoning for agent-based digital twins of distributed multi-robot systems. *SIMULATION*. 2024;100(9):931-957. (0 citations – new articles)

### 9. Digital Twins for Energy Systems

References:

- Kabir, Md Rafiul, Dipal Halder, and Sandip Ray. "Digital Twins for IoT-driven Energy Systems: A Survey." *IEEE Access* (2024). (0 citations – new articles)
- Brosinsky, Christoph, Rainer Krebs, and Dirk Westermann. "Embedded Digital Twins in future energy management systems: paving the way for automated grid control." *at-Automatisierungstechnik* 68, no. 9 (2020): 750-764. (21 citations)
- Song, Zhao, Christoph M. Hackl, Abhinav Anand, Andre Thommessen, Jonas Petzschmann, Omar Kamel, Robert Braunbehrens, Anton Kaifel, Christian Roos, and Stefan Hauptmann. "Digital twins for the future power system: An overview and a future perspective." *Sustainability* 15, no. 6 (2023): 5259. (32 citations)
- Mostafa, Omar & Lazarova-Molnar, Sanja. (2024). Enhancing Reliability of Energy Systems with Digital Twins: Challenges and Opportunities. (0 citations – new articles)

#### 10. Digital Twins in Transportation and Automotive

References:

- Schwarz, Chris, and Ziran Wang. "The role of digital twins in connected and automated vehicles." *IEEE Intelligent Transportation Systems Magazine* 14, no. 6 (2022): 41-51. (91 citations)
- Bhatti, Ghanishtha, Harshit Mohan, and R. Raja Singh. "Towards the future of smart electric vehicles: Digital twin technology." *Renewable and Sustainable Energy Reviews* 141 (2021): 110801. (422 citations)
- Almeaibed, Sadeq, Saba Al-Rubaye, Antonios Tsourdos, and Nicolas P. Avdelidis. "Digital twin analysis to promote safety and security in autonomous vehicles." *IEEE Communications Standards Magazine* 5, no. 1 (2021): 40-46. (135 citations)

#### 11. Digital Twins for Environment and Sustainability

References:

- Tzachor, Asaf, Soheil Sabri, Catherine E. Richards, Abbas Rajabifard, and Michele Acuto. "Potential and limitations of digital twins to achieve the sustainable development goals." *Nature Sustainability* 5, no. 10 (2022): 822-829. (110 citations)
- Corrado, Casey R., Suzanne M. DeLong, Emily G. Holt, Edward Y. Hua, and Andreas Tolk. "Combining green metrics and digital twins for sustainability planning and governance of smart buildings and cities." *Sustainability* 14, no. 20 (2022): 12988. (36 citations)
- Kim, Byungmo, Jaewon Oh, and Cheonhong Min. "Development of a simulation model for digital twin of an oscillating water column wave power generator structure with ocean environmental effect." *Sensors* 23, no. 23 (2023): 9472. (3 citations)

#### 12. Digital Twins in Agriculture

References:

- Peladarinos, Nikolaos, Dimitrios Piromalis, Vasileios Cheimaras, Efthymios Tserepas, Radu Adrian Munteanu, and Panagiotis Papageorgas. "Enhancing smart agriculture by implementing digital twins: A comprehensive review." *Sensors* 23, no. 16 (2023): 7128. (60 citations)
- Escribà-Gelonch, Marc, Shu Liang, Pieter van Schalkwyk, Ian Fisk, Nguyen Van Duc Long, and Volker Hessel. "Digital Twins in Agriculture: Orchestration and Applications." *Journal of Agricultural and Food Chemistry* 72, no. 19 (2024): 10737-10752. (12 citations)
- Verdouw, Cor, Bedir Tekinerdogan, Adrie Beulens, and Sjaak Wolfert. "Digital twins in smart farming." *Agricultural Systems* 189 (2021): 103046. (494 citations)



**Seminar: New Trends in Artificial Intelligence Techniques for Noise Prediction (Master)** Seminar (S)  
2513105, WS 25/26, 2 SWS, Language: English, [Open in study portal](#) On-Site

### Content

Noise, especially in urban areas, is a major environmental issue that impacts quality of life and health, contributing to stress, sleep disturbances, and cardiovascular problems. Traffic noise, primarily from tire-road interactions, has become more prominent as electric vehicles reduce engine noise. Tackling this issue involves both passive methods, like noise barriers, and active solutions such as noise cancellation technologies.

In recent years, artificial intelligence (AI) has emerged as a powerful tool for managing noise. AI-based systems can classify noise sources, create noise maps, and develop control strategies. Advanced AI techniques, including Generative Adversarial Networks (GANs), AutoEncoders, Bi-Long Short-Term Memory (LSTM), and Bi-Gated Recurrent Units (GRUs), Graphical Convolutional Networks (GCN), Physics-informed neural networks, YOLO, Transformer, show great potential for reducing noise. Additionally, many computer vision techniques are used to improve noise conditions. This seminar will explore these AI methods and their role in enhancing conditions safety, minimizing environmental noise, and supporting intelligent transportation systems.

In this seminar, we try to understand Noise through data analysis and other techniques. We discuss current approaches to noise prediction and innovative AI approaches based on data science and machine learning.

### Topics:

Introduction to Noise and Tire-Road Noise

Overview on Noise and Tire-Road Noise

Time Series Analysis and Image Analysis

Data Exploration and Visualization

Noise Feature Extraction and Analysis

Machine learning and Deep Learning Approach for Tire-Road Noise

### Who are we looking for:

We are looking for students who want to expand their specialist knowledge and practical experience in artificial intelligence, signal processing, computer vision and road-tire noise. Participation provides the opportunity to actively participate in shaping the future of using artificial intelligence, computer vision and signal processing to reduce road-tire and traffic noise.

### What we offer:

We provide you with tyre-road noise data. With this data, you can apply many signal processing, computer vision and artificial intelligence algorithms. This is where you can let your creativity run free and implement innovative solutions with our guidance.

### Literature

- Stansfeld, S., Clark, C., Smuk, M., Gallacher, J., & Babisch, W. (2021). Road traffic noise, noise sensitivity, noise annoyance, psychological and physical health and mortality. *Environmental Health*, 20, 1-15.
- Lan, Y., Roberts, H., Kwan, M. P., & Helbich, M. (2020). Transportation noise exposure and anxiety: A systematic review and meta-analysis. *Environmental research*, 191, 110118.
- WHO. (2018) Environmental Noise Guidelines for the European Region.
- EU. (2019) Regulation (EU) No 540/2014 of the European Parliament and of the Council of 16 April 2014 on the Sound Level of Motor Vehicles and of Replacement Silencing Systems, and Amending Directive 2007/46/EC and Repealing Directive 70/157/EEC.



### Seminar Linked Data and the Semantic Web (Master)

2513313, WS 25/26, 3 SWS, Language: German/English, [Open in study portal](#)

Seminar (S)  
On-Site



**Content**

Linked Data is a way of publishing data on the web in a machine-understandable fashion. The aim of this practical seminar is to build applications and devise algorithms that consume, provide, or analyse Linked Data.

The Linked Data principles are a set of practices for data publishing on the web. Linked Data builds on the web architecture and uses HTTP for data access, and RDF for describing data, thus aiming towards web-scale data integration. There is a vast amount of data available published according to those principles: recently, 4.5 billion facts have been counted with information about various domains, including music, movies, geography, natural sciences. Linked Data is also used to make web-pages machine-understandable, corresponding annotations are considered by the big search engine providers. On a smaller scale, devices on the Internet of Things can also be accessed using Linked Data which makes the unified processing of device data and data from the web easy.

In this practical seminar, students will build prototypical applications and devise algorithms that consume, provide, or analyse Linked Data. Those applications and algorithms can also extend existing applications ranging from databases to mobile apps.

For the seminar, programming skills or knowledge about web development tools/technologies are highly recommended. Basic knowledge of RDF and SPARQL are also recommended, but may be acquired during the seminar. Students will work in groups. Seminar meetings will take place as 'Block-Seminar'.

Topics of interest include, but are not limited to:

- Travel Security
- Geo data
- Linked News
- Social Media

The exact dates and information for registration will be announced at the event page.

**Seminar Real-World Challenges in Data Science and Analytics (Bachelor)**

2513314, WS 25/26, 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 25/26, 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 25/26, 2 SWS, Language: German/English, [Open in study portal](#)

**Seminar (S)  
Blended (On-Site/Online)**

**Content**

The seminar is intended as a theoretical supplement to lectures such as "Machine Learning". The theoretical basics will be deepened in the seminar. The aim of the seminar is that the participants work individually to analyze a subsystem from the field of robotics and cognitive systems using one or more procedures from the field of AI/ML.

The individual projects require the analysis of the task at hand, selection of suitable procedures, specification and theoretical evaluation of the approach taken. Finally, the chosen solution has to be documented and presented in a short presentation.

**Learning objectives:**

- Students can apply knowledge from the Machine Learning lecture in a selected field of current research in robotics or cognitive automobiles for theoretical analysis.
- Students can evaluate, document and present their concepts and results.

**Recommendations:**

Attendance of the lecture machine learning

**Workload:**

The workload of 3 credit points consists of the time spent on literature research and planning/specifying the proposed solution. In addition, a short report and a presentation of the work carried out will be prepared.

**Organizational issues**

Anmeldung und weitere Informationen sind im Wiwi-Portal zu finden.

Registration and further information can be found in the WiWi-portal.



### Seminar: From Physical Models to Digital Twins: A Data-Driven Simulation Workshop (Seminar/Master)

2512101, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

Seminar (S)  
On-Site

**Content**

This seminar focuses on the data-driven discovery of simulation models in industrial settings, providing a hands-on approach to understanding and optimizing production processes.

Students will start by designing and constructing production lines using Lego Spike and similar modular systems. This activity will include developing comprehensive data-capturing pipelines to collect detailed event-logging raw data from their production lines. Next, the seminar will explore advanced techniques for transforming this raw data into simulation models, e.g., Petri nets. Participants will learn and apply data-driven model extraction methods, such as process mining to extract workflow processes; statistical methods to fit probability distributions and analyze trends, and machine learning algorithms to model complex behaviors within the production process. Through these techniques, students will extract simulation models that reflect the real-world dynamics of their production lines. The seminar will then guide participants on how to validate the extracted simulation models to ensure their accuracy.

By the end of the seminar, students will be equipped with the skills to build model production lines, collect event logging data from them, transform event log data into actionable simulation models and use these models to drive efficiency and innovation in industrial production settings.

**Grading Scheme:**

Report - 50%

Presentations - 40%

Implementation - 10%



### Seminar: Applications of Digital Twins (Master)

2513103, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

Seminar (S)  
On-Site

**Content****Seminar Name:** Applications of Digital Twins**Size:** 10 students (with 10 different topics)**Workload:**

- 2 Lectures:
  - o Introduction to Digital Twins and topic distribution
  - o "How to Give Effective Presentations" lecture
- 10 student presentations (each 45 minutes in total)
- 10 student reports

**Responsible Person:** Hui Min Lee, Sanja Lazarova-Molnar**Deliverables for Grade:**

- 1 Report per student and topic (8 pages, including references, IEEE Template, compulsory usage of Reference Manager – Zotero or EndNote)
- 25 mins presentation per student plus 20 min discussion (focus on the presentation topic + presentation skills) = 45 minutes for each student

**Credits:** 3 credits = 90 hours**Format/ Structure of the Seminar (Draft):**

- 2 Lectures at the beginning of the semester
- Students have 1 week time to provide a priority list of 5 topics, distribution will be decided based on first come – first serve, ensuring that core topics are covered
- Q&As can be asked and answered over mails or ad-hoc appointments
- Students have time to work on the report and presentation during the semester
- Submission of all reports will be required 2 months after the intro lecture for ensuring fairness
- Presentations are done in blocks of 2 students per class, starting mid-June, presentations will be submitted at the day of the scheduled presentation

**Approximate Time Consumption for Students (Draft):**

- Lectures: 3 hours
- Student Presentations: 7.5 hours
- Topic Subscription: 1 hour
- Presentation Preparation: 15 hours
- Paper Writing and Literature Review: 63.5 hours

**Description:**

The seminar focuses on applications of Digital Twins and data-driven modeling, with an additional goal of improving scientific research and presentation skills for Master students. The seminar covers the diverse applications and use cases of Digital Twins in different domains such as manufacturing, energy systems, healthcare and many more, offering students an in-depth understanding of the role of Digital Twins in transforming the industries.

The seminar is structured as a literature review seminar. Each student can select a topic out of a predefined set, conduct further research and then write a comprehensive research paper. Students will also deliver presentations, synthesizing insights from both the provided starting reference literature and their own additional research.

By the end of the course, students will not only have a solid understanding of the current applications of Digital Twins and emerging trends but also be well-prepared to present their findings in an academic setting.

**Topics:****1. Digital Twins for Manufacturing Systems**

References:

- Zhang, Chenyuan, et al. "A reconfigurable modeling approach for digital twin-based manufacturing system." *Procedia Cirp* 83 (2019): 118-125. (96 citations)
- Kritzinger, Werner, et al. "Digital Twin in manufacturing: A categorical literature review and classification." *Ifac-PapersOnline* 51.11 (2018): 1016-1022. (1934 citations)
- Jaensch, Florian, et al. "Digital twins of manufacturing systems as a base for machine learning." *2018 25th International conference on mechatronics and machine vision in practice (M2VIP)*. IEEE, 2018. (73 citations)

**2. Digital Twins for Energy Systems**

References:

- Steindl, Gernot, et al. "Generic digital twin architecture for industrial energy systems." *Applied Sciences* 10.24 (2020): 8903. (78 citations)

- Granacher, Julia, et al. "Overcoming decision paralysis—A digital twin for decision making in energy system design." *Applied Energy* 306 (2022): 117954. (33 citations) -> focus on interactive digital twins

- Palensky, Peter, et al. "Digital twins and their use in future power systems." *Digital Twin* 1 (2022): 4. (37 citations)

### 3. Digital Twins in Healthcare

References:

- Alazab, Mamoun, et al. "Digital twins for healthcare 4.0-recent advances, architecture, and open challenges." *IEEE Consumer Electronics Magazine* (2022). (26 citations)
- Croatti, Angelo, et al. "On the integration of agents and digital twins in healthcare." *Journal of Medical Systems* 44 (2020): 1-8. (163 citations)
- Erol, Tolga, Arif Furkan Mendi, and Dilara Doğan. "The digital twin revolution in healthcare." *2020 4th international symposium on multidisciplinary studies and innovative technologies (ISMSIT)*. IEEE, 2020. (106 citations)

### 4. Digital Twins of City Infrastructures (in Smart Cities)

References:

- Deren, Li, Yu Wenbo, and Shao Zhenfeng. "Smart city based on digital twins." *Computational Urban Science* 1 (2021): 1-11. (110 citations)
- Deng, Tianhu, Keren Zhang, and Zuo-Jun Max Shen. "A systematic review of a digital twin city: A new pattern of urban governance toward smart cities." *Journal of Management Science and Engineering* 6.2 (2021): 125-134. (192 citations)
- Mylonas, Georgios, et al. "Digital twins from smart manufacturing to smart cities: A survey." *Ieee Access* 9 (2021): 143222-143249. (99 citations)

### 5. Digital Twins in Logistics

References:

- Moshood, Taofeeq D., et al. "Digital twins driven supply chain visibility within logistics: A new paradigm for future logistics." *Applied System Innovation* 4.2 (2021): 29. (71 citations)
- Agalinos, K., et al. "Discrete event simulation and digital twins: review and challenges for logistics." *Procedia Manufacturing* 51 (2020): 1636-1641. (74 citations)
- Korth, Benjamin, Christian Schwede, and Markus Zajac. "Simulation-ready digital twin for realtime management of logistics systems." *2018 IEEE international conference on big data (big data)*. IEEE, 2018. (64 citations)

### 6. Cognitive Digital Twins

References:

- Al Faruque, Mohammad Abdullah, et al. "Cognitive digital twin for manufacturing systems." *2021 Design, Automation & Test in Europe Conference & Exhibition (DATE)*. IEEE, 2021. (28 citations)
- Zhang, Nan, Rami Bahsoon, and Georgios Theodoropoulos. "Towards engineering cognitive digital twins with self-awareness." *2020 IEEE International Conference on Systems, Man, and Cybernetics (SMC)*. IEEE, 2020. (22 citations)
- Zheng, Xiaochen, Jinzhi Lu, and Dimitris Kiritsis. "The emergence of cognitive digital twin: vision, challenges and opportunities." *International Journal of Production Research* 60.24 (2022): 7610-7632. (92 citations)

### 7. Fusing Data and Human Expert Knowledge in Digital Twins

References:

- Kulkarni, Vinay, Souvik Barat, and Tony Clark. "Towards adaptive enterprises using digital twins." *2019 winter simulation conference (WSC)*. IEEE, 2019. (22 citations)
- Vogel-Heuser, Birgit, et al. "Potential for combining semantics and data analysis in the context of digital twins." *Philosophical Transactions of the Royal Society A* 379.2207 (2021): 20200368. (16 citations)
- Todorovski, Ljupčo, and Sašo Džeroski. "Integrating knowledge-driven and data-driven approaches to modeling." *ecological modelling* 194.1-3 (2006): 3-13. (80 citations)

### 8. Digital Twins for Multi-agent / Complex Systems

References:

- Pretel, Elena, Alejandro Moya, Elena Navarro, Víctor López-Jaquero, and Pascual González. "Analysing the synergies between Multi-agent Systems and Digital Twins: A systematic literature review." *Information and Software Technology* (2024): 107503. (2 citations)
- Mariani, S., Picone, M., Ricci, A. (2022). About Digital Twins, Agents, and Multiagent Systems: A Cross-Fertilisation Journey. In: Melo, F.S., Fang, F. (eds) *Autonomous Agents and Multiagent Systems. Best and Visionary Papers. AAMAS 2022*. Lecture Notes in Computer Science, vol 13441. (11 citations)
- Marah H, Challenger M. Adaptive hybrid reasoning for agent-based digital twins of distributed multi-robot systems. *SIMULATION*. 2024;100(9):931-957. (0 citations – new articles)

### 9. Digital Twins for Energy Systems

References:

- Kabir, Md Rafiul, Dipal Halder, and Sandip Ray. "Digital Twins for IoT-driven Energy Systems: A Survey." *IEEE Access* (2024). (0 citations – new articles)
- Brosinsky, Christoph, Rainer Krebs, and Dirk Westermann. "Embedded Digital Twins in future energy management systems: paving the way for automated grid control." *at-Automatisierungstechnik* 68, no. 9 (2020): 750-764. (21 citations)
- Song, Zhao, Christoph M. Hackl, Abhinav Anand, Andre Thommessen, Jonas Petzschmann, Omar Kamel, Robert Braunbehrens, Anton Kaifel, Christian Roos, and Stefan Hauptmann. "Digital twins for the future power system: An overview and a future perspective." *Sustainability* 15, no. 6 (2023): 5259. (32 citations)
- Mostafa, Omar & Lazarova-Molnar, Sanja. (2024). Enhancing Reliability of Energy Systems with Digital Twins: Challenges and Opportunities. (0 citations – new articles)

#### 10. Digital Twins in Transportation and Automotive

References:

- Schwarz, Chris, and Ziran Wang. "The role of digital twins in connected and automated vehicles." *IEEE Intelligent Transportation Systems Magazine* 14, no. 6 (2022): 41-51. (91 citations)
- Bhatti, Ghanishtha, Harshit Mohan, and R. Raja Singh. "Towards the future of smart electric vehicles: Digital twin technology." *Renewable and Sustainable Energy Reviews* 141 (2021): 110801. (422 citations)
- Almeaibed, Sadeq, Saba Al-Rubaye, Antonios Tsourdos, and Nicolas P. Avdelidis. "Digital twin analysis to promote safety and security in autonomous vehicles." *IEEE Communications Standards Magazine* 5, no. 1 (2021): 40-46. (135 citations)

#### 11. Digital Twins for Environment and Sustainability

References:

- Tzachor, Asaf, Soheil Sabri, Catherine E. Richards, Abbas Rajabifard, and Michele Acuto. "Potential and limitations of digital twins to achieve the sustainable development goals." *Nature Sustainability* 5, no. 10 (2022): 822-829. (110 citations)
- Corrado, Casey R., Suzanne M. DeLong, Emily G. Holt, Edward Y. Hua, and Andreas Tolk. "Combining green metrics and digital twins for sustainability planning and governance of smart buildings and cities." *Sustainability* 14, no. 20 (2022): 12988. (36 citations)
- Kim, Byungmo, Jaewon Oh, and Cheonhong Min. "Development of a simulation model for digital twin of an oscillating water column wave power generator structure with ocean environmental effect." *Sensors* 23, no. 23 (2023): 9472. (3 citations)

#### 12. Digital Twins in Agriculture

References:

- Peladarinos, Nikolaos, Dimitrios Piromalis, Vasileios Cheimaras, Efthymios Tserepas, Radu Adrian Munteanu, and Panagiotis Papageorgas. "Enhancing smart agriculture by implementing digital twins: A comprehensive review." *Sensors* 23, no. 16 (2023): 7128. (60 citations)
- Escribà-Gelonch, Marc, Shu Liang, Pieter van Schalkwyk, Ian Fisk, Nguyen Van Duc Long, and Volker Hessel. "Digital Twins in Agriculture: Orchestration and Applications." *Journal of Agricultural and Food Chemistry* 72, no. 19 (2024): 10737-10752. (12 citations)
- Verdouw, Cor, Bedir Tekinerdogan, Adrie Beulens, and Sjaak Wolfert. "Digital twins in smart farming." *Agricultural Systems* 189 (2021): 103046. (494 citations)



**Seminar: New Trends in Artificial Intelligence Techniques for Noise Prediction (Master)** Seminar (S)  
2513108, SS 2026, 2 SWS, Language: English, [Open in study portal](#) On-Site

### Content

Noise, especially in urban areas, is a major environmental issue that impacts quality of life and health, contributing to stress, sleep disturbances, and cardiovascular problems. Traffic noise, primarily from tire-road interactions, has become more prominent as electric vehicles reduce engine noise. Tackling this issue involves both passive methods, like noise barriers, and active solutions such as noise cancellation technologies.

In recent years, artificial intelligence (AI) has emerged as a powerful tool for managing noise. AI-based systems can classify noise sources, create noise maps, and develop control strategies. Advanced AI techniques, including Generative Adversarial Networks (GANs), AutoEncoders, Bi-Long Short-Term Memory (LSTM), and Bi-Gated Recurrent Units (GRUs), Graphical Convolutional Networks (GCN), Physics-informed neural networks, YOLO, Transformer, show great potential for reducing noise. Additionally, many computer vision techniques are used to improve noise conditions. This seminar will explore these AI methods and their role in enhancing conditions safety, minimizing environmental noise, and supporting intelligent transportation systems.

In this seminar, we try to understand Noise through data analysis and other techniques. We discuss current approaches to noise prediction and innovative AI approaches based on data science and machine learning.

### Topics:

Introduction to Noise and Tire-Road Noise  
 Overview on Noise and Tire-Road Noise  
 Time Series Analysis and Image Analysis  
 Data Exploration and Visualization  
 Noise Feature Extraction and Analysis  
 Machine learning and Deep Learning Approach for Tire-Road Noise

### Who are we looking for:

We are looking for students who want to expand their specialist knowledge and practical experience in artificial intelligence, signal processing, computer vision and road-tire noise. Participation provides the opportunity to actively participate in shaping the future of using artificial intelligence, computer vision and signal processing to reduce road-tire and traffic noise.

### What we offer:

We provide you with tyre-road noise data. With this data, you can apply many signal processing, computer vision and artificial intelligence algorithms. This is where you can let your creativity run free and implement innovative solutions with our guidance.

### Organizational:

- Kickoff meeting **on April 23, 2026**: Introduction to topics, information about data, clarification of organizational questions. In the Kickoff Meeting, Groups come together and each group has a theme.
- Interim presentation **28 May 2026**: Presentation of the current situation and information sharing.
- Final presentation on **July 9, 2026**: Presentation of results and submission of documents

**Registration:** Please briefly state your motivation for taking this course. Optionally you can attach your Transcript of Records and CV.

**Deliverables (per team):** 1 Report (min 10 pages, scientific paper format, including references) + Presentations (2) + Implementation Files(codes)

**Grading relevant Parts:** Written Report, Presentations and Implementation



### Seminar Knowledge Discovery and Data Mining (Master)

2513309, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

Seminar (S)  
On-Site

### 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**

Die Anmeldung erfolgt über das WiWi-Portal <https://portal.wiwi.kit.edu/>.

**Literature**

Detaillierte Referenzen werden zusammen mit den jeweiligen Themen angegeben. Allgemeine Hintergrundinformationen ergeben sich z.B. aus den folgenden Lehrbüchern:

- Mitchell, T.; Machine Learning
- McGraw Hill, Cook, D.J. and Holder, L.B. (Editors) Mining Graph Data, ISBN:0-471-73190-0
- Wiley, Manning, C. and Schütze, H.; Foundations of Statistical NLP, MIT Press, 1999.

**Seminar Data Science & Real-time Big Data Analytics (Master)**

2513311, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

**Seminar (S)**  
**On-Site**

**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](mailto:sem-ep@fzi.de).

**Organizational issues**

Die Anmeldung erfolgt über das WiWi-Portal <https://portal.wiwi.kit.edu/>.

**Cognitive Automobiles and Robots**

2513500, SS 2026, 2 SWS, Language: German/English, [Open in study portal](#)

**Seminar (S)**  
**On-Site**

**Content**

The seminar is intended as a theoretical supplement to lectures such as "Machine Learning". The theoretical basics will be deepened in the seminar. The aim of the seminar is that the participants work individually to analyze a subsystem from the field of robotics and cognitive systems using one or more procedures from the field of AI/ML.

The individual projects require the analysis of the task at hand, selection of suitable procedures, specification and theoretical evaluation of the approach taken. Finally, the chosen solution has to be documented and presented in a short presentation.

**Learning objectives:**

- Students can apply knowledge from the Machine Learning lecture in a selected field of current research in robotics or cognitive automobiles for theoretical analysis.
- Students can evaluate, document and present their concepts and results.

**Recommendations:**

Attendance of the lecture machine learning

**Workload:**

The workload of 3 credit points consists of the time spent on literature research and planning/specifying the proposed solution. In addition, a short report and a presentation of the work carried out will be prepared.

**Organizational issues**

Anmeldung und weitere Informationen sind im Wiwi-Portal zu finden.

Registration and further information can be found in the WiWi-portal.

**Seminar Knowledge Graphs and Large Language Models (Master)**

2513607, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

**Seminar (S)**  
**Blended (On-Site/Online)**

**Content**

Large language models (LLMs) such as GPT-4 have shown remarkable capabilities in transforming various natural language processing (NLP) tasks across different domains. However, LLMs often generate incorrect answers, known as hallucinations, posing significant challenges to their usability and reliability. Additionally, LLMs operate as black boxes, making it difficult to understand how they arrive at specific conclusions, leading to transparency and explainability issues. Combining LLMs with KGs creates a powerful synergy that significantly enhances the capabilities of artificial intelligence across various tasks. This integration leverages the strengths of both technologies, with LLMs excelling at understanding and generating human-like text, and KGs providing structured, reliable information about entities and their relationships. Together, they offer a robust approach to problem-solving across diverse domains.

This seminar will focus on the intersection of LLMs and KGs, covering areas of interest including, but not limited to:

- KG completion using LLMs
- Question answering with KGs and LLMs
- Explainability of LLMs with KG integration
- Reasoning with LLMs and KGs
- Enhanced prompt engineering using KGs

**Contributions of the students:**

Each student will be assigned one paper on the topic, which could be a research paper discussing a novel approach or a resource paper presenting datasets, tools, etc. The student will be responsible for the following tasks:

1. **Report Writing:** Read the assigned paper thoroughly and write a 15-page seminar report explaining the methods and findings in their own words.
2. **Presenting:** Prepare and deliver a seminar presentation to share insights from the paper with other seminar participants.
3. **Conducting Experiments:** If the authors provide code, re-implement it for small-scale experiments using Google Colab or make the implementation available via GitHub.



## T

**6.382 Module component: Seminar in Information Systems (Master) [T-WIWI-109827]**

**Coordinators:** Studiendekan der KIT-Fakultät für Informatik  
Studiendekan des KIT-Studienganges

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

**Part of:** [M-WIWI-104815 - Seminar Information Systems](#)

**Type**  
Examination of another type

**Credits**  
3 CP

**Grading**  
graded

**Term offered**  
Each term

**Version**  
1

| Courses  |         |                                                                                 |       |             |                                      |
|----------|---------|---------------------------------------------------------------------------------|-------|-------------|--------------------------------------|
| WT 25/26 | 2500045 | Digital Democracy - Challenges and Opportunities of the Digital Society         | 2 SWS | Seminar / 🌀 | Fegert, Stein, Bezzaoui              |
| WT 25/26 | 2500125 | Human-Centered Systems Seminar: Engineering                                     | 2 SWS | Seminar / 🌀 | Mädche                               |
| WT 25/26 | 2540472 | Master Seminar (Information Systems III) – Future of Commerce / AI and Fairness | 2 SWS | Seminar / 🌀 | Bennardo, Gutschow, Heßler           |
| WT 25/26 | 2540473 | Business Data Analytics                                                         | 2 SWS | Seminar / 🌀 | Hariharan, Grote, Schulz, Motz       |
| WT 25/26 | 2540475 | Positive Information Systems                                                    | 2 SWS | Seminar / 🌀 | Knierim, del Puppo                   |
| WT 25/26 | 2540478 | Smart Grids and Energy Markets                                                  | 2 SWS | Seminar / 🌀 | Weinhardt, Semmelmann, Miskiw, Speck |
| WT 25/26 | 2540510 | Master Seminar in Data Science and Machine Learning                             | 2 SWS | Seminar / 🌀 | Geyer-Schulz, Nazemi                 |
| ST 2026  | 2500020 | Digital Democracy - Challenges and opportunities of the digital society         | 2 SWS | Seminar / 🌀 | Fegert                               |
| ST 2026  | 2500125 | Human-Centered Systems Seminar: Engineering                                     | 3 SWS | Seminar / 🌀 | Mädche                               |
| ST 2026  | 2540469 | Master Seminar: Intelligent & Responsible Information Systems                   | 2 SWS | Seminar / 🌀 | Bennardo, Gutschow, Heßler           |
| ST 2026  | 2540473 | Applied Responsible AI                                                          | 2 SWS | Seminar     | Schulz, Weinhardt                    |
| ST 2026  | 2540475 | Positive Information Systems                                                    | 2 SWS | Seminar     | Knierim                              |
| ST 2026  | 2540478 | Smart Grid Economics & Energy Markets                                           | 2 SWS | Seminar     | Weinhardt                            |
| ST 2026  | 2540493 | Data Science for Industrial Applications                                        | 2 SWS | Seminar / 🌀 | Spitzer, Holstein, Hendriks          |
| ST 2026  | 2540510 | Master Seminar in Data Science and Machine Learning                             | 2 SWS | Seminar     | Geyer-Schulz                         |
| ST 2026  | 2540553 | Biosignal-Adaptive Systems Seminar                                              | 2 SWS | Seminar / 🌀 | Mädche, Beigl                        |
| ST 2026  | 2540557 | Human-Centered Systems Seminar: Research                                        | 3 SWS | Seminar / 🌀 | Mädche                               |
| Exams    |         |                                                                                 |       |             |                                      |
| WT 25/26 | 00072   | Seminar Positive Information Systems                                            |       |             | Weinhardt                            |
| WT 25/26 | 00074   | Seminar Business Data Analytics                                                 |       |             | Weinhardt                            |
| WT 25/26 | 7900017 | Seminar Smart Grid and Energy Markets                                           |       |             | Weinhardt                            |
| WT 25/26 | 7900069 | Human-Centered Systems Seminar: Engineering                                     |       |             | Mädche                               |
| WT 25/26 | 7900151 | Master Seminar in Data Science and Machine Learning                             |       |             | Geyer-Schulz                         |
| WT 25/26 | 7900233 | Human-Centered Systems Seminar: Research                                        |       |             | Mädche                               |
| WT 25/26 | 7940469 | Master Seminar: Information Systems III                                         |       |             | Pfeiffer, Heßler                     |
| ST 2026  | 7900190 | Human-Centered Systems Seminar: Engineering                                     |       |             | Mädche                               |
| ST 2026  | 7900261 | Human-Centered Systems Seminar: Research                                        |       |             | Mädche                               |

|         |         |                                                                                   |          |
|---------|---------|-----------------------------------------------------------------------------------|----------|
| ST 2026 | 7900265 | <a href="#">Biosignal-Adaptive Systems Seminar</a>                                | Mädche   |
| ST 2026 | 7940469 | <a href="#">Master Seminar: Intelligent &amp; Responsible Information Systems</a> | Pfeiffer |

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

### Assessment

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.

### Recommendations

See seminar description in the course catalogue of the KIT (<https://campus.kit.edu/>)

### Additional Information

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 for WIWI-seminars are listed on the internet: <https://portal.wiwi.kit.edu>.

### Workload

90 hours

Below you will find excerpts from courses related to this module component:

|  |                                                                                        |                        |
|--|----------------------------------------------------------------------------------------|------------------------|
|  | <b>Master Seminar (Information Systems III) – Future of Commerce / AI and Fairness</b> | Seminar (S)<br>On-Site |
|  | 2540472, WS 25/26, 2 SWS, Language: English, <a href="#">Open in study portal</a>      |                        |

### Content

This seminar is offered by the Information Systems III research group, which has been based at the Institute for Information Systems (WIN) since January 2025 and is led by [Prof. Dr. Jella Pfeiffer](#). Further information about us can be found on our website ([WIN - Information Systems III](#)).

|  |                                                                                          |                        |
|--|------------------------------------------------------------------------------------------|------------------------|
|  | <b>Business Data Analytics</b>                                                           | Seminar (S)<br>On-Site |
|  | 2540473, WS 25/26, 2 SWS, Language: German/English, <a href="#">Open in study portal</a> |                        |

### Content

wird auf deutsch und englisch gehalten

### Organizational issues

Blockveranstaltung, siehe WWW

|  |                                                                                  |                                         |
|--|----------------------------------------------------------------------------------|-----------------------------------------|
|  | <b>Master Seminar in Data Science and Machine Learning</b>                       | Seminar (S)<br>Blended (On-Site/Online) |
|  | 2540510, WS 25/26, 2 SWS, Language: German, <a href="#">Open in study portal</a> |                                         |

|  |                                                                                  |                                         |
|--|----------------------------------------------------------------------------------|-----------------------------------------|
|  | <b>Human-Centered Systems Seminar: Engineering</b>                               | Seminar (S)<br>Blended (On-Site/Online) |
|  | 2500125, SS 2026, 3 SWS, Language: English, <a href="#">Open in study portal</a> |                                         |

### Content

Formerly known as "Current Topics in Digital Transformation"

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 human-centered systems lab (Prof. Mädche). Students will work on a dedicated topic in the context of human-centered systems and apply a pre-defined research method. A broad spectrum of topics is offered every semester, topics may range from creating an experimental design, analyzing collected data, or systematically comparing existing software prototypes in a specific field of interest.

**Data Science for Industrial Applications**2540493, SS 2026, 2 SWS, Language: English, [Open in study portal](#)**Seminar (S)**  
**On-Site****Content****Learning Objectives**

This seminar will require you to screen, select, and apply information systems theories and methodologies to solve contemporary challenges in the manufacturing and adjacent industries. This will include both critical reviews of the literature state-of-the-art [1-2] as well as the systematic conduct of design science research and machine learning methods [3-4]. You will identify key problems in real-world use cases, derive relevant research questions, and systematically gather, choose, and apply academic knowledge to develop solutions in the form of proof-of-concepts or prototypes.

**Course Credits**

The seminar can be credited as Seminar Betriebswirtschaftslehre A [T-WIWI-103474], Seminar Betriebswirtschaftslehre B [T-WIWI-103476] or Seminar Wirtschaftsinformatik [T-WIWI-109827] (3 ECTS). Other courses may be credited upon request.

**Seminar Description**

The Internet of Things (IoT) is significantly transforming industries such as automotive, healthcare, and energy. With the rise of ubiquitous computing power, connectivity/internet access, and the economic application of sensors [5], physical products are providing vast amounts of data, enabling the development of smart services [6]. While such IoT use cases are projected to open a market potential valued at \$3.3 billion in 2030 [7], the industry is still far from exploiting its full capabilities. To solve this challenge, cutting-edge academic knowledge in information systems and machine learning is key to generating valuable insights from machine data.

The seminar is held in cooperation with international industry partners, who provide real-world datasets and ongoing access to subject matter experts. Students will work in teams of 2-4 on different topics and datasets. The assignments will be handed out in a joint kick-off event – to be scheduled once participating students have been selected. Attendance at this kick-off event is mandatory and a prerequisite for participation. Students are required to submit a seminar paper of 12-15 pages on an individual basis.

Expertise in Python and Data Science / Machine Learning as well as successful participation in the course “Artificial Intelligence in Service Systems” (T-WIWI-108715) are strongly recommended.

**Contact**Daniel Hendricks – [daniel.hendricks@kit.edu](mailto:daniel.hendricks@kit.edu)Philipp Spitzer – [philipp.spitzer@kit.edu](mailto:philipp.spitzer@kit.edu)Joshua Holstein – [joshua.holstein@kit.edu](mailto:joshua.holstein@kit.edu)

**The practical seminar will be held in English. Application documents can be handed in in English or German.**

[1] Webster, J., Watson, R. T. (2002). Analyzing the Past to Prepare for the Future: Writing a Literature Review. *MIS Quarterly*, 26 (2) xiii-xxiii.

[2] Brocke, J. v. et al. (2009). Reconstructing the Giant: On the Importance of Rigour in Documenting the Literature Search Process. *Proceedings of the European Conference on Information Systems*, paper 161.

[3] Wirth, R., Hipp, J. (2000). CRISP-DM: Towards a Standard Process Model for Data Mining. *Proceedings of the 4th International Conference on the Practical Applications of Knowledge Discovery and Data Mining*, 29-40.

[4] Peffers, K., Tuunanen, T., Rothenberger, M., Chatterjee, S. (2008). A Design Science Research Methodology for Information Systems Research. *Journal of Management Information Systems*, 24 (3) 45-78.

[5] Martin, D.; Kühl, N.; Satzger, G. (2021). Virtual Sensors. *Business & Information Systems Engineering*, 63 (3) 315-323.

[6] Hunke, F., Heinz, D. Satzger, G. (2022). Creating customer value from data: foundations and archetypes of analytics-based services. *Electronic Markets*, 32, 503-521.

[7] Chui, M., Collins, M., Patel, M. (2021). IoT value set to accelerate through 2030: Where and how to capture it. McKinsey & Company. URL: <https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/iot-value-set-to-accelerate-through-2030-where-and-how-to-capture-it>

**Master Seminar in Data Science and Machine Learning**2540510, SS 2026, 2 SWS, Language: German/English, [Open in study portal](#)**Seminar (S)****Biosignal-Adaptive Systems Seminar**2540553, SS 2026, 2 SWS, Language: English, [Open in study portal](#)**Seminar (S)**  
**Blended (On-Site/Online)**

### Content

Biosignal-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 biosignal-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 (h-lab, 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 biosignal-adaptive system is and how it can be conceptualized
- Suggest and evaluate different design solutions for addressing the identified problem
- Build a biosignal-adaptive system prototype using state-of-the-art hard- and software
- Perform a user-centric evaluation of the biosignal-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.



### Human-Centered Systems Seminar: Research

2540557, SS 2026, 3 SWS, Language: English, [Open in study portal](#)

Seminar (S)  
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 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

## T

**6.383 Module component: Seminar in Operations Research A (Master) [T-WIWI-103481]**

**Coordinators:** Prof. Dr. Stefan Nickel  
Prof. Dr. Steffen Rebennack  
Prof. Dr. Oliver Stein

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

**Part of:** [M-WIWI-102736 - Seminar Module Economic Sciences](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 3 CP    | graded  | Each term    | 1       |

| Courses  |                |                                                                          |       |                                                                                                 |                                      |
|----------|----------------|--------------------------------------------------------------------------|-------|-------------------------------------------------------------------------------------------------|--------------------------------------|
| WT 25/26 | 2500056        | Seminar: Modern OR and Innovative Logistics                              | 2 SWS | Seminar /    | Nickel, Mitarbeiter, Pomes, Hoffmann |
| WT 25/26 | 2550131        | Seminar on Methodical Foundations of Operations Research (B)             | 2 SWS | Seminar /    | Stein, Beck, Schwarze, Neussel       |
| WT 25/26 | 2550132        | Seminar zur Mathematischen Optimierung (MA)                              | 2 SWS | Seminar /    | Stein, Beck, Schwarze, Neussel       |
| WT 25/26 | 2550462        | Seminar on Trending Topics in Optimization and Machine Learning (Master) | 2 SWS | Seminar /    | Rebennack, Kandora                   |
| WT 25/26 | 2550473        | Seminar on Energy and Power Systems Optimization (Master)                | 2 SWS | Seminar /   | Rebennack, Kandora                   |
| ST 2026  | 2550131        | Seminar on Methodical Foundations of Operations Research (BA)            | 2 SWS | Seminar /  | Stein, Beck, Schwarze, Neussel       |
| ST 2026  | 2550132        | Seminar on Mathematical Optimization (MA)                                | 2 SWS | Seminar /  | Stein, Beck, Schwarze, Neussel       |
| Exams    |                |                                                                          |       |                                                                                                 |                                      |
| WT 25/26 | 7900011_WS2425 | Seminar in Operations Research B (Bachelor)                              |       |                                                                                                 | Stein                                |
| WT 25/26 | 7900012_WS2425 | Seminar in Operations Research A (Master)                                |       |                                                                                                 | Stein                                |
| WT 25/26 | 7900040        | Seminar: Modern OR and Innovative Logistics                              |       |                                                                                                 | Nickel                               |
| WT 25/26 | 7900169        | Seminar Trending Topics in Optimization and Machine Learning (Master)    |       |                                                                                                 | Rebennack                            |
| WT 25/26 | 7900194        | Digitalization in the Steel Industry                                     |       |                                                                                                 | Nickel                               |
| WT 25/26 | 7900314        | Seminar on Power Systems Optimization (Master)                           |       |                                                                                                 | Rebennack                            |
| ST 2026  | 7900200_SS2025 | Seminar in Operations Research A (Master)                                |       |                                                                                                 | Stein                                |
| ST 2026  | 7900201_SS2025 | Seminar in Operations Research (Bachelor)                                |       |                                                                                                 | Stein                                |

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

**Assessment**

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.

**Recommendations**

See seminar description in the course catalogue of the KIT (<https://campus.kit.edu/>)

**Additional Information**

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**

90 hours

*Below you will find excerpts from courses related to this module component:*

**Seminar: Modern OR and Innovative Logistics**

2500056, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)

**Seminar (S)**  
**Blended (On-Site/Online)**

**Content**

This seminar presents current issues in the field of Operations Research and Logistics, critically evaluates them, and discusses them using examples. The focus of the seminar lies on optimization models and algorithms, with particular attention to their practical applicability (especially in supply chain and health care management). All participants are required to write a seminar paper and give a presentation. Depending on the topic, an implementation of the models or heuristics using standard software (e.g., IBM CPLEX or Java) is expected. Further details can be found in the information sheet on Prof. Nickel's website. All topics have the potential to be developed into a thesis.

The seminar topics will be assigned during a preliminary meeting at the beginning of the semester. Attendance is mandatory for the preliminary meeting as well as for all seminar presentations.

In addition, students will receive an introduction to academic writing, literature research, and scientific presenting in three sessions.

**Organizational issues**

Die Anmeldung erfolgt über das Wiwi-Portal. Nähere Informationen erhalten Sie auf der Homepage [dol.ior.kit.edu](http://dol.ior.kit.edu) bzw. im WiWi-Portal sowie bei der Vorbesprechung.

**Literature**

Die Literatur und die relevanten Quellen werden zu Beginn des Seminars bekannt gegeben.

**Seminar on Methodical Foundations of Operations Research (B)**

2550131, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)

**Seminar (S)**  
**On-Site**

**Content**

The seminar aims at describing, evaluating, and discussing recent as well as classical topics in continuous optimization. The focus is on the treatment of optimization models and algorithms, also with respect to their practical application.

Bachelor student 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 rethoric 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 on Methodical Foundations of Operations Research (BA)**

2550131, SS 2026, 2 SWS, Language: German, [Open in study portal](#)

**Seminar (S)**  
**On-Site**

**Content**

The seminar aims at describing, evaluating, and discussing recent as well as classical topics in continuous optimization. The focus is on the treatment of optimization models and algorithms, also with respect to their practical application.

Bachelor student 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 rethoric 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.



## T

**6.384 Module component: Seminar in Privacy [T-INFO-114268]**

**Coordinators:** Prof. Dr. Thorsten Strufe  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-107242 - Seminar in Privacy](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 4 CP    | graded  | Each summer term | 1       |

| Courses |         |                                    |       |                                                                                               |                       |
|---------|---------|------------------------------------|-------|-----------------------------------------------------------------------------------------------|-----------------------|
| ST 2026 | 2400087 | <a href="#">Seminar in Privacy</a> | 2 SWS | Seminar /  | Strufe, Guerra Balboa |

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

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

A written paper must be prepared and a presentation given; in addition, preliminary papers must be submitted and commented on in a peer review between fellow students. Withdrawal is possible within two weeks of the topic being assigned.

**Prerequisites**

None.

**Recommendations**

Fundamentals of IT security, computer networks and distributed systems are required

*Below you will find excerpts from courses related to this module component:*

## V

**Seminar in Privacy**

2400087, SS 2026, 2 SWS, Language: German/English, [Open in study portal](#)

**Seminar (S)**  
On-Site

**Content**

This Seminar discusses current topics of the research field technical data security.

This involves, for example:

- anonymous communication
- network security
- anonymous online- services
- anonymous digital payment services
- rating of the anonymity of online services
- anonymous publications of data (differential privacy, k- anonymity)
- transparency-/awareness-improvement systems
- support for media understanding.

## T

**6.385 Module component: Seminar in Statistics A (Master) [T-WIWI-103483]**

**Coordinators:** Prof. Dr. Oliver Grothe  
Prof. Dr. Melanie Schienle

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

**Part of:** [M-WIWI-102736 - Seminar Module Economic Sciences](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 3 CP    | graded  | Each term    | 1       |

| Courses  |          |                                                                                                     |       |                                                                                                |                                                                            |
|----------|----------|-----------------------------------------------------------------------------------------------------|-------|------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| WT 25/26 | 25000111 | <a href="#">Statistics and Epidemics</a>                                                            | 2 SWS | Seminar /   | Bracher, Nemcova                                                           |
| WT 25/26 | 2500012  |                                                                                                     | 2 SWS | Seminar /   | Grothe, Liu                                                                |
| WT 25/26 | 2521310  | <a href="#">Topics in Econometrics</a>                                                              | 2 SWS | Seminar                                                                                        | Schienle, Krüger, Bracher, Buse, Koster, Rüter, Leimenstoll, Renner, Pohle |
| ST 2026  | 2500012  | <a href="#">Making and Evaluating Predictions</a>                                                   | 2 SWS | Seminar                                                                                        | Schienle, Allen, Zhang                                                     |
| ST 2026  | 2521310  | <a href="#">Advanced Topics in Econometrics</a>                                                     | 2 SWS | Seminar                                                                                        | Schienle, Krüger, Bracher, Buse, Koster, Rüter, Leimenstoll, Renner        |
| ST 2026  | 2550561  | <a href="#">Fortgeschrittene Themen zu Statistik, Datenanalyse und maschinellem Lernen (Master)</a> | 2 SWS | Seminar /  | Grothe, Liu                                                                |
| Exams    |          |                                                                                                     |       |                                                                                                |                                                                            |
| WT 25/26 | 7900216  | <a href="#">Seminar in Statistics A (Master)</a>                                                    |       |                                                                                                | Grothe                                                                     |
| WT 25/26 | 7900254  | <a href="#">Topics in Econometrics</a>                                                              |       |                                                                                                | Schienle, Bracher                                                          |

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

**Assessment**

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.

**Recommendations**

See seminar description in the course catalogue of the KIT (<https://campus.kit.edu/>)

**Additional Information**

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**

90 hours

*Below you will find excerpts from courses related to this module component:*



## Statistics and Epidemics

25000111, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

Seminar (S)  
On-Site

### Content

#### Motivation

Infectious disease epidemiology gives rise to a large variety of real-time data streams. During the COVID-19 pandemic, the interpretation and statistical analysis of these data has proven crucial, but also highly challenging. In this seminar, students will get to know central concepts of infectious disease surveillance and modelling from a statistical perspective. Following an overview of various aspects in the form of blocked lectures, students will choose a more specific topic for their seminar thesis.

#### Learning Goals

Students develop an understanding of central modeling tasks and methods, including

- estimation of reproductive numbers
- compartment models of disease spread
- nowcasting and short-term forecasting of disease spread
- detection of outbreaks
- diagnostic testing

Moreover, they get to know various data types commonly used in the analysis of disease spread.

#### Logistics

The project seminar is worth 4.5 credit points (Leistungspunkte). There will be three blocked lectures (approx. 135 minutes each) in the beginning of the lecture period. For the various topics covered, subjects for seminar theses will be proposed (and students are allowed to propose their own topics). Towards the end of the semester, students present their progress on the chosen topics to the group. Grades will be based on this presentation (25%) and the final report (75%).

#### Organizational issues

##### Prerequisites

Students should have a very good working knowledge of statistics, including proficiency in a programming language for applied data analysis. The lecture VWL3 Introduction to Econometrics is a prerequisite for the project seminar. Most available software in the field is in R, but in principle Python can be used as well. Advanced knowledge of biology, medicine or epidemiology is not required.

#### Application Procedure

Please submit a transcript of records as well as a short letter of motivation (roughly 200 words) via WIWI-Portal: <https://portal.wiwi.kit.edu/ys/8902>

Application time frame: September 5th, 2025 to October, 31th, 2025.



## Topics in Econometrics

2521310, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)

Seminar (S)

#### Organizational issues

Wöchentliche Veranstaltung, Donnerstags 13:00-14:30 Uhr in B17 - R320



## Making and Evaluating Predictions

2500012, SS 2026, 2 SWS, Language: German/English, [Open in study portal](#)

Seminar (S)

### Content

A key goal of statistics and data science is to make predictions. Good predictions are important for decision-making, allowing us to balance risks and mitigate the impacts of potentially damaging events. In this seminar, we will study theoretical questions regarding the evaluation of predictions, such as "What does it mean for a prediction to be good?", before introducing statistical and machine learning methods to generate both point-valued and probabilistic predictions. We will discuss applications to economics, meteorology, and energy forecasting.

**Format:** The course will start with a short block course at the beginning of the lecture period. Evaluation will be based on a seminar thesis, which students are required to hand in at the end of the lecture period, and a short presentation. The presentations will also take place towards the end of the lecture period.

#### Organizational issues

Blockveranstaltung, Termine werden bekannt gegeben

**Advanced Topics in Econometrics**2521310, SS 2026, 2 SWS, Language: German/English, [Open in study portal](#)**Seminar (S)****Organizational issues**

wöchentlich, Donnerstags 11:00-12:30, B17, R320

**T****6.386 Module component: Seminar Laboratory: Machine Learning and Intelligent Systems [T-INFO-112105]****Coordinators:** Michael Fennel

Prof. Dr.-Ing. Uwe Hanebeck

**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-105959 - Seminar Laboratory: Machine Learning and Intelligent Systems](#)

| Type                        |
|-----------------------------|
| Examination of another type |

| Credits |
|---------|
| 3 CP    |

| Grading |
|---------|
| graded  |

| Term offered |
|--------------|
| Irregular    |

| Version |
|---------|
| 1       |

| Courses  |         |                                                                             |       |                                                                                               |                   |
|----------|---------|-----------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|-------------------|
| ST 2026  | 24004   | <a href="#">Seminar Laboratory Machine Learning and Intelligent Systems</a> | 2 SWS | Seminar /  | Hanebeck, Prossel |
| Exams    |         |                                                                             |       |                                                                                               |                   |
| WT 25/26 | 7500135 | <a href="#">Seminar Laboratory Machine Learning and Intelligent Systems</a> |       |                                                                                               | Hanebeck          |

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

**T****6.387 Module component: Seminar: Designing and Conducting Experimental Studies [T-INFO-106112]****Coordinators:** Prof. Dr.-Ing. Michael Beigl**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-103078 - Seminar: Designing and Conducting Experimental Studies](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 4 CP    | graded  | Irregular    | 1       |

| Exams    |         |                                                                        |       |
|----------|---------|------------------------------------------------------------------------|-------|
| WT 25/26 | 7500239 | <a href="#">Seminar: Designing and Conducting Experimental Studies</a> | Beigl |

**T****6.388 Module component: Seminar: Advanced Algorithms in Computer Graphics [T-INFO-105664]****Coordinators:** Prof. Dr.-Ing. Carsten Dachsbacher**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-102729 - Seminar: Advanced Algorithms in Computer Graphics](#)**Type**  
Examination of another type**Credits**  
3 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
1

| Courses  |         |                                                                            |             |                                                                                               |                         |
|----------|---------|----------------------------------------------------------------------------|-------------|-----------------------------------------------------------------------------------------------|-------------------------|
| WT 25/26 | 2400006 | <a href="#">Seminar Fortgeschrittene Algorithmen in der Computergrafik</a> | 2 SWS       | Seminar /  | Schudeiske, Dachsbacher |
| ST 2026  | 2424816 | <a href="#">Seminar Fortgeschrittene Algorithmen in der Computergrafik</a> | 2 SWS       | Seminar /  | Alber, Dachsbacher      |
| Exams    |         |                                                                            |             |                                                                                               |                         |
| WT 25/26 | 7500193 | <a href="#">Seminar: Advanced Algorithms in Computer Graphics</a>          | Dachsbacher |                                                                                               |                         |

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

## T

**6.389 Module component: Seminar: Advanced Topics in Natural Language Processing [T-INFO-114433]****Coordinators:** Prof. Dr. Jan Niehues**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107353 - Seminar: Advanced Topics in Natural Language Processing](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 3 CP    | Graded  | Each term    | 1       |

| Courses  |         |                                                                        |       |         |             |
|----------|---------|------------------------------------------------------------------------|-------|---------|-------------|
| WT 25/26 | 2400074 | <a href="#">Advanced Topics in Natural Language Processing</a>         | 2 SWS | Seminar | Niehues, Li |
| ST 2026  | 2400217 | <a href="#">Advanced Topics in Natural Language Processing</a>         | 2 SWS | Seminar | Niehues     |
| Exams    |         |                                                                        |       |         |             |
| WT 25/26 | 7500267 | <a href="#">Seminar Advanced Topics in Natural Language Processing</a> |       |         | Niehues     |

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

A written paper must be prepared and a presentation given. Withdrawal is possible within two weeks of the topic being assigned.

**Prerequisites**

None.

**Recommendations**

Knowledge from the lectures Machine Translation and Cognitive Systems

*Below you will find excerpts from courses related to this module component:*

## V

**Advanced Topics in Natural Language Processing**

2400074, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

Seminar (S)

**Content**

Seminar: Advanced Topics in Machine Translation

Machine translation has now made it possible to automatically translate both written text and spoken language into another language. In neural machine translation, methods from machine learning are primarily used to model the translation process.

In the seminar, current research results on various aspects of the systems will be discussed. For this purpose, publications from the areas selected by the participants will be presented. Possible topics include use of Transformer-based models and large language models (LLMs), multilingualism, new methods of deep learning for translation, quality estimation and integration of additional context.

Requirements:

Prior knowledge from the "Machine Translation" lecture is an advantage.

Lecture language is English.

**Organizational issues**

Raum 223, Geb. 50.20

## V

**Advanced Topics in Natural Language Processing**

2400217, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

Seminar (S)



### **Content**

This seminar covers the newest developments in natural language processing (NLP) research, designed for students passionate about applied artificial intelligence.

The seminar consists of two phases:

1. Research Exploration Phase: Presentations by our lab members or invited external speakers on recent NLP research papers. The students will participate in interactive discussions.
2. Student Presentation Phase: Presentations of selected research papers by the students.

The seminar is graded based on the **final presentations** and active **participation** in discussions. No written report is required.

Please do not join this seminar and our other seminar "Speech-to-Speech Translation" in parallel.

### **Organizational issues**

R 223, Geb. 50.20

**T****6.390 Module component: Seminar: Advanced Topics on SAT Solving [T-INFO-114231]**

**Coordinators:** Dr. Ashlin Iser  
Prof. Dr. Peter Sanders

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-107209 - Seminar: Advanced Topics on SAT Solving](#)

**Type**  
Examination of another type

**Credits**  
3 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
1

| Courses  |         |                                                         |       |                                                                                               |                          |
|----------|---------|---------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|--------------------------|
| WT 25/26 | 2400020 | <a href="#">Advanced Topics in SAT Solving</a>          | 2 SWS | Seminar /  | Sanders, Iser, Schreiber |
| Exams    |         |                                                         |       |                                                                                               |                          |
| WT 25/26 | 7500041 | <a href="#">Seminar: Advanced Topics on SAT Solving</a> |       |                                                                                               | Sanders                  |

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

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

A presentation must be given. Withdrawal is possible within two weeks of the topic being assigned.

**Prerequisites**

None.

**Recommendations**

Knowledge of the basics from "SAT Solving in Practice" is helpful.

**T****6.391 Module component: Seminar: AI Systems Engineering [T-INFO-112881]**

**Coordinators:** Prof. Dr.-Ing. Michael Beigl  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-106356 - Seminar: AI Systems Engineering](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 4 CP    | graded  | Irregular    | 1       |

**T****6.392 Module component: Seminar: Algorithm Engineering [T-INFO-112312]**

**Coordinators:** Prof. Dr. Peter Sanders  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-106086 - Seminar: Algorithm Engineering](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 4 CP    | graded  | Irregular    | 1       |

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

A written paper must be prepared and a presentation given. Withdrawal is possible within two weeks of the topic being assigned.

**Prerequisites**

None.

**Recommendations**

Knowledge of algorithms is an advantage. Exemplary lectures are Algorithms I, Algorithms II, Algorithm Engineering and Parallel Algorithms.

**T****6.393 Module component: Seminar: Applications and Extensions of Timed Systems [T-INFO-113132]****Coordinators:** Jun.-Prof. Dr. Maïke Schwammberger**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106512 - Seminar: Applications and Extensions of Timed Systems](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 4 CP    | graded  | Irregular    | 1       |

| Courses  |         |                                                                       |       |                                                                                               |               |
|----------|---------|-----------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|---------------|
| WT 25/26 | 2400196 | <a href="#">Seminar: Applications and Extensions of Timed Systems</a> | 2 SWS | Seminar /  | Schwammberger |
| Exams    |         |                                                                       |       |                                                                                               |               |
| WT 25/26 | 7500374 | <a href="#">Seminar: Applications and Extensions of Timed Systems</a> |       |                                                                                               | Schwammberger |

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

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

Paper and presentation. The main language of the seminar will be English, but it is possible to write the paper either in German or English. The same holds for the presentation.

**Prerequisites**

None.

**Recommendations**

Knowledge in areas of theoretical computer science and modeling of (embedded) software systems is helpful (e.g. CTL, finite automata, first order logic). It is also helpful, but not at all necessary, to have knowledge of the topics of the summer term lecture „Timed Systems“. Necessary topics from that lecture will also be introduced in the beginning of the winter term, if necessary.

**T****6.394 Module component: Seminar: Artificial Intelligence for Energy Systems [T-INFO-113110]**

**Coordinators:** TT-Prof. Dr. Benjamin Schäfer  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-106490 - Seminar: Artificial Intelligence for Energy Systems](#)

| Type                        |
|-----------------------------|
| Examination of another type |

| Credits |
|---------|
| 4 CP    |

| Grading |
|---------|
| graded  |

| Term offered     |
|------------------|
| Each winter term |

| Version |
|---------|
| 1       |

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO), consisting of a Term paper (max. 15 pages) and a Presentation (duration approx. 30 min.)

The grading scale will be announced in the course.

Students may redraw from the examination during the first two weeks after the topic has been communicated. The assessment can be repeated once.

**Prerequisites**

None.

**Recommendations**

Previous participation in “Energieinformatik 1” and/or “Energieinformatik 2” is beneficiary but not mandatory.

**T****6.395 Module component: Seminar: Commercial and Corporate Law in the IT Industry [T-INFO-111405]****Coordinators:** Dr. Georg Nolte**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-101216 - Private Business Law](#)**Type**  
Examination of another type**Credits**  
3 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
1

| Courses  |         |                                                                                |       |                                                                                               |                        |
|----------|---------|--------------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|------------------------|
| WT 25/26 | 2400165 | <a href="#">Seminar Commercial and Corporate Law in Information Technology</a> | 2 SWS | Seminar /  | Nolte                  |
| Exams    |         |                                                                                |       |                                                                                               |                        |
| WT 25/26 | 7500182 | <a href="#">Seminar: Legal Studies II</a>                                      |       |                                                                                               | Boehm, Raabe, Melullis |
| WT 25/26 | 7500310 | <a href="#">Seminar: Commercial and Corporate Law in the IT Industry</a>       |       |                                                                                               | Matz                   |

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

T

6.396 Module component: Seminar: Computer Science TECO [T-INFO-110808]

Coordinators:

Prof. Dr.-Ing. Michael Beigl

Organisation:

KIT Department of Informatics

Part of:

[M-INFO-105328 - Seminar: Computer Science TECO](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 3 CP    | graded  | Irregular    | 2       |



**T****6.397 Module component: Seminar: Continuous Software Engineering [T-INFO-110794]**

**Coordinators:** Prof. Dr.-Ing. Anne Kozirolek  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-105309 - Seminar: Continuous Software Engineering](#)

**Type**  
Examination of another type

**Credits**  
4 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
2

| Courses  |         |                                                          |       |         |           |
|----------|---------|----------------------------------------------------------|-------|---------|-----------|
| WT 25/26 | 2400108 | <a href="#">Continuous Software Engineering</a>          | 2 SWS | Seminar | Kozirolek |
| ST 2026  | 2400166 | <a href="#">Seminar Continuous Software Engineering</a>  | 2 SWS | Seminar | Kozirolek |
| Exams    |         |                                                          |       |         |           |
| WT 25/26 | 7500243 | <a href="#">Seminar: Continuous Software Engineering</a> |       |         | Kozirolek |

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

- the preparation of a written paper (50%)
- the assessment of two seminar papers as part of a peer review (10%)
- the preparation of presentation slides and giving a presentation (20%)
- punctuality of submissions (20%)

**Prerequisites**

None.

*Below you will find excerpts from courses related to this module component:*

**V****Continuous Software Engineering**

2400108, WS 25/26, 2 SWS, Language: German/English, [Open in study portal](#)

**Seminar (S)**

**Content**

Modern software engineering happens in short cycles, which allow fast feedback. Technologies like build servers and containerization support fast, frequent and automated deployment of software to production systems and fast feedback to development (devops).

The term "continuous software engineering" combines different aspects of this intertwinement of different software engineering activities.

In this seminars, students will work on a topic in the context of continuous software engineering. Some of the addressed topics will be concerned with challenges when engineering systems with machine-learning components.

**Literature**

Fitzgerald, Brian, and Klaas-Jan Stol. "Continuous software engineering: A roadmap and agenda." Journal of Systems and Software 123 (2017): 176-189.

**V****Seminar Continuous Software Engineering**

2400166, SS 2026, 2 SWS, Language: German/English, [Open in study portal](#)

**Seminar (S)**

**Content**

Modern software engineering happens in short cycles, which allow fast feedback. Technologies like build servers and containerization support fast, frequent and automated deployment of software to production systems and fast feedback to development (devops).

The term "continuous software engineering" combines different aspects of this intertwinement of different software engineering activities.

In this seminars, students will work on a topic in the context of continuous software engineering. Some of the addressed topics will be concerned with challenges when engineering systems with machine-learning components.

**Literature**

Fitzgerald, Brian, and Klaas-Jan Stol. "Continuous software engineering: A roadmap and agenda." Journal of Systems and Software 123 (2017): 176-189.

## T

**6.398 Module component: Seminar: Critical Topics in AI [T-INFO-113915]****Coordinators:** Prof. Dr. Pascal Friederich**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106958 - Seminar: Critical Topics in AI](#)**Type**  
Examination of another type**Credits**  
3 CP**Grading**  
graded**Term offered**  
Each summer term**Version**  
1

| Courses  |         |                                                |            |                                                                                               |                                                        |
|----------|---------|------------------------------------------------|------------|-----------------------------------------------------------------------------------------------|--------------------------------------------------------|
| WT 25/26 | 2400231 | <a href="#">Seminar: Critical topics in AI</a> | 2 SWS      | Seminar /  | Friederich, Zhou, Torresi, Neubert, Eberhard, Schlöder |
| ST 2026  | 2400215 | <a href="#">Seminar: Critical topics in AI</a> | 2 SWS      | Seminar /  | Friederich, Torresi, Neubert, Schlöder, Metni          |
| Exams    |         |                                                |            |                                                                                               |                                                        |
| WT 25/26 | 7500407 | <a href="#">Seminar: Critical topics in AI</a> | Friederich |                                                                                               |                                                        |

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

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO). The following partial aspects are included in the grading: Term paper (approx. 10-15 pages), presentation (duration 30+15 min.). The grading scale will be announced in the course. Students may redraw from the examination during the first two weeks after the topic has been communicated. The assessment can be repeated once.

**Prerequisites**

Basic knowledge in AI and Machine Learning, e.g.

- BA Informatics: Introduction to artificial intelligence

**Recommendations**

Interest in social topics and research questions is required

## T

**6.399 Module component: Seminar: Deep Learning for Robotics [T-INFO-114204]**

**Coordinators:** Prof. Dr. Gerhard Neumann  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-107175 - Seminar: Deep Learning for Robotics](#)

**Type**  
Examination of another type

**Credits**  
3 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
1

| Courses  |         |                                                     |       |                                                                                               |         |
|----------|---------|-----------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|---------|
| WT 25/26 | 2400099 | <a href="#">Deep Learning for Robotics</a>          | 2 SWS | Seminar /  | Neumann |
| Exams    |         |                                                     |       |                                                                                               |         |
| WT 25/26 | 7500306 | <a href="#">Seminar: Deep Learning for Robotics</a> |       |                                                                                               | Neumann |

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

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

Presentation on the chosen topic at the end of the semester and written elaboration

Withdrawal is possible within two weeks of the topic being assigned.

**Prerequisites**

None.

**Recommendations**

Attendance of the lecture "Machine Learning - Fundamentals and Algorithms" is recommended.

*Below you will find excerpts from courses related to this module component:*

## V

**Deep Learning for Robotics**

2400099, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

**Seminar (S)**  
On-Site

**Content**

Each student has to choose one of the offered topics from the area of deep learning / robot learning / deep reinforcement learning / deep imitation learning.

Each topic consists of several research papers for which the students have to prepare a presentation as well as a report in form of a scientific research paper.

It is recommended to take the seminar together with the "Research Project Deep Learning for Robotics", where the presented algorithms will be implemented and evaluated.

Students will work in teams of 2.

Students are able to independently understand a complex research topic, present the content in a concise and understandable way and prepare a scientific report summarizing the topic.

Students are able to independently understand a complex research topic, present the content in a concise and understandable way and prepare a scientific report summarizing the topic. Students get a deeper understanding of state-of-the-art learning algorithms and get to know current research challenges.

Vortrag zum gewählten Thema am Ende des Semesters und schriftliche Ausarbeitung.

Der Besuch der Vorlesung „Maschinelles Lernen - Grundlagen und Algorithmen“ ist empfehlenswert.

**Organizational issues**

Mehr Informationen in ILIAS

**T****6.400 Module component: Seminar: Digital Accessibility and Assistive Technologies [T-INFO-111832]****Coordinators:** Prof. Dr.-Ing. Rainer Stiefelhagen**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-105884 - Seminar: Digital Accessibility and Assistive Technologies](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 3 CP    | Graded  | Each summer term | 1       |

| Courses  |         |                                                                          |       |                                                                                               |                       |
|----------|---------|--------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|-----------------------|
| WT 25/26 | 2400129 | <a href="#">Seminar Digital Accessibility and Assistive Technologies</a> | 2 SWS | Seminar /  | Stiefelhagen, Schwarz |
| Exams    |         |                                                                          |       |                                                                                               |                       |
| WT 25/26 | 7500122 | <a href="#">Seminar Digital Accessibility and Assistive Technologies</a> |       |                                                                                               | Stiefelhagen          |

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

## T

**6.401 Module component: Seminar: Embedded Systems I [T-INFO-114255]**

**Coordinators:** Prof. Dr.-Ing. Jörg Henkel  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-107231 - Seminar: Embedded Systems I](#)

**Type**  
Examination of another type

**Credits**  
3 CP

**Grading**  
graded

**Term offered**  
Each term

**Version**  
1

| Courses  |         |                                                                                      |  |                                                                                               |                                                          |
|----------|---------|--------------------------------------------------------------------------------------|--|-----------------------------------------------------------------------------------------------|----------------------------------------------------------|
| WT 25/26 | 2400137 | <a href="#">Embedded Machine Learning Seminar</a>                                    |  | Seminar /  | Sikal, Ahmed, Dietrich, Demirdag, Henkel, Khdr, Mentzos  |
| WT 25/26 | 2400148 | <a href="#">Embedded Security and Architectures</a>                                  |  | Seminar /  | Nassar, Khdr, Sikal, Henkel, Alsharkawy, Tobar           |
| ST 2026  | 2400137 | <a href="#">Embedded Machine Learning</a>                                            |  | Seminar /  | Henkel, Sikal, Khdr, Ahmed, Demirdag, Mentzos            |
| ST 2026  | 2400148 | <a href="#">Embedded Security and Architectures</a>                                  |  | Seminar /  | Henkel, Nassar, Khdr, Sikal, Tobar, Alsharkawy, Dietrich |
| Exams    |         |                                                                                      |  |                                                                                               |                                                          |
| WT 25/26 | 7500346 | <a href="#">CES - Seminar: Embedded Systems: Embedded Security and Architectures</a> |  |                                                                                               | Henkel                                                   |
| WT 25/26 | 7500349 | <a href="#">CES - Seminar: Embedded Machine Learning</a>                             |  |                                                                                               | Henkel                                                   |

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

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO). A written paper must be prepared and a presentation given. Withdrawal is possible within two weeks of the topic being assigned.

**Prerequisites**

None.

**Recommendations**

Knowledge of IoT and embedded systems

Below you will find excerpts from courses related to this module component:

## V

**Embedded Machine Learning Seminar**

2400137, WS 25/26, SWS, Language: German/English, [Open in study portal](#)

**Seminar (S)**  
**Blended (On-Site/Online)**

**Content**

In our seminars, students learn about cutting-edge research in the research fields presented below. Students are offered topics by the supervisors, but also can suggest their own topics in these fields. The seminar is offered in both English and German.

**Machine Learning on On-Chip Systems**

Machine learning and on-chip systems form a symbiosis where each research area benefits from advances in the other. In this seminar, students review cutting-edge research on both areas.

Machine learning (ML) gains importance in all aspects of information systems. From high-level algorithms like image recognition to lower-level intelligent CPU management - ML is ubiquitous. On-chip systems also benefit from advances in ML techniques. Examples include adaptive resource management or workload prediction. However, ML techniques also benefit from advances in on-chip systems. A prominent example is acceleration of neural networks in recent desktop GPUs and even smartphone chips.

In this seminar, students will review cutting-edge state-of-the-art research (publications) to a specific topic related to ML on on-chip systems. The findings will be summarized in a seminar report and presented to the other members of the course. Students are welcome to suggest own topics, but this is not required. The seminar can be held in English or German.

**DNN Pruning and Quantization**

As DNNs become more computationally hungry, their hardware implementation becomes more challenging, since embedded devices have limited resources. DNN compression techniques, such as pruning and quantization, can be applied for efficient utilization of computational resources. While pruning involves removing unimportant elements of a DNN structure (connections, filters, channels etc), quantization decreases the precision for representing DNN-related tensors (weights and activations). Both promise to trade-off some of the application's accuracy for limited energy consumption and reduced memory footprint. Students will review state-of-the-art research works on hardware-aware DNN pruning and quantization. The findings will be summarized in a seminar report and presented to the other members of the course.

**Organizational issues**

Bitte im ILIAS zur Teilnahme anmelden.

**Embedded Security and Architectures**

2400148, WS 25/26, SWS, Language: German/English, [Open in study portal](#)

**Seminar (S)**  
**Blended (On-Site/Online)**

### Content

In our seminars, students learn about cutting-edge research in the research fields presented below. Students are offered topics by the supervisors, but also can suggest their own topics in these fields. The seminar is offered in both English and German.

#### Dependability for Reconfigurable Architectures

Dependability has become one of the prime concerns in recent nano-era. Reliability (the ability of the system to deliver services as specified) and Security (the ability of the system to protect itself against deliberate or accidental intrusion) are the two crucial attributes of dependable systems. Among the other reliability threats due to physical limits of CMOS technology, radiation induced soft errors or transient faults are also the most challenging threat to be handled. During this seminar, we will explore state-of-the-art for the power-efficient soft-error reliability and study different research solutions to improve soft-error resiliency in power efficient manner leveraging power-performance-reliability trade-offs. During this seminar, the students will also be able to understand hardware security in reconfigurable architectures,

#### Thermal and Power Aware Embedded Systems

Power densities are continuously increasing along with technology scaling and the integration of more transistors into smaller areas, potentially resulting in thermal emergencies on the chip. To mitigate such emergencies, power and thermal management techniques are employed. The state-of-the-art power and thermal management techniques can be classified into several categories, such as reactive and proactive techniques, centralized and distributed ones. Recently, machine learning algorithms are employed in power and thermal management techniques to make them more proactive and adaptive. Those various categories of the state-of-the-art techniques need to be reviewed in this seminar to demonstrate the advantage and disadvantage of each of them.

#### Security of Reconfigurable Embedded Systems

Various types of (re) configurable systems have emerged in recent years. The spectrum ranges from one-time configurable systems that are programmed at the design time for product-specific requirements, to reconfigurable systems that can also be adapted after commissioning, to dynamically reconfigurable systems whose configuration can be changed at runtime and their ability to dynamic reconfiguration is an important part of their system functionality.

This seminar focuses on the runtime reconfigurable systems, their security aspects and methods. It investigates the current state of research for securing the runtime reconfigurable systems, as well as the feasibility of using the security measures from general processing architectures to runtime reconfigurable systems.

#### Security in Resource Management

Efficient resource management in many-core systems (ie, systems with more than 100 cores, not only a dozen) has become a research challenge in the last years. As complexity and the demand for scalability increase, this new paradigm should also consider new security features to avoid or mitigate the effects of malicious applications both on critical information and the system as a whole.

In this seminar, we will focus on the state-of-the-art of security attacks such as Side Channel Attacks (SCA), Covert channel attacks, as well as other similar resource-based attacks and their effects on other critical applications running on many-core systems. During this seminar, student will dive into the security aspects of resource management, while investigating answers to the following research questions:

- How do these attacks work?
- Which are the associated vulnerabilities? What resources are vulnerable?
- What's their impact on critical information or other resources?
- What are the current countermeasures for the attacks?

### Organizational issues

Please register in ILIAS to participate.



#### Embedded Machine Learning

2400137, SS 2026, SWS, Language: German/English, [Open in study portal](#)

Seminar (S)  
Blended (On-Site/Online)



### Content

In our seminars, students learn about cutting-edge research in the research fields presented below. Students are offered topics by the supervisors, but also can suggest their own topics in these fields. The seminar is offered in both English and German.

#### Machine learning on on-chip systems

Machine learning and on-chip systems form a symbiosis where each research area benefits from advances in the other. In this seminar, students review cutting-edge research on both areas.

Machine learning (ML) gains importance in all aspects of information systems. From high-level algorithms like image recognition to lower-level intelligent CPU management - ML is ubiquitous. On-chip systems also benefit from advances in ML techniques. Examples include adaptive resource management or workload prediction. However, ML techniques also benefit from advances in on-chip systems. A prominent example is acceleration of neural networks in recent desktop GPUs and even smartphone chips.

In this seminar, students will review cutting-edge state-of-the-art research (publications) on a specific topic related to ML on on-chip systems. The findings will be summarized in a seminar report and presented to the other members of the course. Students are welcome to suggest their own topics, but this is not required. The seminar can be held in English or German.

#### Approximate Computing for Efficient Machine Learning

Nowadays, energy efficiency is a first-class design constraint in the ICT sector. Approximate computing emerges as a new design paradigm for generating energy efficient computing systems. There is a large body of resource-hungry applications (eg, image processing and machine learning) that exhibit an intrinsic resilience to errors and produce outputs that are useful and of acceptable quality for the users despite their underlying computations being performed in an approximate manner. By exploiting this inherent error tolerance of such applications, approximate computing trades computational accuracy for savings in other metrics, eg, energy consumption and performance. Machine learning, a very common and top trending workload of both data centers and embedded systems, is a perfect candidate for approximate computing application since, by definition, it delivers approximate results. Performance as well as energy efficiency (especially in the case of embedded systems) are crucial for machine learning applications and thus, approximate computing techniques are widely adopted in machine learning (eg, TPU) to improve its energy profile as well as performance.

#### Machine Learning methods for DNN compilation and mapping

Deep neural networks have achieved great success in challenging tasks such as image classification and object detection. There is a great demand for deploying these networks in different devices, ranging from cloud servers to embedded devices.

Mapping DNNs to these devices is a challenging task since each of these devices has different characteristics in terms of memory organization, compute units, etc. . There have been efforts to automate the process of mapping/compiling DNNs to hardware with different characteristics.

In this seminar, we will discuss the efforts that have been done in mapping/compiling DNNs over hardware using machine learning methods.

### Organizational issues

Please register in ILIAS to participate.



#### Embedded Security and Architectures

2400148, SS 2026, SWS, Language: German/English, [Open in study portal](#)

Seminar (S)  
Blended (On-Site/Online)

**Content**

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**Dependability for Reconfigurable Architectures**

Dependability has become one of the prime concerns in recent nano-era. Reliability (the ability of the system to deliver services as specified) and Security (the ability of the system to protect itself against deliberate or accidental intrusion) are the two crucial attributes of dependable systems. Among the other reliability threats due to physical limits of CMOS technology, radiation induced soft errors or transient faults are also the most challenging threat to be handled. During this seminar, we will explore state-of-the-art for the power-efficient soft-error reliability and study different research solutions to improve soft-error resiliency in power efficient manner leveraging power-performance-reliability trade-offs. During this seminar, the students will also be able to understand hardware security in reconfigurable architectures,

**Thermal and Power Aware Embedded Systems**

Power densities are continuously increasing along with technology scaling and the integration of more transistors into smaller areas, potentially resulting in thermal emergencies on the chip. To mitigate such emergencies, power and thermal management techniques are employed. The state-of-the-art power and thermal management techniques can be classified into several categories, such as reactive and proactive techniques, centralized and distributed ones. Recently, machine learning algorithms are employed in power and thermal management techniques to make them more proactive and adaptive. Those various categories of the state-of-the-art techniques need to be reviewed in this seminar to demonstrate the advantage and disadvantage of each of them.

**Security of Reconfigurable Embedded Systems**

Various types of (re)configurable systems have emerged in recent years. The spectrum ranges from one-time configurable systems that are programmed at the design time for product-specific requirements, to reconfigurable systems that can also be adapted after commissioning, to dynamically reconfigurable systems whose configuration can be changed at runtime and their ability to dynamic reconfiguration is an important part of their system functionality.

This seminar focuses on the runtime reconfigurable systems, their security aspects and methods. It investigates the current state of research for securing the runtime reconfigurable systems, as well as the feasibility of using the security measures from general processing architectures to runtime reconfigurable systems.

**Security in Resource Management**

Efficient resource management in many-core systems (ie, systems with more than 100 cores, not only a dozen) has become a research challenge in the last years. As complexity and the demand for scalability increase, this new paradigm should also consider new security features to avoid or mitigate the effects of malicious applications both on critical information and the system as a whole.

In this seminar, we will focus on the state-of-the-art of security attacks such as Side Channel Attacks (SCA), Covert channel attacks, as well as other similar resource-based attacks and their effects on other critical applications running on many-core systems. During this seminar, student will dive into the security aspects of resource management, while investigating answers to the following research questions:

- How do these attacks work?
- Which are the associated vulnerabilities? What resources are vulnerable?
- What's their impact on critical information or other resources?
- What are the current countermeasures for the attacks?

**Organizational issues**

Please register in ILIAS to participate.

## T

**6.402 Module component: Seminar: Embedded Systems II [T-INFO-114256]**

**Coordinators:** Prof. Dr.-Ing. Jörg Henkel  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-107232 - Seminar: Embedded Systems II](#)

**Type**  
Examination of another type

**Credits**  
3 CP

**Grading**  
graded

**Term offered**  
Each term

**Version**  
1

| Courses |         |                                                     |  |                                                                                               |                                                          |
|---------|---------|-----------------------------------------------------|--|-----------------------------------------------------------------------------------------------|----------------------------------------------------------|
| ST 2026 | 2400137 | <a href="#">Embedded Machine Learning</a>           |  | Seminar /  | Henkel, Sikal, Khdr, Ahmed, Demirdag, Mentzos            |
| ST 2026 | 2400148 | <a href="#">Embedded Security and Architectures</a> |  | Seminar /  | Henkel, Nassar, Khdr, Sikal, Tobar, Alsharkawy, Dietrich |

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

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO). A written paper must be prepared and a presentation given. Withdrawal is possible within two weeks of the topic being assigned.

**Prerequisites**

None.

**Recommendations**

Knowledge of IoT and embedded systems

**Additional Information**

This is identical to the module 'Seminars: Embedded Systems I' and enables participation in a second seminar at the CES Chair.

*Below you will find excerpts from courses related to this module component:*

## V

**Embedded Machine Learning**

2400137, SS 2026, SWS, Language: German/English, [Open in study portal](#)

**Seminar (S)**  
**Blended (On-Site/Online)**

### Content

In our seminars, students learn about cutting-edge research in the research fields presented below. Students are offered topics by the supervisors, but also can suggest their own topics in these fields. The seminar is offered in both English and German.

#### Machine learning on on-chip systems

Machine learning and on-chip systems form a symbiosis where each research area benefits from advances in the other. In this seminar, students review cutting-edge research on both areas.

Machine learning (ML) gains importance in all aspects of information systems. From high-level algorithms like image recognition to lower-level intelligent CPU management - ML is ubiquitous. On-chip systems also benefit from advances in ML techniques. Examples include adaptive resource management or workload prediction. However, ML techniques also benefit from advances in on-chip systems. A prominent example is acceleration of neural networks in recent desktop GPUs and even smartphone chips.

In this seminar, students will review cutting-edge state-of-the-art research (publications) on a specific topic related to ML on on-chip systems. The findings will be summarized in a seminar report and presented to the other members of the course. Students are welcome to suggest their own topics, but this is not required. The seminar can be held in English or German.

#### Approximate Computing for Efficient Machine Learning

Nowadays, energy efficiency is a first-class design constraint in the ICT sector. Approximate computing emerges as a new design paradigm for generating energy efficient computing systems. There is a large body of resource-hungry applications (eg, image processing and machine learning) that exhibit an intrinsic resilience to errors and produce outputs that are useful and of acceptable quality for the users despite their underlying computations being performed in an approximate manner. By exploiting this inherent error tolerance of such applications, approximate computing trades computational accuracy for savings in other metrics, eg, energy consumption and performance. Machine learning, a very common and top trending workload of both data centers and embedded systems, is a perfect candidate for approximate computing application since, by definition, it delivers approximate results. Performance as well as energy efficiency (especially in the case of embedded systems) are crucial for machine learning applications and thus, approximate computing techniques are widely adopted in machine learning (eg, TPU) to improve its energy profile as well as performance.

#### Machine Learning methods for DNN compilation and mapping

Deep neural networks have achieved great success in challenging tasks such as image classification and object detection. There is a great demand for deploying these networks in different devices, ranging from cloud servers to embedded devices.

Mapping DNNs to these devices is a challenging task since each of these devices has different characteristics in terms of memory organization, compute units, etc. . There have been efforts to automate the process of mapping/compiling DNNs to hardware with different characteristics.

In this seminar, we will discuss the efforts that have been done in mapping/compiling DNNs over hardware using machine learning methods.

### Organizational issues

Please register in ILIAS to participate.



#### Embedded Security and Architectures

2400148, SS 2026, SWS, Language: German/English, [Open in study portal](#)

Seminar (S)  
Blended (On-Site/Online)

**Content**

In our seminars, students learn about cutting-edge research in the research fields presented below. Students are offered topics by the supervisors, but also can suggest their own topics in these fields. The seminar is offered in both English and German.

**Dependability for Reconfigurable Architectures**

Dependability has become one of the prime concerns in recent nano-era. Reliability (the ability of the system to deliver services as specified) and Security (the ability of the system to protect itself against deliberate or accidental intrusion) are the two crucial attributes of dependable systems. Among the other reliability threats due to physical limits of CMOS technology, radiation induced soft errors or transient faults are also the most challenging threat to be handled. During this seminar, we will explore state-of-the-art for the power-efficient soft-error reliability and study different research solutions to improve soft-error resiliency in power efficient manner leveraging power-performance-reliability trade-offs. During this seminar, the students will also be able to understand hardware security in reconfigurable architectures,

**Thermal and Power Aware Embedded Systems**

Power densities are continuously increasing along with technology scaling and the integration of more transistors into smaller areas, potentially resulting in thermal emergencies on the chip. To mitigate such emergencies, power and thermal management techniques are employed. The state-of-the-art power and thermal management techniques can be classified into several categories, such as reactive and proactive techniques, centralized and distributed ones. Recently, machine learning algorithms are employed in power and thermal management techniques to make them more proactive and adaptive. Those various categories of the state-of-the-art techniques need to be reviewed in this seminar to demonstrate the advantage and disadvantage of each of them.

**Security of Reconfigurable Embedded Systems**

Various types of (re)configurable systems have emerged in recent years. The spectrum ranges from one-time configurable systems that are programmed at the design time for product-specific requirements, to reconfigurable systems that can also be adapted after commissioning, to dynamically reconfigurable systems whose configuration can be changed at runtime and their ability to dynamic reconfiguration is an important part of their system functionality.

This seminar focuses on the runtime reconfigurable systems, their security aspects and methods. It investigates the current state of research for securing the runtime reconfigurable systems, as well as the feasibility of using the security measures from general processing architectures to runtime reconfigurable systems.

**Security in Resource Management**

Efficient resource management in many-core systems (ie, systems with more than 100 cores, not only a dozen) has become a research challenge in the last years. As complexity and the demand for scalability increase, this new paradigm should also consider new security features to avoid or mitigate the effects of malicious applications both on critical information and the system as a whole.

In this seminar, we will focus on the state-of-the-art of security attacks such as Side Channel Attacks (SCA), Covert channel attacks, as well as other similar resource-based attacks and their effects on other critical applications running on many-core systems. During this seminar, student will dive into the security aspects of resource management, while investigating answers to the following research questions:

- How do these attacks work?
- Which are the associated vulnerabilities? What resources are vulnerable?
- What's their impact on critical information or other resources?
- What are the current countermeasures for the attacks?

**Organizational issues**

Please register in ILIAS to participate.

## T

**6.403 Module component: Seminar: Energy Informatics [T-INFO-106270]**

**Coordinators:** Prof. Dr. Veit Hagenmeyer  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-103153 - Seminar: Energy Informatics](#)

**Type**  
Examination of another type

**Credits**  
4 CP

**Grading**  
graded

**Term offered**  
Irregular

**Version**  
1

| Courses  |         |                                             |       |                                                                                               |                                    |
|----------|---------|---------------------------------------------|-------|-----------------------------------------------------------------------------------------------|------------------------------------|
| WT 25/26 | 2400013 | <a href="#">Seminar: Energy Informatics</a> | 2 SWS | Seminar /  | Hagenmeyer, Schmurr, Langner, Rapp |
| Exams    |         |                                             |       |                                                                                               |                                    |
| WT 25/26 | 7500175 | <a href="#">Seminar: Energy Informatics</a> |       |                                                                                               | Hagenmeyer, Bläsius                |

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

**Assessment**

The assessment of success is graded through the preparation of a written seminar paper and the presentation of the same as a different type of assessment in accordance with § 4 Para. 2 No. 3 SPO.

**Prerequisites**

None.

**Recommendations**

Knowledge of the basics of graph theory, algorithm technology and energy informatics is helpful.

**Additional Information**

This module is offered at irregular intervals.

*Below you will find excerpts from courses related to this module component:*

## V

**Seminar: Energy Informatics**

2400013, WS 25/26, 2 SWS, Language: German/English, [Open in study portal](#)

**Seminar (S)**  
On-Site

**Content**

Energy informatics is a young field of research at the interface of electrical engineering, computer science, economics and law, in which questions about energy systems are dealt with. Issues arising from climate change and the increasing use of renewable energy sources are of particular interest.

In the "Energy Informatics" seminar, we look at selected issues arising from current research. These questions consider, for example, modeling, algorithms or simulations in the context of energy systems.

This seminar is aimed at Master's students in subjects that overlap with energy informatics, for example computer science, mechanical engineering, information systems, econometrics, business engineering or economics engineering. If you have any questions regarding credit transfer, please contact your study program service.

Ideally, students should have an in-depth insight into the subject areas of energy informatics and have basic knowledge of modeling, simulation and algorithms.

**Other participants:** Prof. Dr. Veit Hagenmeyer, T.T.-Prof. Dr. Thomas Bläsius

**Workload:** 4 CP corresponds to approx. 120 hours, approx. 21 hours attending the seminar, approx. 45 hours analyzing and working on the topic, approx. 27 hours preparing and creating the presentation and approx. 27 hours writing the paper.

**Learning objectives:** Based on a given topic, participants identify, collect and evaluate relevant literature. They classify the topic within the subject area of "energy informatics".

Participants prepare a seminar paper and take format specifications into account. Students critically examine other seminar papers and write reviews of the seminar papers of others.

In presentations, the participants present the most important content of their seminar paper in an auditorium-friendly manner and discuss it with the audience.

## T

**6.404 Module component: Seminar: Exoskeletons & Motion Capture [T-INFO-113892]****Coordinators:** Prof. Dr. Katja Mombaur**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106927 - Seminar: Exoskeletons & Motion Capture](#)**Type**  
Examination of another type**Credits**  
3 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
1

| Courses  |         |                                                            |       |           |              |
|----------|---------|------------------------------------------------------------|-------|-----------|--------------|
| WT 25/26 | 2400187 | <a href="#">Seminar: Exoskeletons &amp; Motion Capture</a> | 2 SWS | Seminar / | Mombaur, Lau |
| Exams    |         |                                                            |       |           |              |
| WT 25/26 | 7500161 | <a href="#">Seminar: Exoskeletons &amp; Motion Capture</a> |       |           | Mombaur      |

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

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

This includes the preparation of a term paper in form of a scientific paper (6 pages double column) an oral presentation with slides (30 Min + 15 Min discussion). Students may redraw from the examination during the first two weeks after the topic has been communicated.

Participation in the block seminar is mandatory.

Students have to actively participate in all discussions.

**Prerequisites**

None.

**Recommendations**

Knowledge in Robotics (e.g. from the class Robotics 1 and follow-ups) is helpful

*Below you will find excerpts from courses related to this module component:*

## V

**Seminar: Exoskeletons & Motion Capture**

2400187, WS 25/26, 2 SWS, Language: German/English, [Open in study portal](#)

**Seminar (S)**  
**On-Site**

**Content**

This seminar provides insight into the current state of research and practical application of exoskeletons in medicine and their potential to improve the quality of life for people with and without physical impairments. On the other hand, there is an overview of various motion capture technologies, such as devices and methods for recording human movement, which play an important role in exoskeletons but have many other applications. Exoskeletons—also known as wearable robots—are used to improve mobility and are worn directly on the body to support or completely replace muscle strength. One type of exoskeleton assists people with limited mobility in walking, standing, and other physical activities, enabling them to regain their independence and participate in everyday activities. Other types of exoskeletons are used by healthy people to prevent injuries in difficult working conditions. Motion capture applications span many disciplines in which human behavior and movement are of interest, such as sports science, biomechanics, medicine, psychology, etc., but they also play an important role in the creation of animated films and computer games. In robotics, and especially in the development of exoskeletons, they are important for analyzing human-robot interaction and improving robot design and control. Various motion capture technologies exist for recording movement kinematics, ground reaction forces, and muscle activity. The seminar topics cover the spectrum of different exoskeleton types and motion capture technologies. Procedure: In a session during the first week of the semester, the seminar topic and the individual presentation topics will be presented in detail and assigned to students according to their preferences. Over the course of the semester, students will conduct literature research under supervision and prepare a presentation and a corresponding paper. Since most of the academic literature is in English, the paper should also be written in English. Presentations can be given in either English or German and will take place in one or more block sessions in the last third of the semester. There are still a few places available in the seminar for master's students. If you are interested, please contact [jan.lau@kit.edu](mailto:jan.lau@kit.edu). The topic presentation will take place this semester on November 5 at 2:00 p.m. in Seminar Room 2, InformatiKOM 1.

**Organizational issues**

Vorbesprechung am Mittwoch, den 23.10.24 um 14:00 im Seminarraum 2

## T

**6.405 Module component: Seminar: Explainable Artificial Intelligence [T-INFO-113115]**

**Coordinators:** TT-Prof. Dr. Rudolf Lioutikov  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-106497 - Seminar: Explainable Artificial Intelligence](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 3 CP    | graded  | Each winter term | 1       |

| Courses  |         |                                                              |       |                                                                                               |                       |
|----------|---------|--------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|-----------------------|
| WT 25/26 | 2400143 | <a href="#">Seminar: Explainable Artificial Intelligence</a> | 2 SWS | Seminar /  | Lioutikov, Mattes, Li |
| Exams    |         |                                                              |       |                                                                                               |                       |
| WT 25/26 | 7500384 | <a href="#">Seminar: Explainable Artificial Intelligence</a> |       |                                                                                               | Lioutikov             |

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

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

Presentation on the chosen topic at the end of the semester and written paper.

**Prerequisites**

None.

**Recommendations**

We recommend taking this research project after attending the “Explainable Artificial Intelligence” lecture in the summer semester.

We highly recommend to take this seminar in combination with the “Explainable Artificial Intelligence” research project (Forschungspraktikum).

- Experience in Machine Learning is recommended, e.g. through prior coursework.
- The Computer Science Department offers several great lectures e.g., “Maschinelles Lernen - Grundlagen und Algorithmen” and “Deep Learning”
- A good mathematical background will be beneficial
- Python experience is recommended
- We will use the PyTorch deep learning library. Some prior knowledge in this is helpful but not necessary.

**Additional Information**

It is only possible to resign within two weeks after assignment of the topic.



**T****6.406 Module component: Seminar: Exploring Robotics - Insights from Science Fiction, Research and Society [T-INFO-113398]****Coordinators:** TT-Prof. Dr. Barbara Bruno**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106651 - Seminar: Exploring Robotics - Insights from Science Fiction, Research and Society](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 3 CP    | Graded  | Each summer term | 1       |

| Courses |         |                                                                                         |       |                                                                                               |                    |
|---------|---------|-----------------------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|--------------------|
| ST 2026 | 2400161 | <a href="#">Exploring Robotics: Insights from Science Fiction, Research and Society</a> | 2 SWS | Seminar /  | Bruno, Maure, Yang |

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

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

The overall impression is evaluated. The following partial aspects are included in the grading: Term paper (approx. 6 pages in double-column format), Presentation (duration approx. 10+10 min.).

**Prerequisites**

None.

**Recommendations**

Knowledge of the content of modules Robotics I - Introduction to Robotics, Robotics II: Humanoid Robotics, Robotics III - Sensors and Perception in Robotics is helpful.

*Below you will find excerpts from courses related to this module component:*

**V****Exploring Robotics: Insights from Science Fiction, Research and Society**2400161, SS 2026, 2 SWS, Language: English, [Open in study portal](#)**Seminar (S)**  
On-Site

**Content****Competency Goals**

The students gain experience with literature research on a current research topic. They explore, understand and compare different approaches to a selected scientific problem. The students are able to write a summary of their literature research in the form of a scientific publication in English and give a scientific talk on it.

**Content**

The students choose a topic from the field of robotics (e.g. remote control, behavior-based robotics, human-robot interaction, the "uncanny valley," natural language understanding, machine learning) and conduct a research on it that, building on literature findings, also includes and addresses the perspectives of society and the general media (as given by science fiction books, movies and games, as well as media and news outlets) and technology assessment (including social/societal expectations and needs, ethical implications, and risks/benefits analyses).

Students work under the guidance of a scientific supervisor. At the end of the semester, they present the results and write an elaboration in English in the form of a scientific publication.

**Workload**

Seminar with 2 SWS, 3 LP.

3 LP corresponds to approx. 90 hours, of which

approx. 45 hours of literature research

approx. 25 hrs. elaboration

approx. 10 hrs. preparation of presentation

approx. 10 hrs. compulsory attendance

**Competency certificate**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO). The overall impression is evaluated. The following partial aspects are included in the grading: Term paper (approx. 6 pages in double-column format), Presentation (duration approx. 10+10 min.).

## T

**6.407 Module component: Seminar: Failing Forward: Robotics, Critical Reading and the Making of Good Research [T-INFO-114604]****Coordinators:** TT-Prof. Dr. Barbara Bruno**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107436 - Seminar: Failing Forward: Robotics, Critical Reading and the Making of Good Research](#)

| Type                        | Credits | Grading | Term offered     | Expansion   | Version |
|-----------------------------|---------|---------|------------------|-------------|---------|
| Examination of another type | 3 CP    | Graded  | Each winter term | 1 semesters | 1       |

| Courses  |         |                                                                                                       |       |           |                    |
|----------|---------|-------------------------------------------------------------------------------------------------------|-------|-----------|--------------------|
| WT 25/26 | 2400194 | <a href="#">Failing Forward: Robotics, Critical Reading and the Making of Good Research - Seminar</a> | 2 SWS | Seminar / | Bruno, Maure, Neef |
| Exams    |         |                                                                                                       |       |           |                    |
| WT 25/26 | 7500389 | <a href="#">Seminar: Failing Forward: Robotics, Critical Reading and the Making of Good Research</a>  |       |           | Bruno              |

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

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO). The overall impression is evaluated. The following partial aspects are included in the grading: Term paper (approx. 6 pages in double-column format), Presentation (duration approx. 10+10 min.).

**Prerequisites**

None.

Below you will find excerpts from courses related to this module component:

## V

**Failing Forward: Robotics, Critical Reading and the Making of Good Research - Seminar (S)**  
2400194, WS 25/26, 2 SWS, Language: English, [Open in study portal](#) **On-Site**

**Content**

The students choose a topic from the field of human-robot interaction, e.g. attention modelling, socially-aware navigation, social gestures generation or metrics for HRI experiments. They conduct a literature research on this topic under the guidance of a scientific supervisor. At the end of the semester, they present the results and write an elaboration in English in the form of a scientific publication.

**Competency Goals:**

The students gain experience with literature research on a current research topic. They explore, understand and compare different approaches to a selected scientific problem. The students are able to write a summary of their literature research in the form of a scientific publication in English and give a scientific talk on it.

**Organizational issues****Workload:**

Seminar with 2 SWS, 3 LP.

3 LP corresponds to approx. 90 hours, of which

approx. 45 hours of literature research

approx. 25 hrs. elaboration

approx. 10 hrs. preparation of presentation

approx. 10 hrs. compulsory attendance

**Competency certificate:**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO). The overall impression is evaluated. The following partial aspects are included in the grading: Term paper (approx. 6 pages in double-column format), Presentation (duration approx. 10+10 min.).

**T****6.408 Module component: Seminar: From Big Data to Data Science: Advanced Methods of Information Fusion [T-INFO-101270]****Coordinators:** Prof. Dr.-Ing. Uwe Hanebeck**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-102305 - Seminar: From Big Data to Data Science: Advanced Methods of Information Fusion](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 3 CP    | Graded  | Each term    | 1       |

| Courses  |         |                                                        |       |           |          |
|----------|---------|--------------------------------------------------------|-------|-----------|----------|
| WT 25/26 | 2424344 | <a href="#">Advanced Methods of Information Fusion</a> | 2 SWS | Seminar / | Hanebeck |
| ST 2026  | 24344   | <a href="#">Advanced Methods of Information Fusion</a> | 2 SWS | Seminar / | Hanebeck |
| Exams    |         |                                                        |       |           |          |
| WT 25/26 | 7500021 | <a href="#">Advanced Methods of Information Fusion</a> |       |           | Hanebeck |

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

Below you will find excerpts from courses related to this module component:

**V****Advanced Methods of Information Fusion**2424344, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)**Seminar (S)**  
**On-Site****Content**

The growing spread and performance of modern information and communication technologies produces an ever-increasing amount of data. It is one of the central challenges of our time to extract meaningful information from these data sets. The approach to address these issues, often called data science, combines strategies and methods from the fields of machine learning, mathematics, state estimation, visualization and pattern recognition. During this seminar, the students will familiarize themselves with concepts and methods particularly focusing on estimation theory and its application.

The seminar targets master students in computer science and bachelor students in Information engineering and management.

**Organizational issues**

Gemeinsame Einführungsveranstaltung von Proseminar 2424060 & Seminar 2424344 am 27.10.2025 in Raum 148, Gebäude 50.20.

**V****Advanced Methods of Information Fusion**24344, SS 2026, 2 SWS, Language: German/English, [Open in study portal](#)**Seminar (S)**  
**On-Site****Content**

The growing spread and performance of modern information and communication technologies produces an ever-increasing amount of data. It is one of the central challenges of our time to extract meaningful information from these data sets. The approach to address these issues, often called data science, combines strategies and methods from the fields of machine learning, mathematics, state estimation, visualization and pattern recognition. During this seminar, the students will familiarize themselves with concepts and methods particularly focusing on estimation theory and its application.

The seminar targets master students in computer science and bachelor students in Information engineering and management.

**T****6.409 Module component: Seminar: Graph Algorithms [T-INFO-105128]**

**Coordinators:** Dr. rer. nat. Torsten Ueckerdt  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-102550 - Seminar: Graph Algorithms](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 4 CP    | graded  | Irregular    | 1       |

## T

**6.410 Module component: Seminar: Hot Topics in Artificial Intelligence & Security 1 [T-INFO-113761]****Coordinators:** Prof. Dr. Christian Wressnegger**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106868 - Seminar: Hot Topics in Artificial Intelligence & Security 1](#)**Type**  
Examination of another type**Credits**  
4 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
1

| Courses  |         |                                                                        |       |                                                                                               |                   |
|----------|---------|------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|-------------------|
| WT 25/26 | 24004   | <a href="#">Seminar: Hot Topics in Security of Machine Learning</a>    | 2 SWS | Seminar /  | Wressnegger, Zhao |
| WT 25/26 | 24005   | <a href="#">Seminar: Hot Topics in Cyber-Physical Systems Security</a> | 2 SWS | Seminar /  | Wressnegger       |
| Exams    |         |                                                                        |       |                                                                                               |                   |
| WT 25/26 | 7500314 | <a href="#">Seminar: Hot Topics in Security of Machine Learning</a>    |       |                                                                                               | Wressnegger       |

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

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

A written paper must be prepared and a presentation given. One repetition is possible.

**Prerequisites**

None.

**Recommendations**

The basics of IT security and artificial intelligence are a prerequisite.

*Below you will find excerpts from courses related to this module component:*

## V

**Seminar: Hot Topics in Security of Machine Learning**

24004, WS 25/26, 2 SWS, Language: German/English, [Open in study portal](#)

**Seminar (S)**  
**On-Site**

**Content**

This seminar is concerned with the combination of artificial intelligence, machine learning and computer security in practice. Many tasks in the security landscape are based on manual labor, such as searching for vulnerabilities or analyzing malware. Here, machine learning can be used to establish a higher degree of automation, providing more "intelligent" security solutions (AI for Security). However, also these learning-based systems can be attacked and need to be secured (Security of AI).

This module is part of a seminar series to intensifies the contents of the AISEC lecture. It can be attended individually and in no particular order. The module puts focus on timely topics from recent research and teaches students to work up results from state-of-the-art research. To this end, they will read up on a sub-field, prepare a seminar report, and present their work at the end of the term to their colleagues.

**Organizational issues**

English Course

## T

**6.411 Module component: Seminar: Hot Topics in Artificial Intelligence & Security 2 [T-INFO-113762]****Coordinators:** Prof. Dr. Christian Wressnegger**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106869 - Seminar: Hot Topics in Artificial Intelligence & Security 2](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 4 CP    | Graded  | Each summer term | 1       |

| Courses  |         |                                                                        |       |                                                                                               |                   |
|----------|---------|------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|-------------------|
| WT 25/26 | 24004   | <a href="#">Seminar: Hot Topics in Security of Machine Learning</a>    | 2 SWS | Seminar /  | Wressnegger, Zhao |
| WT 25/26 | 24005   | <a href="#">Seminar: Hot Topics in Cyber-Physical Systems Security</a> | 2 SWS | Seminar /  | Wressnegger       |
| Exams    |         |                                                                        |       |                                                                                               |                   |
| WT 25/26 | 7500317 | <a href="#">Seminar: Hot Topics in Cyber-Physical Systems Security</a> |       |                                                                                               | Wressnegger       |

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

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

A written elaboration must be prepared and a presentation must be given. Withdrawal is possible within two weeks after assignment of the topic. One repetition is possible.

**Prerequisites**

None.

**Additional Information**

The basics of IT security and artificial intelligence are a prerequisite.

Below you will find excerpts from courses related to this module component:

## V

**Seminar: Hot Topics in Security of Machine Learning**

24004, WS 25/26, 2 SWS, Language: German/English, [Open in study portal](#)

**Seminar (S)**  
On-Site

**Content**

This seminar is concerned with the combination of artificial intelligence, machine learning and computer security in practice. Many tasks in the security landscape are based on manual labor, such as searching for vulnerabilities or analyzing malware. Here, machine learning can be used to establish a higher degree of automation, providing more "intelligent" security solutions (AI for Security). However, also these learning-based systems can be attacked and need to be secured (Security of AI).

This module is part of a seminar series to intensifies the contents of the AISEC lecture. It can be attended individually and in no particular order. The module puts focus on timely topics from recent research and teaches students to work up results from state-of-the-art research. To this end, they will read up on a sub-field, prepare a seminar report, and present their work at the end of the term to their colleagues.

**Organizational issues**

English Course

## T

**6.412 Module component: Seminar: Hot Topics in Bioinformatics [T-INFO-101287]**

**Coordinators:** Prof. Dr. Alexandros Stamatakis  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-100750 - Seminar: Hot Topics in Bioinformatics](#)

**Type**  
Examination of another type

**Credits**  
3 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
2

| Courses |         |                                                       |       |           |            |
|---------|---------|-------------------------------------------------------|-------|-----------|------------|
| ST 2026 | 2400011 | <a href="#">Hot Topics in Bioinformatics</a>          | 2 SWS | Seminar / | Stamatakis |
| Exams   |         |                                                       |       |           |            |
| ST 2026 | 7500014 | <a href="#">Seminar: Hot Topics in Bioinformatics</a> |       |           | Stamatakis |

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

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO). (Weighting of presentation and written report: 50% each)

**Prerequisites**

The exam in Introduction to Bioinformatics for Computer Scientists must have been passed in one of the preceding semesters.

**Recommendations**

Basic knowledge in the areas of theoretical computer science (algorithms, data structures) and technical computer science (sequential optimisation in C or C++, computer architectures, parallel programming, vector processors) will be beneficial.

Below you will find excerpts from courses related to this module component:

## V

**Hot Topics in Bioinformatics**

2400011, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

**Seminar (S)**  
On-Site

**Content**

**Prerequisites:** CS Master's level seminar. Participants must have attended and passed the course on "Introduction to Bioinformatics for Computer Scientists" in one of the preceding winter terms.

**Task:** You will need to select papers to present, give a presentation and write a report.

This main seminar allows students to understand and present the contents of current papers in Bioinformatics such as published for instance in the journals *Bioinformatics*, *BMC Bioinformatics*, *Journal of Computational Biology* etc. or at conferences such as *ISMB* or *RECOMB*.

We will provide a list of interesting papers, but students can also propose papers they are interested in. Students may also choose to cover broader topics of more general interest such as multiple sequence alignment, Bayesian phylogenetic inference, read assembly etc.

Each student will be assigned a lab member for help with understanding the article and preparing the slides as well as the report.

Students should give a 35 minute presentation on their topic of choice and write a report (Seminararbeit) comprising 8 pages.

**Goals:** Participants are able to understand, critically assess, and compare current research papers in Bioinformatics. They are able to present algorithms and models from current research papers in oral and written form at a level that corresponds to that of scientific publications and conference presentations. Participants are able to suggest extension to current methods.

**Credits:** 3 ECTS

**Organizational issues**

**IMPORTANT:** Register for the seminar mailing list by sending an email to [Alexandros.Stamatakis@h-its.org](mailto:Alexandros.Stamatakis@h-its.org)

Please also register for the seminar via the campus system.

Up to date information on the seminar is provided at: [Seminar page](#).

We will start with a **kick-off meeting in the first week of the summer term** on April 24 from 10:00 - 11:30 in **SR 010**.

**Seminar presentations will be conducted in a single block between 08:00 - 19:00 toward the end of the semester:** July 27 in room **SR 010** - exact times to be determined



**T****6.413 Module component: Seminar: Hot Topics in Explainable Artificial Intelligence (XAI) [T-INFO-112917]****Coordinators:** Prof. Dr. Christian Wressnegger**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106392 - Seminar: Hot Topics in Explainable Artificial Intelligence \(XAI\)](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 4 CP    | Graded  | Each summer term | 2       |

| Courses |       |                                                                                  |       |                                                                                               |                     |
|---------|-------|----------------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|---------------------|
| ST 2026 | 24005 | <a href="#">Seminar: Hot Topics in Explainable Artificial Intelligence (XAI)</a> | 2 SWS | Seminar /  | Wressnegger, Noppel |

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

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

A written paper (seminar paper) must be prepared and a presentation must be given.

**Prerequisites**

None.

*Below you will find excerpts from courses related to this module component:*

**V****Seminar: Hot Topics in Explainable Artificial Intelligence (XAI)**24005, SS 2026, 2 SWS, Language: English, [Open in study portal](#)**Seminar (S)  
On-Site****Content**

This seminar is concerned with explainable machine learning in computer security. Learning-based systems often are difficult to interpret, and their decisions are opaque to practitioners. This lack of transparency is a considerable problem in computer security, as black-box learning systems are hard to audit and protect from attacks.

The module introduces students to the emerging field of explainable machine learning and teaches them to work up results from recent research. To this end, the students will read up on a sub-field, prepare a seminar report, and present their work at the end of the term to their colleagues.

Topics cover different aspects of the explainability of machine learning methods for the application in computer security in particular.

**Organizational issues**

English Course

## T

**6.414 Module component: Seminar: Information Systems [T-INFO-115055]****Coordinators:** Prof. Dr.-Ing. Klemens Böhm**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107686 - Seminar: Information Systems](#)**Type**  
Examination of another type**Credits**  
3 CP**Grading**  
graded**Term offered**  
Each term**Expansion**  
1 semesters**Version**  
1

| Courses |         |                                             |       |                                                                                               |                             |
|---------|---------|---------------------------------------------|-------|-----------------------------------------------------------------------------------------------|-----------------------------|
| ST 2026 | 2400131 | <a href="#">Advances in Data Science</a>    | 2 SWS | Seminar /  | Böhm, Matteucci, Friederich |
| Exams   |         |                                             |       |                                                                                               |                             |
| ST 2026 | 7500100 | <a href="#">Seminar Information Systems</a> |       |                                                                                               | Böhm                        |

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

Success is assessed by preparing a written seminar paper and presenting it as a graded assessment of a different kind in accordance with Section 4 (2) No. 3 SPO. The seminar grade corresponds to the written performance, but can be lowered or raised by up to two grade levels by the presentation performance. If the seminar paper is discontinued after the topic has been issued, the seminar is assessed with a grade of 5.0.

The coursework is passed if the written paper and the presentations have each been passed individually; regular attendance at the sessions and active participation in the content-related discussions are also required to pass.

**Prerequisites**

None.

**Recommendations**

Lectures of the Chair of Information Management Systems that match the topic of the seminar are strongly recommended.

## T

**6.415 Module component: Seminar: Interactive Learning [T-INFO-112773]**

**Coordinators:** TT-Prof. Dr. Rudolf Lioutikov  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-106301 - Seminar: Interactive Learning](#)

**Type**  
Written examination

**Credits**  
3 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
2

| Courses |         |                                                       |       |                                                                                               |           |
|---------|---------|-------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|-----------|
| ST 2026 | 2400136 | <a href="#">Seminar on Behavior Foundation Models</a> | 2 SWS | Seminar /  | Lioutikov |

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

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

Presentation on the chosen topic at the end of the semester and written elaboration.

**Prerequisites**

None.

**Recommendations**

We highly recommend to take this seminar in combination with the “Interactive Learning” research project (Forschungspraktikum).

It is highly recommended to attend the “Explainable Artificial Intelligence” lecture in parallel or prior to this seminar.

- Experience in Machine Learning is recommended, e.g. through prior coursework.
- The Computer Science Department offers several great lectures e.g., “Maschinelles Lernen - Grundlagen und Algorithmen” and “Deep Learning”
- A good mathematical background will be beneficial
- Python experience is recommended
- We might use the PyTorch deep learning library in the exercises. Some prior knowledge in this is helpful but not necessary.

*Below you will find excerpts from courses related to this module component:*

## V

**Seminar on Behavior Foundation Models**

2400136, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

**Seminar (S)**  
On-Site

**Content**

Arbeitsaufwand = 90 h = 3 ECTS

- Präsenzzeit: 15hr
- Selbststudium: 45h
- Scientific Report schreiben: 20h

Präsentation vorbereiten: 10h

Each student will select several related papers in the field of Interactive Learning. The organizers will suggest several papers but the students will be encouraged to identify and research additional relevant papers during the semester. The students will then prepare a presentation and a basic scientific research paper.

It is highly recommended to take this seminar in combination with the “Interactive Learning” Research Project (Forschungspraktikum), where the students get the chance to deepen their understanding, implement and evaluate their presented work.

We highly recommend to take this seminar in combination with the Research Practical Course on Behavior Foundation Models.

It is highly recommended to attend the “Explainable Artificial Intelligence” lecture in parallel or prior to this seminar.

- Experience in Machine Learning is recommended, e.g. through prior coursework.
  - The Computer Science Department offers several great lectures e.g., “Maschinelles Lernen - Grundlagen und Algorithmen” and “Deep Learning”
- A good mathematical background will be beneficial
- Python experience is recommended
- We might use the PyTorch deep learning library in the exercises. Some prior knowledge in this is helpful but not necessary.

Vortrag zum gewählten Thema am Ende des Semesters und schriftliche Ausarbeitung.

Ein Rücktritt ist innerhalb von zwei Wochen nach Vergabe des Themas möglich.

It is only possible to resign within two weeks after assignment of the topic.

**Organizational issues**

Früherer Name: Seminar: Interactive Learning (Inhalte sind gleich geblieben)

**T****6.416 Module component: Seminar: Interpretability and Causality in Machine Learning [T-INFO-114237]****Coordinators:** Jun.-Prof. Dr. Jan Stühmer**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107217 - Seminar: Interpretability and Causality in Machine Learning](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 3 CP    | Graded  | Each summer term | 1       |

| Courses |         |                                                                             |       |                                                                                               |         |
|---------|---------|-----------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|---------|
| ST 2026 | 2400181 | <a href="#">Interpretability and Causality in Machine Learning</a>          | 2 SWS | Seminar /  | Stühmer |
| Exams   |         |                                                                             |       |                                                                                               |         |
| ST 2026 | 7500319 | <a href="#">Seminar: Interpretability and Causality in Machine Learning</a> |       |                                                                                               | Stühmer |

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

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

A written elaboration must be prepared and a presentation must be given. Students may redraw from the examination during the first two weeks after the topic has been communicated. The assessment can be repeated once.

**Prerequisites**

None.

**Recommendations**

Attendance of the lecture "Machine Learning - Fundamentals and Algorithms" is recommended.

**T****6.417 Module component: Seminar: IT- Security Law [T-INFO-111404]****Coordinators:** Martin Schallbruch**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106754 - Public Economic and Technology Law](#)**Type**  
Examination of another type**Credits**  
3 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
1

| Courses  |         |                                           |       |                                                                                               |             |
|----------|---------|-------------------------------------------|-------|-----------------------------------------------------------------------------------------------|-------------|
| WT 25/26 | 2424389 | <a href="#">Seminar "IT security law"</a> | 2 SWS | Seminar /  | Schallbruch |
| Exams    |         |                                           |       |                                                                                               |             |
| WT 25/26 | 7500249 | <a href="#">Seminar: IT- Security Law</a> |       |                                                                                               | Zufall      |

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

**T****6.418 Module component: Seminar: Learning Causality - a Challenge for Human and Artificial Intelligence [T-INFO-114102]****Coordinators:** Dr. Dominik Janzing**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107033 - Seminar: Learning Causality - a Challenge for Human and Artificial Intelligence](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 3 CP    | Graded  | Each summer term | 2       |

| Courses  |         |                                                                                                 |         |                                                                                               |         |
|----------|---------|-------------------------------------------------------------------------------------------------|---------|-----------------------------------------------------------------------------------------------|---------|
| WT 25/26 | 2400245 | <a href="#">Do LLMs understand cause and effect?</a>                                            | 2 SWS   | Seminar /  | Janzing |
| ST 2026  | 2400145 | <a href="#">Do LLMs understand cause and effect?</a>                                            | 2 SWS   | Seminar /  | Janzing |
| Exams    |         |                                                                                                 |         |                                                                                               |         |
| WT 25/26 | 7500291 | <a href="#">Seminar: Learning Causality - a Challenge for Human and Artificial Intelligence</a> | Janzing |                                                                                               |         |

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

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

A written paper must be prepared and a presentation given. Withdrawal is possible within two weeks of the topic being assigned

**Prerequisites**

None.

**Recommendations**

The seminar is aimed at students of computer science, but also other subjects if they have a good mathematical background and interest (e.g. mathematics, physics, psychology).

Basic concepts of probability theory are assumed

## T

**6.419 Module component: Seminar: Legal Studies Master I [T-INFO-115025]**

**Coordinators:** Professorenschaft des Fachbereichs Recht  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-107671 - Seminar Module Law Master](#)

| Type                        | Credits | Grading | Version |
|-----------------------------|---------|---------|---------|
| Examination of another type | 3 CP    | graded  | 1       |

| Courses  |         |                                                                                                             |       |           |                                                      |
|----------|---------|-------------------------------------------------------------------------------------------------------------|-------|-----------|------------------------------------------------------|
| WT 25/26 | 2400014 | <a href="#">Current Issues in Patent Law</a>                                                                | 2 SWS | Seminar / | Melullis                                             |
| WT 25/26 | 2400060 | <a href="#">Data in Software-Intensive Technical Systems – Modeling – Analysis – Protection</a>             | 2 SWS | Seminar / | Reussner, Raabe, Werner, Müller-Quade                |
| WT 25/26 | 2400125 | <a href="#">Security and Privacy Awareness</a>                                                              | 2 SWS | Seminar / | Seidel-Saul, Volkamer, Boehm, Ballreich, Sikra, Veit |
| WT 25/26 | 2400165 | <a href="#">Seminar Commercial and Corporate Law in Information Technology</a>                              | 2 SWS | Seminar / | Nolte                                                |
| WT 25/26 | 2400177 | <a href="#">Human vs. Machine: (Un-)Biased Legal Decision-Making?</a>                                       | 2 SWS | Seminar / | Holzhausen                                           |
| WT 25/26 | 2400184 | <a href="#">EU Digital Regulatory Framework</a>                                                             | 2 SWS | Seminar / | Zufall                                               |
| WT 25/26 | 2400203 | <a href="#">EU Fundamental Rights and EU Economic Law in Smart Cities</a>                                   | 2 SWS | Seminar / | Kasper-Schöniger                                     |
| WT 25/26 | 2424186 | <a href="#">Seminar Patent Law</a>                                                                          | 2 SWS | Seminar / | Dammler                                              |
| WT 25/26 | 2424389 | <a href="#">Seminar "IT security law"</a>                                                                   | 2 SWS | Seminar / | Schallbruch                                          |
| ST 2026  | 2400005 | <a href="#">Governance, Risk &amp; Compliance</a>                                                           | 2 SWS | Seminar / | Herzig, Siddiq                                       |
| ST 2026  | 2400078 | <a href="#">Intelligente Chatbots und Recht</a>                                                             | 2 SWS | Seminar / | Raabe                                                |
| ST 2026  | 2400171 | <a href="#">Regulating AI: from ethics to law</a>                                                           | 2 SWS | Seminar / | Gil Gasiola                                          |
| ST 2026  | 2400177 | <a href="#">Designing Data Governance of Digital Systems</a>                                                | 2 SWS | Seminar / | Pathak                                               |
| ST 2026  | 2400207 | <a href="#">(Generative) AI and Law</a>                                                                     | 2 SWS | Seminar / | Boehm, Turkovic-Popovski                             |
| ST 2026  | 2400225 | <a href="#">Rechtlicher Rahmen für Künstliche Intelligenz</a>                                               | 2 SWS | Seminar / | Sattler                                              |
| ST 2026  | 24820   | <a href="#">Current Issues in Patent Law</a>                                                                | 2 SWS | Seminar / | Melullis                                             |
| Exams    |         |                                                                                                             |       |           |                                                      |
| WT 25/26 | 7500249 | <a href="#">Seminar: IT- Security Law</a>                                                                   |       |           | Zufall                                               |
| WT 25/26 | 7500298 | <a href="#">Seminar: Law and Legal Studies</a>                                                              |       |           | Zufall                                               |
| WT 25/26 | 7500310 | <a href="#">Seminar: Commercial and Corporate Law in the IT Industry</a>                                    |       |           | Matz                                                 |
| ST 2026  | 7500268 | <a href="#">Seminar aus Rechtswissenschaften Bachelor und Master I (LS Zivilrecht u. LS Prof. F. Boehm)</a> |       |           | Boehm, Melullis, Raabe, Sattler                      |
| ST 2026  | 7500300 | <a href="#">Seminar aus Rechtswissenschaften Master II (LS Zivilrecht u. LS Prof. F. Boehm)</a>             |       |           | Boehm, Melullis, Raabe, Sattler                      |
| ST 2026  | 7500341 | <a href="#">Seminar: Legal Studies Bachelor and Master I (LS Öffentliches Recht und Informatik)</a>         |       |           | Zufall                                               |
| ST 2026  | 7500365 | <a href="#">Seminar: Legal Studies Master II (Public Law and Computer Science)</a>                          |       |           | Zufall                                               |

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

Below you will find excerpts from courses related to this module component:

## V

**Security and Privacy Awareness**

2400125, WS 25/26, 2 SWS, Language: German/English, [Open in study portal](#)

**Seminar (S)**  
**Blended (On-Site/Online)**



**Content**

Within the framework of this interdisciplinary seminar, the topics security awareness and privacy awareness are to be considered from different perspectives. It deals with legal, information technology, psychological, social as well as philosophical aspects.

**Important notes:**

- The seminar language is English. This means that English is the standard for the presentation and the seminar paper, and German is only permitted for the paper after consultation with the supervisor, for example, if the topic of the thesis requires it.
- The seminar is only for MASTER students (or Mastervorzug)
- The link to enrol is for every student, regardless of the study background

**Topics:**

The advertised topics can be found in the wiwi portal.

**Human vs. Machine: (Un-)Biased Legal Decision-Making?**

2400177, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

**Seminar (S)**  
**On-Site**

**Content**

This seminar provides an overview of the foundational principles of behavioral economics and their relevance to public law. Special attention is given to (biased) decision-making, both from a substantive and procedural perspective. Students will explore how regulation should be designed to account for cognitive biases and achieve intended policy outcomes. In addition, the seminar will address the role of automated decision-making systems - examining how such systems are influenced by, and may also reinforce or mitigate, behavioral biases.

The seminar will cover the following topics:

- Introduction to (behavioral) economic theory and its application to law
- Cognitive biases and their impact on (public) decision-making
- Different types of regulation in light of behavioral insights
- Implications for automated decision-making systems
- The role of human biases in the AI Act

Algorithmic decision-making is often treated as a black box—something that should not be permitted to make decisions in legal contexts. In response, Article 14 of the EU AI Act requires high-risk AI systems to be designed in such a way that they can be effectively overseen by natural persons. This human-in-the-loop requirement stems, among other things, from the perception that AI systems operate ambiguously and produce decisions that are not fully comprehensible.

However, treating humans in comparison as fundamentally transparent or fully rational decision-makers is equally naïve. Understanding how people actually behave—not just how they should behave—is essential for designing effective, fair, and legitimate legal systems. Traditional legal research often assumes rational actors, yet behavioral research shows that cognitive biases, heuristics, and emotional influences shape the decisions of both citizens and public officials.

This seminar addresses that gap by equipping students with behavioral insights to critically assess and improve legal and administrative. A particular focus is placed on how human biases are already embedded in the data underlying automated decision-making systems, potentially reproducing or amplifying unfairness. At the same time, students will explore how such systems can be intentionally designed to mitigate behavioral distortions and support better decision-making.

**Organizational issues**

1. Termin: 13.11.2025 9:00-15:00 Uhr (Seminarrum Nr. 313, bei uns am Institut)

2. Termin: 05.02.2025 9:00- 16:00 Uhr (Seminarrum Nr. 313, bei uns am Institut).

**EU Digital Regulatory Framework**

2400184, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

**Seminar (S)**  
**On-Site**

### Content

This class aims to provide an overview on the legal instruments forming the EU digital regulatory framework. Following its Digital Single Market Strategy, the EU has set up a new strategic programme for a "Digital Decade". Existing regulations like the General Data Protection Regulation (GDPR), or the E-Commerce Directive, are being complemented by a variety of new instruments that aim to set binding rules on online markets, to regulate data flows in various ways, but also to pioneer a legal framework on AI. Prominent instruments include the new AI Act, the Digital Services Act (DSA) and Digital Markets Act (DMA), the Data Act, Data Governance Act, or Open Data Directive.

The class will provide an overview on the existing framework: Which regulations and directives are relevant? How do they apply and interact with each other in a broader context?

Another objective is to provide students with the ability to read these legal instruments: How to access regulatory instruments that often have more than 100 pages (without having to read every single sentence)? How to gain a comprehensive, high-level understanding of the instrument? How to identify parts relevant to a particular legal problem?

The class will start with an introduction into EU law and regulatory instruments in general. Concrete guidance on reading, analysing and working with legal instruments in English will be given. Based on these instructions, students will be assigned legal instruments to present in the final unit along with a two-pages report.

Grades will be assigned based on the quality of these presentations and the report, as well as participation in the discussion (presentation: 40 %, two-pages report: 40 %, discussion: 20 %).

### Organizational issues

WS 2024/25

Hierbei handelt es sich NICHT um eine Pro-Seminar, sondern um ein Seminar (aus Rechtswissenschaften).

Anmeldungen für das Seminar bitte NUR! über das WiWi-Portal!

\*Für die Prüfung bitte NUR über CAS (Campus-Portal) anmelden!

\*Erläuterung: nach der für die Teilnahme am Seminar verbindlichen Teilnahme an der Einführungsveranstaltung bitte Anmeldung über das Campus-System (notwendig für die Erfassung der Note der Seminararbeit).



### EU Fundamental Rights and EU Economic Law in Smart Cities

2400203, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

Seminar (S)  
On-Site

### Content

This seminar is designed to instruct students in recognising legal questions as they relate to an interdisciplinary topic, classifying such questions along the hierarchy of norms, and solving them in a convincing argumentative manner. By focusing on „EU Fundamental Rights and EU Economic Law in Smart Cities“, we will discuss the influence of large cities and metropolises on their more rural periphery. Possible aspects of discussion are, inter alia,

- democratic legitimacy questions in such cases,
- elements of structural support/aid
- approaches to implement technical innovations in smart cities,
- questions relating to the development of (large) infrastructures,
- aspects of the efficient use of infrastructure, and
- environmental aspects.

Particularly in times of increasingly comprehensive European regulation, European standards and regulatory approaches will be at the heart of the discussion while not neglecting their interplay with national regulation. Learning in more depth about the interplay of European and national regulation will further accustom participating students to discuss relevant legal questions across (legal) sectors and with a broader view on regulations' effects.

Conducting the seminar in English intends to facilitate students to link their ideas and arguments to current European and international debates.

### Organizational issues

This is a seminar (not a pro-seminar).

Registrations only via WiWi-Portal.

Kick-off-meeting WS 2025/26:

Friday, 7th November 2025, 14:00 - 18:00 h (online)

(Mr. Kasper-Schöniger will send you the according link via ILIAS a few days before the kick-off date.)

**Presentations:**

- Friday, 6th February 2026, 09:00 - 18:00 h

and

- Saturday, 7th February 2026, 10:00 - 16:00

**Place:** see section "TERMINE" (below).

**Regulating AI: from ethics to law**2400171, SS 2026, 2 SWS, Language: English, [Open in study portal](#)**Seminar (S)**  
**On-Site****Content**

This seminar will provide an overview of technology regulation, with a particular focus on the regulation of AI systems. Following an introduction to the different forms of regulation, students will explore the various regulatory instruments in light of the key principles of AI, such as

- fairness / non-discrimination,
- transparency / explainability,
- non-maleficence,
- privacy / data protection,
- sustainability
- security / safety, and
- accountability.

This will enable them to discuss how these principles and rules can be applied in real-world scenarios.

**Organizational issues**

Please register for the seminar **ONLY** via the WiWi-Portal!

Please register for the exam **ONLY** via CAS (Campus-Portal)!\*

\*Explanation After attending the introductory event, which is mandatory for participation in the seminar, please register via the campus system (necessary for recording the grade of the seminar paper).

**Block Seminar in Summer term 2026:**

- Wednesday, 22th April 2026, 09:00 - 13:00 h;
- Wednesday, 22th July 2026, 09:00 - 13:00 h.

Room: each seminar takes place in room no. 313 (building 07.08) .

**Designing Data Governance of Digital Systems**2400177, SS 2026, 2 SWS, Language: English, [Open in study portal](#)**Seminar (S)**  
**On-Site****Content**

The latest regulations in the digital sector at EU level represent a highly topical and important regulatory instrument with enormous practical relevance for students of computer science and business informatics. The seminar not only enables students to acquire important knowledge in this area, but also to apply it specifically to the governance of digital systems and to learn the practical design of digital systems against the background of legal framework conditions.

**Organizational issues**

\*Please register **for the exam ONLY** via **CAS** (Campus-Portal)!

\*Explanation: after attending the introductory event, which is mandatory for participation in the seminar, **please register via the campus system** (necessary for recording the grade of the seminar paper).

Due to the minimum number of text characters that can be used, please check ILIAS and the WiWi portal for details such as dates and location. Thank you.

**T****6.420 Module component: Seminar: Machine Learning in Climate and Environmental Sciences [T-INFO-113519]****Coordinators:** TT-Prof. Dr. Peer Nowack**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106719 - Seminar: Machine Learning in Climate and Environmental Sciences](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 3 CP    | graded  | Irregular    | 1       |

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

In the form of a written seminar paper and the presentation of the same.

**Prerequisites**

- Familiarity with machine learning concepts and techniques.
- Basic knowledge of climate and environmental science is advantageous but not mandatory.

**Recommendations**

- An interest in climate and environmental sciences topics is a prerequisite.

**T****6.421 Module component: Seminar: Neural Networks and Artificial Intelligence [T-INFO-104777]****Coordinators:** Prof. Dr. Jan Niehues**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-102412 - Seminar: Neural Networks and Artificial Intelligence](#)**Type**  
Examination of another type**Credits**  
3 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
1

| Courses |         |                                                             |       |         |                   |
|---------|---------|-------------------------------------------------------------|-------|---------|-------------------|
| ST 2026 | 2400130 | <a href="#">Neural Networks and Artificial Intelligence</a> | 2 SWS | Seminar | Waibel, Retkowski |

Below you will find excerpts from courses related to this module component:

**V****Neural Networks and Artificial Intelligence**2400130, SS 2026, 2 SWS, [Open in study portal](#)**Seminar (S)****Content**

Inhalt (EN):

In many tasks that appear natural to us, the fastest computers are unable to match the performance of the human brain. Neural networks attempt to simulate the parallel and distributed architecture of the brain in order to master these skills with learning algorithms. In this context, focus is being put on neural network approaches to computer vision and speech recognition, robotics and other areas.

In this seminar students will acquaint themselves with literature from provided topics and will present their results as a talk supported by slides to the other participants of the seminar.

**Recommendations:**

- Finishing the module "Kognitive Systeme" prior to the seminar is recommended.
- Attending the lecture "Deep Learning und Neuronale Netze" prior to the seminar is of advantage

## T

**6.422 Module component: Seminar: Post-Quantum Cryptography [T-INFO-111200]****Coordinators:** Prof. Dr. Jörn Müller-Quade**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-105585 - Seminar: Post-Quantum Cryptography](#)

| Type                        |
|-----------------------------|
| Examination of another type |

| Credits |
|---------|
| 3 CP    |

| Grading |
|---------|
| graded  |

| Term offered |
|--------------|
| Irregular    |

| Version |
|---------|
| 1       |

| Courses  |         |                                                    |       |                                                                                               |                        |
|----------|---------|----------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|------------------------|
| WT 25/26 | 2400126 | <a href="#">Seminar Post-Quantum Cryptography</a>  | 2 SWS | Seminar /  | Müller-Quade, Hellmich |
| Exams    |         |                                                    |       |                                                                                               |                        |
| WT 25/26 | 7500327 | <a href="#">Seminar: Post-Quantum Cryptography</a> |       |                                                                                               | Müller-Quade           |

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

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

A written paper must be prepared and a presentation given. Withdrawal is possible within two weeks of the topic being assigned

**Prerequisites**

None.

**Recommendations**

Basic knowledge of IT-Security and cryptography are recommended.

## T

**6.423 Module component: Seminar: Practical Graph Algorithms [T-INFO-114297]****Coordinators:** Prof. Dr. Henning Meyerhenke**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107264 - Seminar: Practical Graph Algorithms](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 4 CP    | graded  | Irregular    | 1       |

| Courses |         |                                            |       |         |            |
|---------|---------|--------------------------------------------|-------|---------|------------|
| ST 2026 | 2400196 | <a href="#">Practical Graph Algorithms</a> | 2 SWS | Seminar | Meyerhenke |

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

A written paper must be prepared and a presentation given. Withdrawal is possible within two weeks of the topic being assigned.

**Prerequisites**

None.

**Recommendations**

Knowledge of algorithms, in particular graph algorithms, is a clear advantage. Exemplary lectures are Algorithms I and Algorithms II.

## T

**6.424 Module component: Seminar: Privacy and Security [T-INFO-114236]**

**Coordinators:** Prof. Dr. Thorsten Strufe  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-107216 - Seminar: Privacy and Security](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 4 CP    | graded  | Each winter term | 1       |

| Courses  |         |                                              |       |         |                       |
|----------|---------|----------------------------------------------|-------|---------|-----------------------|
| WT 25/26 | 2400118 | <a href="#">Seminar Privacy and Security</a> | 2 SWS | Seminar | Strufe, Guerra Balboa |
| Exams    |         |                                              |       |         |                       |
| WT 25/26 | 7500127 | <a href="#">Seminar Privacy and Security</a> |       |         | Strufe                |

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

A written paper must be prepared and a presentation given; in addition, preliminary papers must be submitted and commented on in a peer review between fellow students. Withdrawal is possible within two weeks of the topic being assigned.

**Prerequisites**

None.

**Recommendations**

Fundamentals of IT security, computer networks and distributed systems are required

*Below you will find excerpts from courses related to this module component:*

## V

**Seminar Privacy and Security**

2400118, WS 25/26, 2 SWS, Language: German/English, [Open in study portal](#)

**Seminar (S)**

**Content**

This Seminar discusses current topics of the research field technical data security.

This involves, for example:

- anonymous communication
- network security
- anonymous online- services
- anonymous digital payment services
- rating of the anonymity of online services
- anonymous publications of data (differential privacy, k- anonymity)
- transparency-/awareness-improvement systems
- support for media understanding.

**Organizational issues**

Die Anmeldung geschieht über ILIAS. Die genauen Termine finden Sie im ILIAS-Kurs und auf der Webseite des Lehrstuhls.



## T

**6.425 Module component: Seminar: Proofs from THE BOOK [T-INFO-106604]**

**Coordinators:** Prof. Dr. Peter Sanders

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-103306 - Seminar: Proofs from THE BOOK](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 3 CP    | Graded  | Irregular    | 1       |

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

The student must present multiple proofs over the course of the semester and moderate the ensuing discussion about those proofs. No written documents are required. Students may redraw from their participation until the end of the second seminar date.

**Prerequisites**

None.

**Recommendations**

The German version “Das Buch der Beweise” is available online at the KIT library within the KIT network. The English version “Proofs from THE BOOK” is available as a physical copy at the KIT library. We recommend having a look inside either version before registering for this seminar.

**T****6.426 Module component: Seminar: Quantum Information Theory [T-INFO-110904]**

**Coordinators:** Prof. Dr. Jörn Müller-Quade  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-105408 - Seminar: Quantum Information Theory](#)

**Type**  
Examination of another type

**Credits**  
3 CP

**Grading**  
graded

**Term offered**  
Irregular

**Version**  
1

| Courses |         |                                            |       |                                                                                               |                                        |
|---------|---------|--------------------------------------------|-------|-----------------------------------------------------------------------------------------------|----------------------------------------|
| ST 2026 | 2400085 | <a href="#">Quantum Information Theory</a> | 2 SWS | Seminar /  | Müller-Quade,<br>Fruböse, Meier, Jiang |

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

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

A presentation must be given and a written elaboration of exercises must be prepared.  
 Withdrawal is possible within two weeks of the topic being assigned.

**Prerequisites**

None.

**Recommendations**

Basic knowledge of IT-Security and linear algebra are recommended.

*Below you will find excerpts from courses related to this module component:*

**V****Quantum Information Theory**

2400085, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

**Seminar (S)**  
On-Site

**Content**

Please check the date of the introductory session in ILIAS. The **introductory session** may be at a different time than the regular **seminar** and topics will be presented and distributed then.

**Organizational issues**

Please check the date of the introductory session in ILIAS. The **introductory session** may be at a different time than the regular **seminar** and topics will be presented and distributed then.

## T

**6.427 Module component: Seminar: Recent Highlights in Algorithms [T-INFO-114201]**

**Coordinators:** TT-Prof. Dr. Thomas Bläsius  
Prof. Dr. Peter Sanders  
Dr. rer. nat. Torsten Ueckerdt

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-107172 - Seminar: Recent Highlights in Algorithms](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 4 CP    | graded  | Irregular    | 1       |

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO), by preparing a written seminar paper and the presentation of the same

**Prerequisites**

None.

**Recommendations**

Knowledge of the basics of graph theory and algorithm technology is helpful.

**T****6.428 Module component: Seminar: Research Trends in Human-Computer Interaction [T-INFO-113284]****Coordinators:** Prof. Dr. Kathrin Gerling**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106594 - Seminar: Research Trends in Human-Computer Interaction](#)**Type**  
Examination of another type**Credits**  
3 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
2

| Courses  |         |                                                                         |       |                                                                                               |         |
|----------|---------|-------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|---------|
| WT 25/26 | 2400199 | <a href="#">Research Trends in Human-Computer Interaction (Seminar)</a> | 2 SWS | Seminar /  | Gerling |
| ST 2026  | 2400080 | <a href="#">Research Trends in Human-Computer Interaction (Seminar)</a> | 2 SWS | Seminar /  | Gerling |
| Exams    |         |                                                                         |       |                                                                                               |         |
| WT 25/26 | 7500058 | <a href="#">Research Trends in Human-Computer Interaction (Seminar)</a> |       |                                                                                               | Gerling |
| ST 2026  | 7500036 | <a href="#">Research Trends in Human-Computer Interaction (Seminar)</a> |       |                                                                                               | Gerling |

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

**T****6.429 Module component: Seminar: Robot Reinforcement Learning [T-INFO-110862]****Coordinators:** Prof. Dr. Gerhard Neumann**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-105379 - Seminar: Robot Reinforcement Learning](#)

| Type                        |
|-----------------------------|
| Examination of another type |

| Credits |
|---------|
| 3 CP    |

| Grading |
|---------|
| graded  |

| Term offered |
|--------------|
| Irregular    |

| Version |
|---------|
| 1       |

| Courses |         |                                                       |       |                                                                                               |         |
|---------|---------|-------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|---------|
| ST 2026 | 2400084 | <a href="#">Seminar: Robot Reinforcement Learning</a> | 2 SWS | Seminar /  | Neumann |

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

## T

**6.430 Module component: Seminar: Secure Multiparty Computation [T-INFO-111501]****Coordinators:** Prof. Dr. Jörn Müller-Quade**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-105761 - Seminar: Secure Multiparty Computation](#)

| Type                        |
|-----------------------------|
| Examination of another type |

| Credits |
|---------|
| 3 CP    |

| Grading |
|---------|
| graded  |

| Term offered |
|--------------|
| Irregular    |

| Version |
|---------|
| 1       |

| Courses  |         |                                                        |              |                                                                                               |                             |
|----------|---------|--------------------------------------------------------|--------------|-----------------------------------------------------------------------------------------------|-----------------------------|
| WT 25/26 | 2400088 | <a href="#">Seminar Secure Multiparty Computation</a>  | 2 SWS        | Seminar /  | Raiber, Jiang, Müller-Quade |
| Exams    |         |                                                        |              |                                                                                               |                             |
| WT 25/26 | 7500326 | <a href="#">Seminar: Secure Multiparty Computation</a> | Müller-Quade |                                                                                               |                             |

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

**Assessment**

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

A written paper must be prepared and/or a presentation must be given. Withdrawal is possible within two weeks of the topic being assigned.

**Prerequisites**

None.

**Recommendations**

Knowledge of the content of the lecture Cryptographic Protocols is assumed.

**T****6.431 Module component: Seminar: Selected Topics in Public-Key-Cryptography [T-INFO-111201]****Organisation:** KIT Department of Informatics**Part of:** [M-INFO-105586 - Seminar: Selected Topics in Public-Key-Cryptography](#)

| Type                        |
|-----------------------------|
| Examination of another type |

| Credits |
|---------|
| 3 CP    |

| Grading |
|---------|
| graded  |

| Term offered     |
|------------------|
| Each winter term |

| Version |
|---------|
| 1       |

## T

**6.432 Module component: Seminar: Service-Oriented Architectures [T-INFO-104740]****Coordinators:** Prof. Dr. Sebastian Abeck**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-102372 - Seminar: Service-Oriented Architectures](#)**Type**  
Examination of another type**Credits**  
3 CP**Grading**  
graded**Term offered**  
Each term**Version**  
1

| Courses  |          |                                                         |       |                                                                                               |                  |
|----------|----------|---------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|------------------|
| WT 25/26 | 2400072  | <a href="#">Seminar: Service-oriented Architectures</a> | 2 SWS | Seminar /  | Abeck, Schneider |
| ST 2026  | 2400072  | <a href="#">Seminar: Service-oriented Architectures</a> | 2 SWS | Seminar /  | Abeck, Schneider |
| Exams    |          |                                                         |       |                                                                                               |                  |
| WT 25/26 | 75104740 | <a href="#">Seminar: Service-Oriented Architectures</a> | Abeck |                                                                                               |                  |
| ST 2026  | 75104740 | <a href="#">Seminar: Service-Oriented Architectures</a> | Abeck |                                                                                               |                  |

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



## T

**6.433 Module component: Seminar: Software Architecture, Security and Privacy [T-INFO-114260]****Coordinators:** Prof. Dr. Ralf Reussner**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107236 - Seminar: Software Architecture, Security and Privacy](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 4 CP    | graded  | Irregular    | 1       |

| Courses  |         |                                                                                                         |       |                                                                                               |                                       |
|----------|---------|---------------------------------------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|---------------------------------------|
| WT 25/26 | 2400060 | <a href="#">Data in Software-Intensive Technical Systems – Modeling – Analysis – Protection</a>         | 2 SWS | Seminar /  | Reussner, Raabe, Werner, Müller-Quade |
| Exams    |         |                                                                                                         |       |                                                                                               |                                       |
| WT 25/26 | 7500232 | <a href="#">Seminar Data in Software-Intensive Technical Systems – Modeling – Analysis – Protection</a> |       |                                                                                               | Reussner                              |

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

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

- the preparation of a written paper (50%)
- the assessment of two seminar papers as part of a peer review (10%)
- the preparation of presentation slides and giving a presentation (20%)
- punctuality of submissions (20%)

**Prerequisites**

None.

**T****6.434 Module component: Seminar: Software Quality Assurance and Software Test [T-INFO-111850]****Coordinators:** Prof. Dr.-Ing. Ina Schaefer**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-105895 - Seminar: Software Quality Assurance and Software Test](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 4 CP    | Graded  | Each summer term | 2       |

**T****6.435 Module component: Seminar: Speech-to-Speech Translation [T-INFO-114208]****Coordinators:** Prof. Dr. Jan Niehues**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107179 - Seminar: Speech-to-Speech Translation](#)

| Type                        | Credits | Grading        | Term offered     | Version |
|-----------------------------|---------|----------------|------------------|---------|
| Examination of another type | 3 CP    | Grading graded | Each summer term | 1       |

| Courses |         |                                                      |       |                                                                                               |         |
|---------|---------|------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|---------|
| ST 2026 | 2400032 | <a href="#">Seminar Speech-to-Speech Translation</a> | 2 SWS | Seminar /  | Niehues |

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

The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

**Prerequisites**

None.

*Below you will find excerpts from courses related to this module component:***V****Seminar Speech-to-Speech Translation**2400032, SS 2026, 2 SWS, Language: English, [Open in study portal](#)**Seminar (S)  
On-Site****Content**

In a globalized world, language barriers are a major obstacle for communication. Speech-to-Speech translation (S2ST) technology is a promising solution to overcome this barrier. S2ST models convert source speech into speech in another language. Within S2ST, knowledge from automatic speech recognition and machine translation models are combined. Starting from solutions that simply combine individual systems, recently many interesting research directions have been explored (e.g., end-to-end models, simultaneous speech translation, speech synthesis, etc.).

In this seminar, students will delve into a chosen topic from the area of S2ST, based on the provided initial literature. At the end of the semester, the students will present their findings in oral presentations and written reports. The topics and the corresponding supervisors will be presented during the kickoff meeting.

Only the kickoff meeting and final presentations are attended by all participants together. During the semester, the communication will be with the topic supervisors individually.

Please do not join this seminar and our other seminar "Advanced Topics in Natural Language Processing" in parallel.

**T****6.436 Module component: Seminar: Ubiquitous Systems [T-INFO-103578]**

**Coordinators:** Prof. Dr.-Ing. Michael Beigl  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-101880 - Seminar: Ubiquitous Systems](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 4 CP    | graded  | Each term    | 1       |

| Courses  |         |                                             |       |                                                                                               |                 |
|----------|---------|---------------------------------------------|-------|-----------------------------------------------------------------------------------------------|-----------------|
| WT 25/26 | 2424844 | <a href="#">Seminar: Ubiquitous Systems</a> | 2 SWS | Seminar                                                                                       | Beigl, Röddiger |
| ST 2026  | 24844   | <a href="#">Seminar: Ubiquitous Systems</a> | 2 SWS | Seminar /  | Beigl           |
| Exams    |         |                                             |       |                                                                                               |                 |
| WT 25/26 | 7500005 | <a href="#">Seminar: Ubiquitous Systems</a> | Beigl |                                                                                               |                 |

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

## T

**6.437 Module component: Service Design Thinking [T-WIWI-102849]**

**Coordinators:** Prof. Dr. Gerhard Satzger  
Prof. Dr. Orestis Terzidis

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

**Part of:** [M-WIWI-101503 - Service Design Thinking](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 9 CP    | graded  | Irregular    | 5       |

| Courses  |         |                                         |       |                                                                                               |                           |
|----------|---------|-----------------------------------------|-------|-----------------------------------------------------------------------------------------------|---------------------------|
| WT 25/26 | 2595600 | <a href="#">Service Design Thinking</a> | 2 SWS | Lecture /  | Osaro, Terzidis, Feldmann |
| ST 2026  | 2595600 | <a href="#">Service Design Thinking</a> | 2 SWS | Lecture /  | Osaro, Terzidis, Feldmann |

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

**Assessment**

Success is assessed in the form of an alternative exam assessment which consists of a case study, workshops, and a final presentation. The weighting of these components for the grade will be announced at the beginning of the course.

**Prerequisites**

None

**Recommendations**

This course is held in English – proficiency in writing and communication is required.

Our past students recommend to take this course at the beginning of the masters program.

**Additional Information**

Due to practical project work as a component of the program, access is limited. The module (as well as the module component) spans two semesters. It starts in September every year and runs until end of June in the subsequent year. Entering the program is only possible at its beginning - after prior application in May/June. For more information on the application process and the program itself are provided in the module component description and the program's website (<https://sdtkarlsruhe.de/>). Furthermore, the lecturers provide an information event for applicants every year in May.

Below you will find excerpts from courses related to this module component:

## V

**Service Design Thinking**

2595600, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
On-Site

### Content

The Service Design Thinking program is much more than a normal course. Through this program, we provide the knowledge and skills that true innovators need. In this context, we train our participants in the human-centric innovation approach "Design Thinking". In addition, participants work in small international and interdisciplinary teams on real innovation challenges from practice.

The teams are made up of students from KIT and another university from the global SUGAR network. These include, for example, the Hasso Plattner Institute in Potsdam, Trinity College in Dublin and the University of Science and Technology of China. The program includes visits to international events of the SUGAR Network, which are usually held in places known for their high level of innovation. At these events, our participants present their (interim) results to a large audience consisting of employees from the partner companies and the universities involved.

### What students will learn:

- A comprehensive understanding of the globally recognized innovation approach "Design Thinking" as introduced and promoted by the Stanford University
- Development of new, creative solutions through extensive need finding, in particular with regard to the relevant service users
- to develop prototypes of the collected ideas early and independently, to test them and improve them iteratively, thereby solving the issue defined by the partner company
- to communicate, present and network in an interdisciplinary and international environment
- to apply the learned approach in the context of a real innovation project provided by a practical partner.

### Course phases (roughly 4 weeks each):

- **Kick off:**  
Learning the basic method elements by solving an exercise challenge. Participation in the Global Kick-Off of the SUGAR Network consisting of method workshops, working on team challenges, networking with other universities and forming project teams for the challenges of the practical partners.
- **Design Space Exploration:**  
Exploring the problem space by questioning the given innovation challenge from practice. Familiarization with the topic area of the respective challenge. Gathering first impressions of the requirements and needs of people related to the problem.
- **Critical Function Prototype:**  
Building an intensive understanding of the needs of the target group of the respective challenge. Deriving critical functions from the customer's perspective that could help solve the overall problem. Building prototypes for the critical functions and testing them in real customer situations.
- **Dark Horse Prototype:**  
Reversal of assumptions and experiences made so far. The goal is to develop radically new and unconventional ideas. Implementation of the ideas into simple prototypes and subsequent testing.
- **Funky Prototype:**  
Integration of the individual successfully tested functions from the critical function and dark horse phase into solution concepts. These are also tested and further developed.
- **Functional Prototype:**  
Selection of successful funky prototypes and development of these towards high-resolution prototypes. The final solution approach for the project is written down in detail and feedback is obtained.
- **Final Prototype:**  
Implementing the final prototype and presenting it to the practical partner as well as the SUGAR Network.

### Organizational issues

Bei der Vorlesung handelt es sich um eine zweisemestrige Veranstaltung, die jährlich im September startet.

### Literature

- Design Thinking: Das Handbuch; Falk Uebernickel, Walter Brenner, Therese Naef, Britta Pukall, Bernhard Schindlholzer
- The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems; Michael Lewrick, Patrick Link, Larry Leifer
- The Design Thinking Toolbox: A Guide to Mastering the Most Popular and Valuable Innovation Methods; Michael Lewrick, Patrick Link, Larry Leifer
- Frame Innovation: Create New Thinking by Design (Design Thinking, Design Theory); Kees Dorst



### Service Design Thinking

2595600, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
On-Site

### Content

The Service Design Thinking program is much more than a normal course. Through this program, we provide the knowledge and skills that true innovators need. In this context, we train our participants in the human-centric innovation approach "Design Thinking". In addition, participants work in small international and interdisciplinary teams on real innovation challenges from practice.

The teams are made up of students from KIT and another university from the global SUGAR network. These include, for example, the Hasso Plattner Institute in Potsdam, Trinity College in Dublin and the University of Science and Technology of China. The program includes visits to international events of the SUGAR Network, which are usually held in places known for their high level of innovation. At these events, our participants present their (interim) results to a large audience consisting of employees from the partner companies and the universities involved.

### What students will learn:

- A comprehensive understanding of the globally recognized innovation approach "Design Thinking" as introduced and promoted by the Stanford University
- Development of new, creative solutions through extensive need finding, in particular with regard to the relevant service users
- to develop prototypes of the collected ideas early and independently, to test them and improve them iteratively, thereby solving the issue defined by the partner company
- to communicate, present and network in an interdisciplinary and international environment
- to apply the learned approach in the context of a real innovation project provided by a practical partner.

### Course phases (roughly 4 weeks each):

- **Kick off:**  
Learning the basic method elements by solving an exercise challenge. Participation in the Global Kick-Off of the SUGAR Network consisting of method workshops, working on team challenges, networking with other universities and forming project teams for the challenges of the practical partners.
- **Design Space Exploration:**  
Exploring the problem space by questioning the given innovation challenge from practice. Familiarization with the topic area of the respective challenge. Gathering first impressions of the requirements and needs of people related to the problem.
- **Critical Function Prototype:**  
Building an intensive understanding of the needs of the target group of the respective challenge. Deriving critical functions from the customer's perspective that could help solve the overall problem. Building prototypes for the critical functions and testing them in real customer situations.
- **Dark Horse Prototype:**  
Reversal of assumptions and experiences made so far. The goal is to develop radically new and unconventional ideas. Implementation of the ideas into simple prototypes and subsequent testing.
- **Funky Prototype:**  
Integration of the individual successfully tested functions from the critical function and dark horse phase into solution concepts. These are also tested and further developed.
- **Functional Prototype:**  
Selection of successful funky prototypes and development of these towards high-resolution prototypes. The final solution approach for the project is written down in detail and feedback is obtained.
- **Final Prototype:**  
Implementing the final prototype and presenting it to the practical partner as well as the SUGAR Network.

### Organizational issues

Bei der Vorlesung handelt es sich um eine zweisemestrige Veranstaltung, die jährlich im September startet.

### Literature

- Design Thinking: Das Handbuch; Falk Uebernickel, Walter Brenner, Therese Naef, Britta Pukall, Bernhard Schindlholzer
- The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems; Michael Lewrick, Patrick Link, Larry Leifer
- The Design Thinking Toolbox: A Guide to Mastering the Most Popular and Valuable Innovation Methods; Michael Lewrick, Patrick Link, Larry Leifer
- Frame Innovation: Create New Thinking by Design (Design Thinking, Design Theory); Kees Dorst

## T

**6.438 Module component: Service Operations and Cyber Security [T-WIWI-114109]**

**Coordinators:** Esther Mohr  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-102805 - Service Operations](#)  
[M-WIWI-102808 - Digital Service Systems in Industry](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 4,5 CP  | graded  | Each summer term | 1       |

| Exams   |       |                                                       |  |        |
|---------|-------|-------------------------------------------------------|--|--------|
| ST 2026 | 00030 | <a href="#">Service Operations and Cyber Security</a> |  | Nickel |

**Assessment**

The assessment is carried out as a single examination of another type that combines two mandatory components:

1. written dissertation
2. oral final exam (duration ≈ 30 – 40 minutes)

Both components are integrated into one overall assessment, which reflects the overall impression of the combined performance. Further details on the concrete design (e.g., grading criteria) will be announced during the lecture.

**Modeled Prerequisites**

The following conditions have to be fulfilled:

1. The module component [T-WIWI-102872 - Challenges in Supply Chain Management](#) must not have been started.

**Recommendations**

Basic knowledge as conveyed in the module "Introduction to Operations Research" is assumed.

**Additional Information**

The number of course participants is limited to 12 due to the collaborative work in project teams. As a result of this limitation, registration is required before the course begins. Further information can be found on the course's website. The event takes place irregularly. The planned lectures and courses for the next three years will be announced online.



## T

**6.439 Module component: SIL Entrepreneurship Emphasis [T-WIWI-110287]**

**Coordinators:** Prof. Dr. Orestis Terzidis  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-105010 - Student Innovation Lab \(SIL\) 1](#)

**Type**  
Examination of another type

**Credits**  
3 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
1

| Courses  |         |                                               |       |         |          |
|----------|---------|-----------------------------------------------|-------|---------|----------|
| WT 25/26 | 2500002 | <a href="#">SIL Entrepreneurship Emphasis</a> | 4 SWS | Seminar | Terzidis |
| Exams    |         |                                               |       |         |          |
| WT 25/26 | 7900041 | <a href="#">SIL Entrepreneurship Emphasis</a> |       |         | Terzidis |
| ST 2026  | 7900302 | <a href="#">SIL Entrepreneurship Emphasis</a> |       |         | Terzidis |

**Assessment**

Alternative exam assessment (§4(2), 3 SPO). The final grade is a result from both, the grade of the term paper and its presentation, as well as active participation during the seminar. In addition, smaller, ungraded tasks are provided in the course to monitor progress.

**Prerequisites**

None

**Recommendations**

None

**Workload**

90 hours

## T

**6.440 Module component: SIL Entrepreneurship Project [T-WIWI-110166]**

**Coordinators:** Prof. Dr. Orestis Terzidis  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-105010 - Student Innovation Lab \(SIL\) 1](#)

**Type**  
Examination of another type

**Credits**  
3 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
1

| Courses  |         |                                              |       |         |          |
|----------|---------|----------------------------------------------|-------|---------|----------|
| WT 25/26 | 2545082 | <a href="#">SIL Entrepreneurship Project</a> | 4 SWS | Seminar | Terzidis |
| Exams    |         |                                              |       |         |          |
| WT 25/26 | 7900037 | <a href="#">SIL Entrepreneurship Project</a> |       |         | Terzidis |

**Assessment**

Success is assessed in the form of an alternative exam assessment. The grade results from the evaluation of two seminar papers. Further details will be provided at the beginning of the course. The points system for the assessment of the two seminar papers is determined by the lecturer of the course. It will be announced at the beginning of the course.

**Prerequisites**

None

**Recommendations**

None

**Workload**

90 hours

## T

**6.441 Module component: Simulation and Optimization in Robotics and Biomechanics [T-INFO-113123]****Coordinators:** Prof. Dr. Katja Mombaur**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106504 - Simulation and Optimization in Robotics and Biomechanics](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 6 CP    | Graded  | Each winter term | 6       |

| Courses  |         |                                                                          |       |                                                                                                         |                    |
|----------|---------|--------------------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------|--------------------|
| WT 25/26 | 2400160 | <a href="#">Simulation and Optimization in Robotics and Biomechanics</a> | 4 SWS | Lecture / Practice /  | Mombaur, Ackermann |
| Exams    |         |                                                                          |       |                                                                                                         |                    |
| WT 25/26 | 7500355 | <a href="#">Simulation and Optimization in Robotics and Biomechanics</a> |       |                                                                                                         | Mombaur            |

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

The assessment is carried out as an oral examination (§ 4 Abs. 2 No. 1 SPO) lasting up to 30 minutes. It can be repeated once.

As a prerequisite for the participation in the oral exam, students must regularly and successfully participate in the exercises. Students must regularly submit exercise sheets. The number of exercise sheets and the scale for passing will be announced at the beginning of the course.

**Prerequisites**

T-INFO-114838 – Simulation and Optimization in Robotics and Biomechanics – Pass grade is required. Completion of module Robotics 1 or corresponding knowledge required  
Programming skills in C/C++

**Additional Information**

Limitation to 30 participants

*Below you will find excerpts from courses related to this module component:*

## V

**Simulation and Optimization in Robotics and Biomechanics**2400160, WS 25/26, 4 SWS, Language: English, [Open in study portal](#)**Lecture / Practice (VÜ)  
On-Site****Content**

The goal of this course is to give a practical introduction into simulation and optimization of motions in robotics and biomechanics. Simulation and optimization play an important role in generating and controlling motions in complex robotics systems and in predicting and analyzing motions of humans. Theory and methods will be covered, but the focus is on the use software tools for modeling, simulation, optimization and visualization of multibody systems. Topics covered include:

- Dynamic process modeling
- Transforming real world problems into mathematical models
- Modeling of complex robotics and biomechanics systems (e.g. humanoids), based on previous modeling knowledge
- Common template models for bipedal walking and running in robotics and biomechanics
- Simulation of mechanical / robotics systems (Integrators and Initial value problems)
- Boundary value problems
- Nonlinear optimization problems
- Optimal control problems
- Direct and indirect methods for optimal control problems, focus on direct methods, especially direct multiple shooting
- Stability of dynamical systems, stability in biomechanics and robotics

**Organizational issues**

Note that the class will start in the second week of the term - i.e. on Wednesday November 5!

**T****6.442 Module component: Simulation and Optimization in Robotics and Biomechanics  
- Pass [T-INFO-114838]****Coordinators:** Prof. Dr. Katja Mombaur**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106504 - Simulation and Optimization in Robotics and Biomechanics](#)

| Type              | Credits | Grading   | Term offered     | Expansion   | Version |
|-------------------|---------|-----------|------------------|-------------|---------|
| Coursework (oral) | 0 CP    | pass/fail | Each winter term | 1 semesters | 1       |

| Exams    |         |                                                                                 |         |
|----------|---------|---------------------------------------------------------------------------------|---------|
| WT 25/26 | 7500313 | <a href="#">Simulation and Optimization in Robotics and Biomechanics - Pass</a> | Mombaur |
| WT 25/26 | 7500355 | <a href="#">Simulation and Optimization in Robotics and Biomechanics</a>        | Mombaur |

**Assessment**

Success is assessed in the form of coursework in accordance with Section 4 (3) SPO (ungraded exercise certificate).  
Exercise sheets must be handed in regularly to pass the course. The specific details will be announced in the lecture.

**Additional Information**

Participation in the exercise is compulsory and the contents of the exercise are relevant for the examination.

## T

**6.443 Module component: Simulation Game in Energy Economics [T-WIWI-108016]****Coordinators:** Dr. Massimo Genoese**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-101451 - Energy Economics and Energy Markets](#)**Type**  
Examination of another type**Credits**  
3,5 CP**Grading**  
graded**Term offered**  
Each summer term**Version**  
2

| Courses |         |                                                     |       |                                                                                                         |                     |
|---------|---------|-----------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------|---------------------|
| ST 2026 | 2581025 | <a href="#">Simulation Game in Energy Economics</a> | 3 SWS | Lecture / Practice /  | Genoese, Zimmermann |
| Exams   |         |                                                     |       |                                                                                                         |                     |
| ST 2026 | 7981025 | <a href="#">Simulation Game in Energy Economics</a> |       |                                                                                                         | Fichtner            |

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

Examination as written assignment and oral presentation (§4 (2), 1 SPO).

**Prerequisites**

None

**Recommendations**

Visiting the course "Introduction to Energy Economics"

**Additional Information**

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 courses related to this module component:*

## V

**Simulation Game in Energy Economics**2581025, SS 2026, 3 SWS, Language: German, [Open in study portal](#)**Lecture / Practice (VÜ)**  
On-Site**Content**

- Introduction
- Agents and market places in the electricity industry
- Selected planning tasks of energy service companies
- Methods of modelling in the energy sector
- Agent-based simulation: The PowerACE model
- Simulation game: Simulation in energy economics (electricity and emission trading, investment decisions)

The lecture is structured in a theoretical and a practical part. In the theoretical part, the students are taught the basics to carry out simulations themselves in the practical part which comprises amongst others the simulation of the power exchange. The participants of the simulation game take a role as a power trader in the power market. Based on various sources of information (e.g. prognosis of power prices, available power plants, fuel prices), they can launch bids in the power exchange.

Assessment: presentation and written summary

Prerequisites: Basics in Energy economics and markets are advantageous.

**Organizational issues**

CIP-Pool West, Raum 102, Geb. 06.41 - siehe Institutsaushang

**Literature****Weiterführende Literatur:**

Möst, D. und Genoese, M. (2009): Market power in the German wholesale electricity market. The Journal of Energy Markets (47–74). Volume 2/Number 2, Summer 2009

## T

**6.444 Module component: Smart Energy Infrastructure [T-WIWI-107464]**

**Coordinators:** Dr. Armin Ardone  
Dr. Dr. Andrej Marko Pustisek

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

**Part of:** [M-WIWI-101452 - Energy Economics and Technology](#)

**Type**  
Written examination

**Credits**  
5,5 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
2

| Courses  |         |                                                 |       |                                                                                               |                           |
|----------|---------|-------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|---------------------------|
| WT 25/26 | 2581023 | <a href="#">(Smart) Energy Infrastructure</a>   | 4 SWS | Lecture /  | Ardone, Pustisek, Schuler |
| Exams    |         |                                                 |       |                                                                                               |                           |
| WT 25/26 | 7900178 | <a href="#">Smart Energy Infrastructure NEW</a> |       |                                                                                               | Fichtner                  |
| ST 2026  | 7900228 | <a href="#">Smart Energy Infrastructure NEW</a> |       |                                                                                               | Fichtner                  |

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

**Assessment**

The assessment consists of a written exam (90 minutes). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

**Workload**

165 hours

Below you will find excerpts from courses related to this module component:

## V

**(Smart) Energy Infrastructure**

2581023, WS 25/26, 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 derivatives, 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.

## T

**6.445 Module component: Smart Grid Applications [T-WIWI-107504]**

**Coordinators:** Prof. Dr. Christof Weinhardt

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

**Part of:** [M-WIWI-101446 - Market Engineering](#)  
[M-WIWI-103720 - eEnergy: Markets, Services and Systems](#)

| Type                | Credits | Grading | Term offered    | Version |
|---------------------|---------|---------|-----------------|---------|
| Written examination | 4,5 CP  | graded  | see Annotations | 2       |

**Assessment**

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

**Recommendations**

None

**Additional Information**

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).

## T

**6.446 Module component: Social Choice Theory [T-WIWI-102859]**

**Coordinators:** Prof. Dr. Clemens Puppe  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101500 - Microeconomic Theory](#)  
[M-WIWI-101504 - Collective Decision Making](#)

**Type**  
Written examination

**Credits**  
4,5 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
3

| Courses |         |                                               |       |                                                                                                |              |
|---------|---------|-----------------------------------------------|-------|------------------------------------------------------------------------------------------------|--------------|
| ST 2026 | 2520537 | <a href="#">Social Choice Theory</a>          | 2 SWS | Lecture /   | Puppe, Kretz |
| ST 2026 | 2520539 | <a href="#">Übung zu Social Choice Theory</a> | 1 SWS | Practice /  | Puppe, Kretz |

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

**Assessment**

The assessment consists of a written exam (60 min.). The examination is offered every summer semester.

**Prerequisites**

None

Below you will find excerpts from courses related to this module component:

## V

**Social Choice Theory**

2520537, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

**Lecture (V)**  
On-Site

**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.

**Workload:**

Total workload for 4.5 credit points: approx. 135 hours

Attendance: 30 hours

Self-study: 105 hours

**Literature**

Main texts:

- Moulin, H. 1988. *Axioms of Cooperative Decision Making*. Cambridge University Press.
- List, C. and Puppe, C. 2009. Judgement Aggregation. A survey. In: *The Handbook of rational & social choice*. P. Anand, P. Pattanaik, C. Puppe (Eds.). Oxford University Press.

Secondary texts:

- Sen, A. K. 1970. *Collective Choice and Social Welfare*. Holden-Day.
- Gaertner, W. 2009. *A Primer in Social Choice Theory*. Revised edition. Oxford University Press.
- Gaertner, W. 2001. *Domain Conditions in Social Choice Theory*. Cambridge University Press.



## T

**6.447 Module component: Software Architecture and Quality [T-INFO-114261]****Coordinators:** Prof. Dr. Ralf Reussner**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107237 - Software Architecture and Quality](#)  
[M-WIWI-107529 - Information Systems: Software & Systems Engineering](#)**Type**  
Written examination**Credits**  
3 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
3

| Courses  |         |                                                   |       |                                                                                               |          |
|----------|---------|---------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|----------|
| WT 25/26 | 2424667 | <a href="#">Software Architecture and Quality</a> | 2 SWS | Lecture /  | Reussner |
| Exams    |         |                                                   |       |                                                                                               |          |
| WT 25/26 | 7500032 | <a href="#">Software Architecture and Quality</a> |       |                                                                                               | Reussner |

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

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 60 minutes.

**Prerequisites**This lecture and the lectures *Component-Based Software Development* and *Software Architecture* are mutually exclusive.

## T

**6.448 Module component: Software Engineering II [T-INFO-114259]**

**Coordinators:** Prof. Dr.-Ing. Anne Koziolk  
 Prof. Dr. Raffaella Mirandola  
 Prof. Dr. Ralf Reussner

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-107235 - Software Engineering II](#)

**Type**  
Written examination

**Credits**  
6 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
1

| Courses  |         |                                         |       |                                                                                               |                               |
|----------|---------|-----------------------------------------|-------|-----------------------------------------------------------------------------------------------|-------------------------------|
| ST 2026  | 24076   | <a href="#">Software Engineering II</a> | 4 SWS | Lecture /  | Reussner, Mirandola, Dehghani |
| Exams    |         |                                         |       |                                                                                               |                               |
| WT 25/26 | 7500054 | <a href="#">Software Engineering II</a> |       |                                                                                               | Reussner                      |
| ST 2026  | 7500207 | <a href="#">Software Engineering II</a> |       |                                                                                               | Reussner                      |

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

**Assessment**

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 90 minutes.

**Prerequisites**

None.

**Recommendations**

The course *Software Engineering I* should already have been attended.

**T****6.449 Module component: Software Lab Parallel Numerics [T-INFO-105988]**

**Coordinators:** Prof. Dr. Wolfgang Karl  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-102998 - Software Lab Parallel Numerics](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 6 CP    | graded  | Each term    | 2       |

## T

**6.450 Module component: Software Product Line Engineering [T-INFO-114234]****Coordinators:** Prof. Dr.-Ing. Ina Schaefer**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107212 - Software Product Line Engineering](#)**Type**  
Oral examination**Credits**  
3 CP**Grading**  
graded**Term offered**  
Each summer term**Version**  
1

| Courses  |         |                                                   |       |                                                                                                         |             |
|----------|---------|---------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------|-------------|
| ST 2026  | 2400050 | <a href="#">Software Product Line Engineering</a> | 2 SWS | Lecture / Practice /  | Feichtinger |
| Exams    |         |                                                   |       |                                                                                                         |             |
| WT 25/26 | 7500158 | <a href="#">Software Product Line Engineering</a> |       |                                                                                                         | Feichtinger |

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

The assessment is carried out as an oral examination, usually lasting 25 minutes in accordance with Section 4 (2) No. 2 SPO.

Depending on the number of attending students, it will be announced six weeks before the examination (§ 6 Para. 3 SPO) whether the performance assessment will take place

- in the form of an oral examination in accordance with Section 4 (2) No. 2 SPO (as described above) or
- in the form of a written examination lasting 90 minutes in accordance with Section 4 (2) No. 1 SPO.

**Prerequisites**

None.

**Recommendations**

Basic knowledge from the lectures Software Engineering II [T-INFO-101370] and Formal Systems [T-INFO-101336] is helpful.

## T

**6.451 Module component: Software Quality Management [T-WIWI-102895]****Coordinators:** Prof. Dr. Andreas Oberweis**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-101477 - Development of Business Information Systems](#)  
[M-WIWI-107529 - Information Systems: Software & Systems Engineering](#)**Type**  
Written examination**Credits**  
4,5 CP**Grading**  
graded**Term offered**  
Each summer term**Version**  
3

| Courses  |                  |                                                                                      |       |                                                                                                |          |
|----------|------------------|--------------------------------------------------------------------------------------|-------|------------------------------------------------------------------------------------------------|----------|
| ST 2026  | 2511208          | <a href="#">Software Quality Management</a>                                          | 2 SWS | Lecture /   | Oberweis |
| ST 2026  | 2511209          | <a href="#">Übungen zu Software-Qualitätsmanagement</a>                              | 1 SWS | Practice /  | Kruse    |
| Exams    |                  |                                                                                      |       |                                                                                                |          |
| WT 25/26 | 79AIFB_STQM_C1   | <a href="#">Software Quality Management (Registration extended until 16.02.2026)</a> |       |                                                                                                | Oberweis |
| ST 2026  | 791-AIFB-STQM-HK | <a href="#">Software Quality Management (Registration until 20.07.2026)</a>          |       |                                                                                                | Oberweis |

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

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 courses related to this module component:

## V

**Software Quality Management**2511208, SS 2026, 2 SWS, Language: German, [Open in study portal](#)**Lecture (V)**  
On-Site**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**

- Helmut Balzert: Lehrbuch der Software-Technik. Spektrum-Verlag 2008
- 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.

## T

**6.452 Module component: Software Security Engineering [T-INFO-112862]**

**Coordinators:** Dr. Christopher Gerking  
Prof. Dr. Ralf Reussner

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-106344 - Software Security Engineering](#)

**Type**  
Written examination

**Credits**  
3 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
2

| Courses  |         |                                               |       |                                                                                               |         |
|----------|---------|-----------------------------------------------|-------|-----------------------------------------------------------------------------------------------|---------|
| ST 2026  | 2400059 | <a href="#">Software Security Engineering</a> | 2 SWS | Lecture /  | Gerking |
| Exams    |         |                                               |       |                                                                                               |         |
| WT 25/26 | 7500040 | <a href="#">Software Security Engineering</a> |       |                                                                                               | Gerking |
| ST 2026  | 7500357 | <a href="#">Software Security Engineering</a> |       |                                                                                               | Gerking |

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

**Assessment**

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting approx. 90 minutes.

**Prerequisites**

None.

**Recommendations**

Knowledge of Software Engineering I and Software Engineering II is recommended.

**T****6.453 Module component: Software-Evolution [T-INFO-101256]**

**Coordinators:** Prof. Dr. Ralf Reussner  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-100719 - Software-Evolution](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 3 CP    | Graded  | Each winter term | 1       |

| Courses  |         |                                    |          |                                                                                               |       |
|----------|---------|------------------------------------|----------|-----------------------------------------------------------------------------------------------|-------|
| WT 25/26 | 2424164 | <a href="#">Software Evolution</a> | 2 SWS    | Lecture /  | Lange |
| Exams    |         |                                    |          |                                                                                               |       |
| WT 25/26 | 7500004 | <a href="#">Software-Evolution</a> | Reussner |                                                                                               |       |

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

**Assessment**

The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting 25 minutes.

**Prerequisites**

None.

**Recommendations**

Knowledge of software technology and software architectures is helpful.



## T

**6.454 Module component: Softwaretest and Quality Management (SQM) [T-INFO-114263]****Coordinators:** Prof. Dr.-Ing. Ina Schaefer**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107239 - Software Test and Quality Management \(SQM\)](#)

| Type                | Credits | Grading        | Term offered     | Version |
|---------------------|---------|----------------|------------------|---------|
| Written examination | 5 CP    | Grading graded | Each winter term | 1       |

| Courses  |         |                                                                      |                         |                                                                                                |                         |
|----------|---------|----------------------------------------------------------------------|-------------------------|------------------------------------------------------------------------------------------------|-------------------------|
| WT 25/26 | 2400112 | <a href="#">Softwaretest and Quality Management (SQM)</a>            | 2 SWS                   | Lecture /   | Heydari Tabar, Schaefer |
| WT 25/26 | 2400113 | <a href="#">Softwaretest and Quality Management (SQM) - Exercise</a> | 2 SWS                   | Practice /  | Schaefer, Heydari Tabar |
| Exams    |         |                                                                      |                         |                                                                                                |                         |
| WT 25/26 | 7500248 | <a href="#">Software Test and Quality Management (SQM)</a>           | Schaefer, Heydari Tabar |                                                                                                |                         |
| ST 2026  | 7500180 | <a href="#">Software Test and Quality Management (SQM)</a>           | Schaefer, Heydari Tabar |                                                                                                |                         |

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

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 90 minutes.

**Prerequisites**

None.

**Additional Information**

At the end of the course there is also the opportunity to be certified as an "ISTQB - Certified Tester - Foundation Level". A date and the modalities for the exam will be agreed on in the lecture.

Below you will find excerpts from courses related to this module component:

## V

**Softwaretest and Quality Management (SQM)**2400112, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)**Lecture (V)**  
**On-Site****Content**

1. Basics (introduction, definition of terms, principles of software testing, fundamental test process, psychology of testing)
2. Testing in the software life cycle (general V-model, component test, integration test, system test, acceptance test, testing of new product versions, overview of test types)
3. Static testing (structured group tests, static analyses, metrics)
4. Dynamic testing (black-box procedure, white-box procedure, experience-based test case determination)
5. Test management (test organisation and planning, economic aspects, test strategy, management of test work, error management, requirements for configuration management).
6. Testing tools (types, selection, introduction)
7. Modern test procedures (model-based testing, regression testing, testing of variant-rich systems)
8. Debugging

**Organizational issues**

Am Ende der Vorlesung besteht zusätzlich die Möglichkeit, sich zum "ISTQB - Certified Tester - Foundation Level" zertifizieren zu lassen. Ein entsprechender Termin und die Modalitäten für die Prüfung wird in der VL vereinbart und rechtzeitig in der Terminliste auf der Homepage zur Vorlesung bekanntgegeben.

**Literature**

Andreas Spillner, and Tilo Linz. Basiswissen Softwaretest: Aus-und Weiterbildung zum Certified Tester–Foundation Level nach ISTQB-Standard. dpunkt-Verlag, 2019.

Helmut Balzert, and Christof Ebert. Lehrbuch der Software-Technik. Spektrum, Akad. Verlag, 1996. V.a. Band 2.

Martin Pol, Tim Koomen, and Andreas Spillner. Management und Optimierung des Testprozesses: Ein praktischer Leitfaden für erfolgreiches Testen von Software mit TPI® und TMap®. dpunkt-Verlag, 2002.

Georg Erwin Thaller. Software-Test: Verifikation und Validation. Heise, 2002.

**Softwaretest and Quality Management (SQM) - Exercise**

2400113, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

**Practice (Ü)  
On-Site**

**Content**

The exercise deepens the content of the lecture SQM and applies it to practical examples. At the end of the course there is also the opportunity to be certified as an "ISTQB - Certified Tester - Foundation Level". A date and the modalities for the exam will be agreed on in the lecture.

## T

**6.455 Module component: Spatial Economics [T-WIWI-103107]****Coordinators:** Prof. Dr. Ingrid Ott**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-101485 - Transport Infrastructure Policy and Regional Development](#)  
[M-WIWI-107010 - Economics in a Connected World](#)**Type**  
Written examination**Credits**  
4,5 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
1

| Courses  |         |                                                |       |                                                                                                |               |
|----------|---------|------------------------------------------------|-------|------------------------------------------------------------------------------------------------|---------------|
| WT 25/26 | 2561260 | <a href="#">Spatial Economics</a>              | 2 SWS | Lecture /   | Ott           |
| WT 25/26 | 2561261 | <a href="#">Exercise for Spatial Economics</a> | 1 SWS | Practice /  | Ott, Mirzoyan |
| Exams    |         |                                                |       |                                                                                                |               |
| WT 25/26 | 7900075 | <a href="#">Spatial Economics</a>              |       |                                                                                                | Ott           |
| WT 25/26 | 7900276 | <a href="#">Spatial Economics</a>              |       |                                                                                                | Ott           |

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

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

**Recommendations**

Basic micro- and macroeconomic knowledge is required, such as that taught in the courses "Economics I" [2600012] and "Economics II" [2600014], attendance of which is strongly recommended (but not mandatory). An interest in quantitative-mathematical modeling is also a prerequisite. Attendance of the course "Introduction to Economic Policy" [2560280] is recommended.

Below you will find excerpts from courses related to this module component:

## V

**Spatial Economics**2561260, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)**Lecture (V)**  
On-Site

**Content**

The course covers the following topics:

- Geography, trade and development
- Geography and economic theory
- Core models of economic geography and empirical evidence
- Agglomeration, home market effect, and spatial wages
- Applications and extensions

**Learning objectives:**

The student

- analyses how spatial distribution of economic activity is determined.
- uses quantitative methods within the context of economic models.
- has basic knowledge of formal-analytic methods.
- understands the link between economic theory and its empirical applications.
- understands to what extent concentration processes result from agglomeration and dispersion forces.
- is able to determine theory based policy recommendations.

**Recommendations:**

Basic knowledge of micro- and macroeconomics is assumed, as taught in the courses Economics I [2600012], and Economics II [2600014]. An interest in mathematical modeling is advantageous.

**Workload:**

The total workload for this course is approximately 135 hours.

- Classes: ca. 30 h
- Self-study: ca. 45 h
- Exam and exam preparation: ca. 60 h

**Assessment:**

The assessment consists of a written exam (60 minutes) (following §4(2), 1 of the examination regulation).

**Literature**

Steven Brakman, Harry Garretsen, Charles van Marrewijk (2009): The New Introduction to Geographical Economics, 2nd ed, Cambridge University Press.

Weitere Literatur wird in der Vorlesung bekanntgegeben.  
(Further literature will be announced in the lecture.)

## T

**6.456 Module component: Special Topics in Information Systems [T-WIWI-113724]**

**Coordinators:** Prof. Dr. Christof Weinhardt  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101410 - Business & Service Engineering](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 4,5 CP  | graded  | Each term    | 1       |

**Assessment**

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

**Recommendations**

None

**Additional Information**

All the practical seminars offered at the chair of Prof. Dr. Weinhardt can be chosen in the Special Topics in Information Systems course. The current topics of the practical seminars are available at the following homepage: [www.iism.kit.edu/im/lehre](http://www.iism.kit.edu/im/lehre).

The Special Topics Information Systems is equivalent to the practical seminar, as it was only offered for the major in "Information Systems" so far. With this course students majoring in "Industrial Engineering and Management" and "Economics Engineering" also have the chance of getting practical experience and enhance their scientific capabilities.

The Special Topics Information Systems can be chosen instead of a regular lecture (see module description). Please take into account, that this course can only be accounted once per module.

## T

**6.457 Module component: Special Topics in Information Systems [T-WIWI-113727]**

**Coordinators:** Prof. Dr. Christof Weinhardt  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101411 - Information Engineering](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 4,5 CP  | graded  | Each term    | 1       |

**Assessment**

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

**Recommendations**

None

**Additional Information**

All the practical seminars offered at the chair of Prof. Dr. Weinhardt can be chosen in the Special Topics in Information Systems course. The current topics of the practical seminars are available at the following homepage: [www.iism.kit.edu/im/lehre](http://www.iism.kit.edu/im/lehre).

The Special Topics Information Systems is equivalent to the practical seminar, as it was only offered for the major in "Information Systems" so far. With this course students majoring in "Industrial Engineering and Management" and "Economics Engineering" also have the chance of getting practical experience and enhance their scientific capabilities.

The Special Topics Information Systems can be chosen instead of a regular lecture (see module description). Please take into account, that this course can only be accounted once per module.

## T

**6.458 Module component: Special Topics in Information Systems [T-WIWI-113726]**

**Coordinators:** Prof. Dr. Christof Weinhardt  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-103720 - eEnergy: Markets, Services and Systems](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 4,5 CP  | graded  | Each term    | 1       |

**Assessment**

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

**Recommendations**

None

**Additional Information**

All the practical seminars offered at the chair of Prof. Dr. Weinhardt can be chosen in the Special Topics in Information Systems course. The current topics of the practical seminars are available at the following homepage: [www.iism.kit.edu/im/lehre](http://www.iism.kit.edu/im/lehre).

The Special Topics Information Systems is equivalent to the practical seminar, as it was only offered for the major in "Information Systems" so far. With this course students majoring in "Industrial Engineering and Management" and "Economics Engineering" also have the chance of getting practical experience and enhance their scientific capabilities.

The Special Topics Information Systems can be chosen instead of a regular lecture (see module description). Please take into account, that this course can only be accounted once per module.

**T****6.459 Module component: Special Topics in Information Systems [T-WIWI-113725]**

**Coordinators:** Prof. Dr. Christof Weinhardt  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101506 - Service Analytics](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 4,5 CP  | graded  | Each term    | 1       |

**Assessment**

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

**Recommendations**

None

**Additional Information**

All the practical seminars offered at the chair of Prof. Dr. Weinhardt can be chosen in the Special Topics in Information Systems course. The current topics of the practical seminars are available at the following homepage: [www.iism.kit.edu/im/lehre](http://www.iism.kit.edu/im/lehre).

The Special Topics Information Systems is equivalent to the practical seminar, as it was only offered for the major in "Information Systems" so far. With this course students majoring in "Industrial Engineering and Management" and "Economics Engineering" also have the chance of getting practical experience and enhance their scientific capabilities.

The Special Topics Information Systems can be chosen instead of a regular lecture (see module description). Please take into account, that this course can only be accounted once per module.



## T

**6.460 Module component: Startup Experience [T-WIWI-111561]**

**Coordinators:** Prof. Dr. Orestis Terzidis  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101488 - Entrepreneurship \(EnTechnon\)](#)

**Type**  
Examination of another type

**Credits**  
6 CP

**Grading**  
graded

**Term offered**  
Each term

**Version**  
1

| Courses  |         |                                    |          |                                                                                               |                                  |
|----------|---------|------------------------------------|----------|-----------------------------------------------------------------------------------------------|----------------------------------|
| WT 25/26 | 2545004 | <a href="#">Startup Experience</a> | 4 SWS    | Seminar /  | Weimar, Martjan, Terzidis        |
| ST 2026  | 2545004 | <a href="#">Startup Experience</a> | 4 SWS    | Seminar /  | Weimar, Terzidis, Martjan, Osaro |
| Exams    |         |                                    |          |                                                                                               |                                  |
| WT 25/26 | 7900186 | <a href="#">Startup Experience</a> | Terzidis |                                                                                               |                                  |
| ST 2026  | 7900186 | <a href="#">Startup Experience</a> | Terzidis |                                                                                               |                                  |

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

**Assessment**

Alternative exam assessment. Details on the design of the examination performance of other types will be announced in the course. The grade is composed of a presentation and a written paper (plus any specified documentation, e.g. work results, experience diary, reflection).

**Recommendations**

Lecture Entrepreneurship already completed

**Additional Information**

The language in the seminar is English. The seminar contents will be published on the chair homepage.

**Workload**

180 hours

Below you will find excerpts from courses related to this module component:

## V

**Startup Experience**

2545004, WS 25/26, 4 SWS, Language: English, [Open in study portal](#)

**Seminar (S)**  
On-Site

## Content

### Content

In the Startup Experience seminar you will develop entrepreneurial competences that will enable you to build a new business. In an entrepreneurial project, you have three main objectives:

1. Identify and develop an opportunity. Who is your target customer and what problem or task does he or she have? How attractive and how big is this market?
2. How will you add value to it? How can you use specific resources, including technology, to develop a solution?
3. How can you design and set up a viable organisation? What business model do you propose to create, deliver and capture value?

Our primary focus is on digital healthcare ventures, granting you the opportunity to delve into the realm of entrepreneurship within the healthcare system. After gaining a deep understanding of healthcare needs, you will utilize creativity techniques to uncover potential business ideas that provide value for patients and doctors. Additionally, you will learn how to create viable business models, dive into health regulations, and pitch your idea to a jury.

### Learning Objectives

After completing this course, the course participants will be able to:

- Work effectively in a cohesive team
- Understand the role of digital entrepreneurship in healthcare
- Apply creativity techniques to ideate
- Use utility analysis approaches to select promising solutions
- Develop a value proposition based on techniques like the value proposition canvas or the jobs-to-be-done method
- Apply advanced business modeling methods to develop a sound business concept
- Develop and deliver a concise presentation ("pitch") to communicate your project
- Gain basic knowledge of healthcare regulations and reimbursement ways

### Additional information:

Alternative exam assessment. The grade consists of the presentation and the written elaboration. Potentially, a 'project diary' of the seminar progress may be part of the deliverables (depends on tutor and will be communicated at the kick-off).

For a successful course completion, we expect you to submit a Business Plan with the following features:

- Scope: 9000 words,
- Sound and clear structure,
- Expression and spelling are correct
- Complete and correct references, quotations, etc.
- Visual elements are chosen appropriately
- Documentation and traceability of data acquisition, analysis and evaluation,
- Content is developed according to the course instructions.

Furthermore, we expect you to deliver a team Pitch.

- Duration: will be communicated (typically 5-10 minutes)
- Content: Introduction/Purpose; Problem; Solution; Business Model; Prototype; Competition; Management Team; Current Status and next steps,
- Layout and form: appropriate choice,
- Appearance: appropriate amount of visual elements,
- Data: well researched and organized visually
- Story Line: is sound; clear and convincing.

### Organizational issues

Registration is via the Wiwi portal.

In the seminar you will work on a project in teams of max. 5 persons. The groups are formed in the seminar.



### Startup Experience

2545004, SS 2026, 4 SWS, Language: English, [Open in study portal](#)

Seminar (S)  
On-Site

## Content

### Content

In the Startup Experience seminar you will develop entrepreneurial competences that will enable you to build a new business. In an entrepreneurial project, you have three main objectives:

1. Identify and develop an opportunity. Who is your target customer and what problem or task does he or she have? How attractive and how big is this market?
2. How will you add value to it? How can you use specific resources, including technology, to develop a solution?
3. How can you design and set up a viable organisation? What business model do you propose to create, deliver and capture value?

Our primary focus is on digital healthcare ventures, granting you the opportunity to delve into the realm of entrepreneurship within the healthcare system. After gaining a deep understanding of healthcare needs, you will utilize creativity techniques to uncover potential business ideas that provide value for patients and doctors. Additionally, you will learn how to create viable business models, dive into health regulations, and pitch your idea to a jury.

### Learning Objectives

After completing this course, the course participants will be able to:

- Work effectively in a cohesive team
- Understand the role of digital entrepreneurship in healthcare
- Apply creativity techniques to ideate
- Use utility analysis approaches to select promising solutions
- Develop a value proposition based on techniques like the value proposition canvas or the jobs-to-be-done method
- Apply advanced business modeling methods to develop a sound business concept
- Develop and deliver a concise presentation ("pitch") to communicate your project
- Gain basic knowledge of healthcare regulations and reimbursement ways

### Additional information:

Alternative exam assessment. The grade consists of the presentation and the written elaboration. Potentially, a 'project diary' of the seminar progress may be part of the deliverables (depends on tutor and will be communicated at the kick-off).

For a successful course completion, we expect you to submit a Business Plan with the following features:

- Scope: 9000 words,
- Sound and clear structure,
- Expression and spelling are correct
- Complete and correct references, quotations, etc.
- Visual elements are chosen appropriately
- Documentation and traceability of data acquisition, analysis and evaluation,
- Content is developed according to the course instructions.

Furthermore, we expect you to deliver a team Pitch.

- Duration: will be communicated (typically 5-10 minutes)
- Content: Introduction/Purpose; Problem; Solution; Business Model; Prototype; Competition; Management Team; Current Status and next steps,
- Layout and form: appropriate choice,
- Appearance: appropriate amount of visual elements,
- Data: well researched and organized visually
- Story Line: is sound; clear and convincing.

### Organizational issues

Registration is via the Wiwi-Portal.

**Attention:** The Startup X seminar overlaps in some instances with the entrepreneurship lecture. Please be aware of this before applying for the seminar.

In the seminar you will work on a project in teams of max. 5 persons. Team applications are welcome but not a prerequisite for participation. The seminars will be held in English.

**T****6.461 Module component: Statistical Modeling of Generalized Regression Models [T-WIWI-103065]**

**Coordinators:** apl. Prof. Dr. Wolf-Dieter Heller  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101638 - Econometrics and Statistics I](#)  
[M-WIWI-101639 - Econometrics and Statistics II](#)  
[M-WIWI-105414 - Statistics and Econometrics II](#)

**Type**  
Written examination

**Credits**  
4,5 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
1

| Courses  |                   |                                                                       |       |         |        |
|----------|-------------------|-----------------------------------------------------------------------|-------|---------|--------|
| WT 25/26 | 2521350           | <a href="#">Statistical Modeling of Generalized Regression Models</a> | 2 SWS | Lecture | Heller |
| Exams    |                   |                                                                       |       |         |        |
| WT 25/26 | 7900011           | <a href="#">Statistical Modeling of Generalized Regression Models</a> |       |         | Heller |
| WT 25/26 | 7900146 (WS23/24) | <a href="#">Statistical Modeling of generalized regression models</a> |       |         | Heller |

**Assessment**

The assessment of this course is a written examination (60 min) according to §4(2), 1 of the examination regulation.

**Prerequisites**

None

**Recommendations**

Knowledge of the contents covered by the course "Economics III: Introduction in Econometrics" [2520016]

*Below you will find excerpts from courses related to this module component:*

**V****Statistical Modeling of Generalized Regression Models**

2521350, WS 25/26, 2 SWS, [Open in study portal](#)

Lecture (V)

**Content****Learning objectives:**

The student has profound knowledge of generalized regression models.

**Requirements:**

Knowledge of the contents covered by the course *Economics III: Introduction in Econometrics* [2520016].

**Workload:**

Total workload for 4.5 CP: approx. 135 hours

Attendance: 30 hours

Preparation and follow-up: 65 hours

## T

**6.462 Module component: Stochastic Calculus and Finance [T-WIWI-103129]****Coordinators:** Dr. Mher Safarian**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-101639 - Econometrics and Statistics II](#)**Type**  
Written examination**Credits**  
4,5 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
1

| Courses  |         |                                                            |       |          |          |
|----------|---------|------------------------------------------------------------|-------|----------|----------|
| WT 25/26 | 2521331 | <a href="#">Stochastic Calculus and Finance</a>            | 2 SWS | Lecture  | Safarian |
| WT 25/26 | 2521332 | <a href="#">Übungen zu Stochastic Calculus and Finance</a> | 2 SWS | Practice | Safarian |
| Exams    |         |                                                            |       |          |          |
| WT 25/26 | 7900225 | <a href="#">Stochastic Calculus and Finance</a>            |       |          | Safarian |

**Assessment**

The assessment of this course consists of a written examination (\$4(2), 1 SPOs, 180 min.).

**Prerequisites**

None

**Additional Information**

For more information see <http://statistik.econ.kit.edu/>

Below you will find excerpts from courses related to this module component:

## V

**Stochastic Calculus and Finance**

2521331, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

**Lecture (V)****Content****Learning objectives:**

After successful completion of the course students will be familiar with many common methods of pricing and portfolio models in finance. Emphasis will be put on both finance and the theory behind it.

**Content:**

The course will provide rigorous yet focused training in stochastic calculus and mathematical finance. Topics to be covered:

1. Stochastic Calculus: Stochastic Processes, Brownian Motion and Martingales, Entropy, Stopping Times, Local martingales, Doob-Meyer Decomposition, Quadratic Variation, Stochastic Integration, Ito Formula, Girsanov Theorem, Jump-diffusion Processes, Stable and Levy processes.
2. Mathematical Finance: Pricing Models, The Black-Scholes Model, State prices and Equivalent Martingale Measure, Complete Markets and Redundant Security Prices, Arbitrage Pricing with Dividends, Term-Structure Models (One Factor Models, Cox-Ingersoll-Ross Model, Affine Models), Term-Structure Derivatives and Hedging, Mortgage-Backed Securities, Derivative Assets (Forward Prices, Future Contracts, American Options, Look-back Options), Incomplete Markets, Markets with Transaction Costs, Optimal Portfolio and Consumption Choice (Stochastic Control and Merton continuous time optimization problem, CAPM), Equilibrium models, Numerical Methods.

**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**

- Dynamic Asset Pricing Theory, Third Edition by D. Duffie, Princeton University Press, 1996
- Stochastic Calculus for Finance II: Continuous-Time Models by S. E. Shreve, Springer, 2003
- Stochastic Finance: An Introduction in Discrete Time by H. Föllmer, A. Schied, de Gruyter, 2011
- Methods of Mathematical Finance by I. Karatzas, S. E. Shreve, Springer, 1998
- Markets with Transaction Costs by Yu. Kabanov, M. Safarian, Springer, 2010
- Introduction to Stochastic Calculus Applied to Finance by D. Lamberton, B. Lapeyre, Chapman & Hall, 1996

## T

**6.463 Module component: Stochastic Information Processing [T-INFO-101366]**

**Coordinators:** Prof. Dr.-Ing. Uwe Hanebeck  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-100829 - Stochastic Information Processing](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 6 CP    | graded  | Each winter term | 1       |

| Courses  |         |                                                   |       |                                                                                                         |                  |
|----------|---------|---------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------|------------------|
| WT 25/26 | 2424113 | <a href="#">Stochastic Information Processing</a> | 3 SWS | Lecture / Practice /  | Hanebeck, Frisch |
| Exams    |         |                                                   |       |                                                                                                         |                  |
| WT 25/26 | 7500031 | <a href="#">Stochastic Information Processing</a> |       |                                                                                                         | Hanebeck         |
| ST 2026  | 7500010 | <a href="#">Stochastic Information Processing</a> |       |                                                                                                         | Hanebeck         |

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

**Assessment**

Success is assessed in the form of an oral examination, usually lasting 15 - 25 minutes in accordance with Section 4 (2) No. 2 SPO.

**Prerequisites**

None.

**Recommendations**

Knowledge of the basics of probability theory is helpful.

**Additional Information**

As a theoretical foundation lecture, "Stochastic Information Systems" is an ideal introduction to the ISAS lectures. Conversely, prior knowledge of "Localization of Mobile Agents" (LMA) [course no. 24613] and "Information Processing in Sensor Networks" (IIS) [course no. 24102] may still be helpful, depending on the type of learner - more concrete applications are highlighted there. In all our lectures, all content is explained in detail from the very beginning; it is therefore possible to start with SI, LMA or IIS.

Below you will find excerpts from courses related to this module component:

## V

**Stochastic Information Processing**

2424113, WS 25/26, 3 SWS, Language: German/English, [Open in study portal](#)

Lecture / Practice (VÜ)  
On-Site

**Content**

To deal with complex dynamic systems, as they occur for example in robotics, one typically requires both system models and the temporal evolution of the system states. For both system identification and state reconstruction, however, usually only noisy data are available.

For continuous state spaces, an exact calculation of the probability densities is only possible in a few special cases. In practice, general nonlinear systems are often traced back to these special cases by simplifying assumptions. One extreme is linearization with subsequent application of linear estimation theory. However, this often leads to unsatisfactory results and requires additional heuristic measures. At the other extreme are numerical approximation methods, which only evaluate the desired probability densities at discrete points in the state space. Although the basic principle of these methods is usually quite simple, their practical implementation is often difficult and, in particular for higher-dimensional systems, computationally demanding.

As a middle ground, analytical nonlinear estimation methods would therefore often be desirable. In this lecture the main difficulties in the development of such estimation methods are outlined and corresponding solution modules are presented. Based on these building blocks, some analytical estimation methods are discussed in detail as examples, which are very suitable for practical implementation and offer a good compromise between computing effort and performance. Useful applications of these estimation methods are also discussed. Both known methods and the results of current research are presented.

**Organizational issues**

Der Prüfungstermin ist per E-Mail zu vereinbaren. Zusätzliche Anmeldung im [CAS](#) nicht vergessen.

**Literature**

**Weiterführende Literatur**

Skript zur Vorlesung



**T****6.464 Module component: Strategy and Management Theory: Developments and "Classics" [T-WIWI-106190]**

**Coordinators:** Prof. Dr. Hagen Lindstädt  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-103119 - Advanced Topics in Strategy and Management](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 3 CP    | graded  | Irregular    | 1       |

| Courses  |         |                                                                                      |       |                                                                                               |           |
|----------|---------|--------------------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|-----------|
| WT 25/26 | 2577921 | <a href="#">Strategy and Management Theory: Developments and "Classics" (Master)</a> | 2 SWS | Lecture /  | Lindstädt |
| Exams    |         |                                                                                      |       |                                                                                               |           |
| WT 25/26 | 7900120 | <a href="#">Strategy and Management Theory: Developments and "Classics"</a>          |       |                                                                                               | Lindstädt |

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

**Assessment**

The control of success according to § 4(2), 3 SPO takes place by writing a scientific work and a presentation of the results of the work in the context of a conclusion meeting. Details on the design of the performance review will be announced during the lecture.

**Prerequisites**

None

**Recommendations**

Basic knowledge as conveyed in the bachelor module „Strategy and Organization“ is recommended.

**Additional Information**

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.

**Workload**

90 hours

Below you will find excerpts from courses related to this module component:

**V****Strategy and Management Theory: Developments and "Classics" (Master)**

2577921, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)

Lecture (V)  
On-Site

**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

**Success Monitoring:**

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.

## T

**6.465 Module component: Successful Transformation Through Innovation [T-WIWI-111823]**

**Coordinators:** Malte Busch  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101507 - Innovation Management](#)  
[M-WIWI-101507 - Innovation Management](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 3 CP    | Graded  | Each summer term | 1       |

| Courses |         |                                                              |       |             |       |
|---------|---------|--------------------------------------------------------------|-------|-------------|-------|
| ST 2026 | 2500018 | <a href="#">Successful transformation through innovation</a> | 2 SWS | Seminar / ● | Busch |

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

**Assessment**

Alternative exam assessments. The grade consists of an presentation of the results (50%) and a seminar paper (50%).

**Recommendations**

Prior attendance of the course Innovation Management [2545015] is recommended.

**Additional Information**

Teaching and learning format: Seminar

**Workload**

90 hours

Below you will find excerpts from courses related to this module component:

## V

**Successful transformation through innovation**

2500018, SS 2026, 2 SWS, Language: German, [Open in study portal](#)

**Seminar (S)**  
On-Site

**Content**

This seminar uses strategic innovation management and concepts such as organizational ambidexterity, boundary spanning and stakeholder approaches to shed light on how companies can increase their innovative capacity through innovation. Students will use a core paper to understand the steps a company takes to become an innovative organization. The aim is to understand how medium-sized companies can develop into innovation-driven organizations in the context of organizational inertia and path dependency with the help of the aforementioned concepts. Part of the seminar will be to analyze the role of different stakeholders and how companies can become part of innovation ecosystems.

Based on the impulses and the core paper, students will apply the concepts they have learned to selected companies and present their results. These are also incorporated into academic seminar papers. As part of this work process, students deal independently with a current, research-oriented question and apply scientific criteria consistently. They research relevant information, analyze and abstract it critically and draw their own conclusions on this basis, reflecting their interdisciplinary knowledge and selectively developing current research findings.

The results obtained are systematically presented in written and oral form in compliance with academic standards - including structured presentation, correct specialist terminology and comprehensible references. In doing so, the students argue in a technically sound manner and are able to defend their positions in scientific discourse with experts. In addition, they are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

**Organizational issues**

Weblink: [https://itm.entechnon.kit.edu/192\\_1281.php](https://itm.entechnon.kit.edu/192_1281.php)[https://itm.entechnon.kit.edu/192\\_1673.php](https://itm.entechnon.kit.edu/192_1673.php)

**T****6.466 Module component: Supplement Enterprise Information Systems [T-WIWI-110346]**

**Coordinators:** Prof. Dr. Andreas Oberweis  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101477 - Development of Business Information Systems](#)

| Type                | Credits | Grading | Term offered | Version |
|---------------------|---------|---------|--------------|---------|
| Written examination | 4,5 CP  | graded  | Each term    | 1       |

**Assessment**

Success is assessed in the form of a written examination (60 minutes) or, if applicable, an oral examination (approx. 30 minutes).

**Prerequisites**

None

**Additional Information**

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.

**Workload**

135 hours

**T****6.467 Module component: Supply Chain Management with Advanced Planning Systems [T-WIWI-102763]**

**Coordinators:** Claus J. Bosch  
Dr. Mathias Göbelt

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

**Part of:** [M-WIWI-101412 - Industrial Production III](#)  
[M-WIWI-101471 - Industrial Production II](#)

**Type**  
Written examination

**Credits**  
3,5 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
1

| Courses  |         |                                                                        |       |                                                                                               |               |
|----------|---------|------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|---------------|
| ST 2026  | 2581961 | <a href="#">Supply Chain Management with Advanced Planning Systems</a> | 2 SWS | Lecture /  | Göbelt, Bosch |
| Exams    |         |                                                                        |       |                                                                                               |               |
| WT 25/26 | 7981961 | <a href="#">Supply Chain Management with Advanced Planning Systems</a> |       |                                                                                               | Schultmann    |

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

**Assessment**

The assessment consists of an oral (30 minutes) or 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.

**Prerequisites**

None

**Recommendations**

None

*Below you will find excerpts from courses related to this module component:*

**V****Supply Chain Management with Advanced Planning Systems**

2581961, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

**Lecture (V)**  
**On-Site**

### **Content**

This lecture deals with supply chain management from a practitioner's perspective with a special emphasis Advanced Planning Systems (APS) and the planning domain. The software solution SAP SCM, one of the most widely used Advanced Planning Systems, is used as an example to show functionality and application of an APS in practice.

First, the term supply chain management is defined and its scope is determined. Methods to analyze supply chains as well as indicators to measure supply chains are derived. Second, the structure of an APS (advanced planning system) is discussed in a generic way. Later in the lecture, the software solution SAP SCM is mapped to this generic structure. The individual planning tasks and software modules (demand planning, supply network planning / sales & operations planning, production planning / detailed scheduling, deployment, transportation planning, global available-to-promise) are presented by discussing the relevant business processes, providing academic background, describing typical planning processes and showing the user interface and user-related processes in the software solution. At the end of the lecture, implementation methodologies and project management approaches for SAP SCM are covered.

### **Contents**

#### **1. Introduction to Supply Chain Management**

- 1.1. Supply Chain Management Fundamentals
- 1.2. Supply Chain Management Analytics

#### **2. Structure of Advanced Planning Systems**

#### **3. SAP SCM**

- 3.1. Introduction / SCM Solution Map
- 3.2. Demand Planning
- 3.3. Supply Network Planning / Sales & Operations Planning
- 3.4. Production Planning and Detailed Scheduling
- 3.5. Deployment
- 3.6. Transportation Planning / Global Available to Promise
- 3.7. Cloud-based Supply Chain Planning

#### **4. SAP SCM in Practice**

- 4.1. Project Management and Implementation
- 4.2. SAP Implementation Methodology

### **Literature**

will be announced in the course

**T****6.468 Module component: Sustainable Information Systems [T-WIWI-114995]**

**Coordinators:** TT-Prof. Dr. Philipp Staudt  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-107649 - Sustainable Information Systems](#)

**Type**  
Written examination

**Credits**  
4,5 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
1

| Courses |         |                                                                     |       |         |        |
|---------|---------|---------------------------------------------------------------------|-------|---------|--------|
| ST 2026 | 2500007 | <a href="#">Methods in Sustainable Information Systems Research</a> | 3 SWS | Lecture | Staudt |

**Assessment**

Written examination (60 minutes). The examination is offered every semester and can be repeated at any regular examination date.

**Workload**

135 hours

*Below you will find excerpts from courses related to this module component:*

**V****Methods in Sustainable Information Systems Research**

2500007, SS 2026, 3 SWS, [Open in study portal](#)

Lecture (V)

**Content**

This lecture provides students with essential research methods for studying sustainability challenges in information systems. The course begins with an introduction to Green IS and sustainability fundamentals, establishing the theoretical foundation for understanding how information systems can contribute to environmental and social goals. Students will gain insight into current research topics and debates in the field of sustainable information systems. The core of the course focuses on key research methodologies used in MIS research, including qualitative approaches such as case study research, as well as quantitative methods including surveys, laboratory experiments, and field experiments. Each method is introduced through published research papers from the sustainability domain, allowing students to see how these approaches are applied in practice. By the end of the course, students will be equipped with the methodological toolkit needed to design and conduct rigorous research on sustainability questions in information systems contexts.

**T****6.469 Module component: Tax Law [T-INFO-111437]**

**Coordinators:** Detlef Dietrich  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-101216 - Private Business Law](#)

**Type**  
Written examination

**Credits**  
3 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
1

| Courses  |         |                         |       |                                                                                               |          |
|----------|---------|-------------------------|-------|-----------------------------------------------------------------------------------------------|----------|
| ST 2026  | 24646   | <a href="#">Tax Law</a> | 2 SWS | Lecture /  | Dietrich |
| Exams    |         |                         |       |                                                                                               |          |
| WT 25/26 | 7500062 | <a href="#">Tax Law</a> |       |                                                                                               | Matz     |
| ST 2026  | 7500120 | <a href="#">Tax Law</a> |       |                                                                                               | Sattler  |

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



## T

**6.470 Module component: Telecommunications and Internet – Economics and Policy [T-WIWI-113147]**

**Coordinators:** Prof. Dr. Kay Mitusch  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101406 - Network Economics](#)  
[M-WIWI-101409 - Electronic Markets](#)  
[M-WIWI-107010 - Economics in a Connected World](#)

**Type**  
Written examination

**Credits**  
4,5 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
1

| Courses  |         |                                                                                    |         |                                                                                                |         |
|----------|---------|------------------------------------------------------------------------------------|---------|------------------------------------------------------------------------------------------------|---------|
| WT 25/26 | 2561232 | <a href="#">Telecommunication and Internet - Economics and Policy</a>              | 2 SWS   | Lecture /   | Mitusch |
| WT 25/26 | 2561233 | <a href="#">Exercises to Telecommunication and Internet - Economics and Policy</a> | 1 SWS   | Practice /  | Mitusch |
| Exams    |         |                                                                                    |         |                                                                                                |         |
| WT 25/26 | 7900246 | <a href="#">Telecommunications and Internet – Economics and Policy</a>             | Mitusch |                                                                                                |         |

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

**Assessment**

Students' understanding and knowledge will be assessed through either an oral or a written exam. The actual method used will be announced during the course. The course takes place every winter term, and exams are offered two times a year, in March and in September.

**Recommendations**

Basic knowledge of microeconomics is a precondition. Further knowledge of industrial economics or networks economics is useful, but not necessary. No prior knowledge of telecommunications or internet technologies is required.

**Additional Information**

Disclaimer:

German wording is sometimes provided in parallel. Some German original literature is used (especially official and legislative texts) where we will try to provide English translations in parallel.

**Workload**

135 hours

Below you will find excerpts from courses related to this module component:

## V

**Telecommunication and Internet - Economics and Policy**

2561232, WS 25/26, 2 SWS, Language: German/English, [Open in study portal](#)

Lecture (V)  
Blended (On-Site/Online)

**Content**Description:

The course provides students with a comprehensive understanding of the economic principles, dynamics, and policies that govern the telecommunication and internet industries and markets. It focuses on the infrastructure of the internet, both physical and logical.

Course Objectives:

**Understand the telecommunication and internet landscape:** Students will be introduced to the historical development, evolution, and current state of the telecommunication and internet industries. This includes technology, industrial organization, regulation, and other policies. Students will explore the emergence of modern telecommunication networks, the birth of the internet, and key milestones that have shaped the global communication landscape.

**Examine network economics:** Students will explore the unique economic characteristics of telecommunications networks, including network effects, economies of scale, the implications for investment decisions and market entry barriers, and regulatory responses.

**Analyse market structures and competition policies:** Students will dive into the various market structures that exist within the telecommunication and internet industries, including: access to the internet by users, access to the infrastructure by firms, economic interactions between the autonomous systems (i.e. sub-networks) and other players (like internet exchange points) of the internet, implications for quality of services and network neutrality. Emphasis will be placed on competitiveness of markets, resp. market power, on the role of regulation, and how they impact market dynamics.

**Investigate infrastructure investment and policy:** The course will address the significant role of infrastructure investment in the telecommunication and internet sectors. Students will analyse the economic drivers behind infrastructure construction, government policies, and regulatory frameworks that influence investment decisions.

**Address emerging trends:** The course will address the latest trends and technologies in telecommunication and the internet, such as 5G, Internet of Things (IoT), and cloud computing, content delivery networks, and their economic implications.

**Assess platform economics:** The role of digital platforms in the telecommunication and internet industries will be addressed. Students will understand platform business models and the economics of multisided markets. In this context, the "hypergiants" of the internet get into the focus as well as the challenges and opportunities they present.

Teaching Methodology:

The course will adopt a combination of lectures, case studies, and guest lectures from (industry) experts. Real-world examples will be used to illustrate economic principles in action within the telecommunication and internet sectors. A few economic models will be analysed, but most of the issues will be addressed verbally.

**T****6.471 Module component: Telecommunications Law [T-INFO-101309]****Organisation:** KIT Department of Informatics**Part of:** [M-INFO-106754 - Public Economic and Technology Law](#)**Type**  
Written examination**Credits**  
3 CP**Grading**  
graded**Term offered**  
Each summer term**Version**  
1

| Courses  |         |                                         |       |                                                                                               |          |
|----------|---------|-----------------------------------------|-------|-----------------------------------------------------------------------------------------------|----------|
| ST 2026  | 2424632 | <a href="#">Telekommunikationsrecht</a> | 2 SWS | Lecture /  | Döveling |
| Exams    |         |                                         |       |                                                                                               |          |
| WT 25/26 | 7500049 | <a href="#">Telecommunications Law</a>  |       |                                                                                               | Zufall   |
| ST 2026  | 7500085 | <a href="#">Telecommunications Law</a>  |       |                                                                                               | Zufall   |

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

## T

## 6.472 Module component: Telematics [T-INFO-114269]

**Coordinators:** Prof. Dr. Martina Zitterbart  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-107243 - Telematics](#)

**Type**  
Written examination

**Credits**  
6 CP

**Grading**  
graded

**Term offered**  
Each winter term

**Version**  
1

| Courses  |         |                            |       |                                                                                               |                                     |
|----------|---------|----------------------------|-------|-----------------------------------------------------------------------------------------------|-------------------------------------|
| WT 25/26 | 2400007 | <a href="#">Telematics</a> | 4 SWS | Lecture /  | Zitterbart, Helmig, Mahrt, Seehofer |
| Exams    |         |                            |       |                                                                                               |                                     |
| WT 25/26 | 7500166 | <a href="#">Telematics</a> |       |                                                                                               | Zitterbart                          |
| ST 2026  | 7500098 | <a href="#">Telematics</a> |       |                                                                                               | Zitterbart                          |

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

### Assessment

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 90 minutes.

Depending on the number of participants, it will be announced six weeks before the examination (Section 6 (3) SPO) whether the assessment will take place

- in the form of an oral examination of approx. 30 minutes in accordance with § 4 Para. 2 No. 2 SPO
- or in the form of a written examination in accordance with § 4 Para. 2 No. 1 SPO

### Prerequisites

None.

### Recommendations

- Contents of the lecture *Introduction to computer networks* or comparable lectures are a prerequisite.
- Attendance of the module-accompanying *basic practical course Protocol Engineering* is recommended.

Below you will find excerpts from courses related to this module component:

## V

### Telematics

2400007, WS 25/26, 4 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
On-Site

### Content

The lecture covers (i.a.) protocols, architectures, as well as methods and algorithms, for routing and establishing reliable end-to-end connections in the Internet. In addition to various methods for media access control in local area networks, the lecture also covers other communication systems, e.g. circuit-switched systems such as ISDN. Participants should also have understood the possibilities for managing and administering networks.

Familiarity with the contents of the lecture *Einführung in Rechnernetze* or comparable lectures is assumed.

### Learning Objectives

After attending this lecture, the students will

- have a profound understanding of protocols, architectures, as well as procedures and algorithms used for routing and for establishing reliable end-to-end connections in the Internet
- have a profound understanding of different media access control procedures in local networks and other communication systems like circuit-switched ISDN
- have a profound understanding of the problems that arise in large scale dynamic communication systems and are familiar with mechanism to deal with these problems
- be familiar with current developments such as SDN and data center networking
- be familiar with different aspects and possibilities for network management and administration

Students have a profound understanding of the basic protocol mechanisms that are necessary to establish reliable end-to-end communication. Students have detailed knowledge about the congestion and flow control mechanisms used in TCP and can discuss fairness issue in the context of multiple parallel transport streams. Students can analytically determine the performance of transport protocols and know techniques for dealing with specific constraints in the context of TCP, e.g., high data rates and low latencies. Students are familiar with current topics such as the problem of middle boxes on the Internet, the usage of TCP in data centers or multipath TCP. Students are also familiar with practical aspects of modern transport protocols and know practical ways to overcome heterogeneity in the development of distributed applications.

Students know the functions of (Internet) routing and routers and can explain and apply common routing algorithms. Students are familiar with routing architectures and different alternatives for buffer placement as well as their advantages and disadvantages. Students understand the classification into interior and exterior gateway protocols and have in-depth knowledge of the functionality and features of common protocols such as RIP, OSPF, and BGP. Students are also familiar with current topics such as label switching, IPv6 and SDN.

Students know the function of media access control and are able to classify and analytically evaluate different media access control mechanisms. Students have an in-depth knowledge of Ethernet and various Ethernet variants and characteristics, which especially includes current developments such as real-time Ethernet and data center Ethernet. Students can explain and apply the Spanning Tree Protocol.

Students know the architecture of ISDN and can reproduce the peculiarities of setting up the ISDN subscriber line. Students are familiar with the technical features of DSL.

### Literature

S. Keshav. An Engineering Approach to Computer Networking. Addison-Wesley, 1997 J.F. Kurose, K.W. Ross. Computer Networking: A Top-Down Approach Featuring the Internet. 4rd Edition, Addison-Wesley, 2007 W. Stallings. Data and Computer Communications. 8th Edition, Prentice Hall, 2006 Weiterführende Literatur •D. Bertsekas, R. Gallager. Data Networks. 2nd Edition, Prentice-Hall, 1991 •F. Halsall. Data Communications, Computer Networks and Open Systems. 4th Edition, Addison-Wesley Publishing Company, 1996 •W. Haaß. Handbuch der Kommunikationsnetze. Springer, 1997 •A.S. Tanenbaum. Computer-Networks. 4th Edition, Prentice-Hall, 2004 •Internet-Standards •Artikel in Fachzeitschriften

## T

**6.473 Module component: Testing Digital Systems I [T-INFO-101388]****Coordinators:** Prof. Dr. Mehdi Baradaran Tahoori**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-100851 - Testing Digital Systems I](#)

| Type             | Credits | Grading | Term offered | Version |
|------------------|---------|---------|--------------|---------|
| Oral examination | 3 CP    | graded  | Irregular    | 1       |

| Courses  |         |                                           |       |                                                                                               |         |
|----------|---------|-------------------------------------------|-------|-----------------------------------------------------------------------------------------------|---------|
| WT 25/26 | 2400151 | <a href="#">Testing Digital Systems I</a> | 2 SWS | Lecture /  | Tahoori |
| Exams    |         |                                           |       |                                                                                               |         |
| WT 25/26 | 7500039 | <a href="#">Testing Digital Systems I</a> |       |                                                                                               | Tahoori |
| ST 2026  | 7500008 | <a href="#">Testing Digital Systems I</a> |       |                                                                                               | Tahoori |

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

The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting 20 minutes.

**Prerequisites**

None.

**Recommendations**

Knowledge of Digital Design and Computer Architecture is helpful.

*Below you will find excerpts from courses related to this module component:*

## V

**Testing Digital Systems I**2400151, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)**Lecture (V)**  
**On-Site****Content**

Testing of digital circuits plays a critical role during the design and manufacturing cycles. It also ensures the quality of parts shipped to the customers. Test generation and design for testability are integral parts of automated design flow of all electronics products. The objective of this course is to provide the foundations for developing test methods for digital systems and provides the techniques necessary to practice design for testability.

This course encompasses the theoretical and practical aspects of digital systems testing and the design of easily testable circuits. Topics include Introduction to Testing (testing definition, types of test, automatic test equipment, test economics, and quality models), Failures and Errors (definitions, failure modes, failure mechanisms, reliability defects), Faults (fault models, stuck-at faults, bridging faults, timing faults, transistor-level faults, functional-level faults, effectiveness of different fault models based on real data), Logic and Fault Simulation (fault equivalence and fault collapsing, true-value simulation, fault simulation algorithms, statistical methods), Test Generation for Combinational Circuits (algebraic methods, path-tracing (D-alg, PODEM, FAN), testability metrics, test file compression), Digital Design-For-Testability and Internal Scan Design (ad-hoc methods, scan architectures, scan-based test methodology).

**T****6.474 Module component: Testing Digital Systems II [T-INFO-105936]**

**Coordinators:** Prof. Dr. Mehdi Baradaran Tahoori  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-102962 - Testing Digital Systems II](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 3 CP    | graded  | Each summer term | 1       |

**Assessment**

The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting 20 minutes.

**Prerequisites**

None.

**Recommendations**

Knowledge of Digital Design and Computer Architecture is helpful.

## T

**6.475 Module component: The de-Casteljau Algorithm [T-INFO-113389]**

**Coordinators:** Prof. Dr. Hartmut Prautzsch  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-106642 - The de-Casteljau Algorithm](#)

**Type**  
Oral examination

**Credits**  
3 CP

**Grading**  
graded

**Version**  
1

| Courses  |         |                                            |       |                                                                                               |           |
|----------|---------|--------------------------------------------|-------|-----------------------------------------------------------------------------------------------|-----------|
| WT 25/26 | 2400170 | <a href="#">The Casteljau's Algorithms</a> | 2 SWS | Lecture /  | Prautzsch |
| Exams    |         |                                            |       |                                                                                               |           |
| WT 25/26 | 7500020 | <a href="#">De Casteljau's Algorithm</a>   |       |                                                                                               | Prautzsch |

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

**Assessment**

The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting approx. 20-30 minutes.

**Prerequisites**

None.



## T

**6.476 Module component: The Ethics and Politics of Information Technology in Market Economies [T-GEISTSOZ-114909]**

**Coordinators:** Dr. phil. Simon Derpmann  
**Organisation:** KIT Department of Humanities and Social Sciences  
**Part of:** [M-WIWI-107601 - Ethics of Information Technology](#)

| Type                | Credits | Grading | Term offered     | Expansion   | Version |
|---------------------|---------|---------|------------------|-------------|---------|
| Written examination | 4,5 CP  | graded  | Each winter term | 1 semesters | 2       |

| Courses  |         |                                                                                                                      |       |                                                                                             |             |
|----------|---------|----------------------------------------------------------------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------|-------------|
| WT 25/26 | 5012090 | <a href="#">Code, Capital, and Conscience: the Ethics and Politics of Information Technology in Market Economies</a> | 2 SWS | Block /  | Derpmann    |
| Exams    |         |                                                                                                                      |       |                                                                                             |             |
| WT 25/26 | 7400772 | <a href="#">The Ethics and Politics of Information Technology in Market Economies</a>                                |       |                                                                                             | Hillerbrand |

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

**Assessment**

The assessment consists of a written exam (60 min.) according to § 4 paragraph 2 Nr. 1 of the examination regulation. The exam is considered passed (grade 4.0) if at least 50 out of a maximum of 100 possible points are achieved. Grades are assigned in increments of five points (the best grade, 1.0, is awarded from 95 points onwards).

By participating in a preparation group for a poster presentation at the final workshop of the course, a bonus of up to five points (equivalent to a maximum of one grade step, i.e. 0.3 or 0.4) can be earned. This bonus will be added to the score of the passed exam. The exact criteria for awarding this bonus will be announced at the beginning of the lecture.

**Workload**

135 hours

Below you will find excerpts from courses related to this module component:

## V

**Code, Capital, and Conscience: the Ethics and Politics of Information Technology in Market Economies**

5012090, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

Block (B)  
On-Site

**Content**

This course examines moral and social issues arising from the use of information technologies in the modern market landscape. Information technologies are transforming social relationships, business, media, education, and politics, and they bring significant ethical and societal challenges.

The course addresses normative perspectives on topics such as digital data collection and usage, privacy, freedom of speech, intellectual property, platform monopolies, surveillance, automation, and current developments in artificial intelligence. Its aim is to provide an overview of these key questions and to offer methodological tools for analyzing their moral and societal dimensions. At the core of the course is the practice of reflection and discourse, using real-life examples, case studies, and current developments. Participants are expected to develop a solid understanding of central ethical concepts and to gain confidence and autonomy in critically engaging with societal debates on the moral implications of information technologies. This enables them to identify and assess ethical challenges in digitization and to formulate and evaluate guidelines and strategies for responsible technology use in business and society.

The course is designed to foster discourse competence and relies on active participation. Successful completion requires regular attendance, engagement in discussion groups, and passing the final exam.

## T

**6.477 Module component: Theoretical Foundations of Cryptography [T-INFO-111199]****Coordinators:** Prof. Dr. Jörn Müller-Quade**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-105584 - Theoretical Foundations of Cryptography](#)**Type**  
Written examination**Credits**  
6 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
1

| Courses  |         |                                                         |       |                                                                                               |                             |
|----------|---------|---------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|-----------------------------|
| WT 25/26 | 2400237 | <a href="#">Theoretical Foundations of Cryptography</a> | 3 SWS | Lecture /  | Müller-Quade, Berger, Klooß |
| Exams    |         |                                                         |       |                                                                                               |                             |
| WT 25/26 | 7500274 | <a href="#">Theoretical Foundations of Cryptography</a> |       |                                                                                               | Müller-Quade                |
| ST 2026  | 7500002 | <a href="#">Theoretical Foundations of Cryptography</a> |       |                                                                                               | Müller-Quade                |

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

The assessment takes the form of a written examination (lasting 120 minutes) in accordance with § 4 Para. 2 No. 1 SPO.

Depending on the number of participants, it will be announced six weeks before the examination (Section 6 (3) SPO) whether the assessment will take the form of an oral examination of approx.

- in the form of an oral examination of approx. 30 minutes in accordance with § 4 Para. 2 No. 2 SPO or
- in the form of a written examination in accordance with § 4 Para. 2 No. 1 SPO

takes place.

**Prerequisites**

If the module M-INFO-100836 Selected Chapters of Cryptography has already been examined, the module Theoretical Foundations of Cryptography cannot be examined.

**T****6.478 Module component: Theory of Satisfiability Algorithms [T-INFO-114982]**

**Coordinators:** Prof. Dr.-Ing. Marvin Künnemann  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-107639 - Theory of Satisfiability Algorithms](#)

**Type**  
Oral examination

**Credits**  
4 CP

**Grading**  
graded

**Expansion**  
1 semesters

**Version**  
1

| Courses |         |                                                     |       |                                                                                                         |           |
|---------|---------|-----------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------|-----------|
| ST 2026 | 2400077 | <a href="#">Theory of Satisfiability Algorithms</a> | 2 SWS | Lecture / Practice /  | Künnemann |

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

**Assessment**

The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting approx. 20-30 minutes.

**Prerequisites**

None.

**Recommendations**

Basic knowledge of algorithms and data structures (e.g., Algorithms 1) and theoretical computer science (e.g., TGI) is assumed.

Basic knowledge in the analysis of randomized algorithms may be helpful (e.g., Probability and Computing), but is not a strict requirement.

Below you will find excerpts from courses related to this module component:

**V****Theory of Satisfiability Algorithms**

2400077, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

Lecture / Practice (VÜ)  
On-Site

**Content****Competency Goals:**

Students know the foundations of the rigorous theoretical analysis of algorithms for the Satisfiability problem and its many variants. They have an overview over the state of the art of worst-case time upper bounds. They understand further theoretical aspects such as combinatorial properties, hardness conjectures, etc. and are able to derive implications for the (sub)exponential-time solvability of related problems.

**Content:**

The Satisfiability (SAT) problem for Boolean formulas is fundamental for computer science, due to a variety of applications (cf. the practical success of SAT solvers) as well as its central role for the theory of computation. This course focuses on theoretical aspects of the problem, which includes topics among:

- exponential-time algorithms with provable worst-case guarantees (e.g., for k-SAT, CNF-SAT and further variants)
- tractable special cases of the problem
- classification of constraint satisfaction problems
- combinatorial insights (e.g., the algorithmic Lovasz Local Lemma)
- the sparsification lemma and its limits
- generalizations: MaxSAT, #SAT, Quantified SAT
- hardness hypotheses and their implications: ETH, SETH, NSETH, MASETH, Formula-SETH
- isolation lemma

**Workload:**

4 CP correspond to roughly 120 h of work, estimated as follows:

- ca. 30 h attendance in lectures
- ca. 60 h follow-up on lectures, solving exercises, independent review
- ca. 30 h preparation for exam

**Prerequisites:**

Basic knowledge of algorithms and data structures (e.g., Algorithms 1) and theoretical computer science (e.g., TGI) is assumed.

Basic knowledge in the analysis of randomized algorithms may be helpful (e.g., Probability and Computing), but is not a strict requirement.

**Competency certificate:**

The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting roughly 20-30 minutes.

## T

**6.479 Module component: Timed Systems [T-INFO-112754]**

**Coordinators:** Jun.-Prof. Dr. Maike Schwammberger

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-106293 - Timed Systems](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 6 CP    | graded  | Each summer term | 4       |

**Assessment**

The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting 20 minutes.

Depending on the number of participants, it will be announced six weeks before the examination (Section 6 (3) SPO) whether the assessment will take the form of an oral examination of approx.

- in the form of an oral examination of approx. 30 minutes in accordance with § 4 Para. 2 No. 2 SPO or

- in the form of a written examination in accordance with § 4 Para. 2 No. 1 SPO

takes place.

**Prerequisites**

None.

**Recommendations**

Basic knowledge in areas of theoretical computer science and modeling of (embedded) software systems is helpful (e.g. temporal logics, finite automata, predicate logic), but is not required.

**Additional Information**

The book "E.-R. Olderog, H. Dierks: Real-Time Systems" is used as reading material for some of the lecture contents (<https://doi.org/10.1017/CBO9780511619953>).

## T

**6.480 Module component: Tools for Probabilistic Machine Learning [T-INFO-113763]**

**Coordinators:** Prof. Dr.-Ing. Uwe Hanebeck  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-106870 - Tools for Probabilistic Machine Learning](#)

| Type             | Credits | Grading        | Term offered     | Version |
|------------------|---------|----------------|------------------|---------|
| Oral examination | 6 CP    | Grading graded | Each winter term | 1       |

| Courses  |         |                                                          |       |                                                                                                         |          |
|----------|---------|----------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------|----------|
| WT 25/26 | 2400215 | <a href="#">Tools for Probabilistic Machine Learning</a> | 3 SWS | Lecture / Practice /  | Frisch   |
| Exams    |         |                                                          |       |                                                                                                         |          |
| WT 25/26 | 7500093 | <a href="#">Tools for Probabilistic Machine Learning</a> |       |                                                                                                         | Hanebeck |
| WT 25/26 | 7500386 | <a href="#">Tools for Probabilistic Machine Learning</a> |       |                                                                                                         | Hanebeck |
| ST 2026  | 7500487 | <a href="#">Tools for Probabilistic Machine Learning</a> |       |                                                                                                         | Hanebeck |

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

Below you will find excerpts from courses related to this module component:

## V

**Tools for Probabilistic Machine Learning**

2400215, WS 25/26, 3 SWS, Language: German, [Open in study portal](#)

Lecture / Practice (VÜ)  
Blended (On-Site/Online)

**Content**

The module is designed to teach students the theoretical and practical aspects of probabilistic machine learning. A broad selection of tools from estimation theory is presented in such a way that both a formal, academic as well as a clear, intuitive understanding of the basic principle is attained. Furthermore, the functionality of state-of-art implementations in the relevant libraries will be reviewed. The focus is on the ability to solve a wide range of problems by linking individual numerical and theoretical tools in a modular fashion to form a formally correct and numerically computable processing pipeline. In each case, we examine the reliability of the results. All this is supported by a purely digital exercise with calculation and programming tasks.

Presented numerical tools are interpolation, regression (linear and spline, Gaussian process), Deep Learning (Feed Forward Neural Network, Bayesian Neural Network), non-linear optimization (steepest descent, Newton), sampling (independent random, deterministic), cubature (Monte Carlo, quasi-Monte Carlo).

Theoretical tools presented are factorization of the joint density with acyclic graphs, density representation (Gaussian, Exponential Family), least squares, maximum likelihood, risk minimization, error-tolerant estimation, Bayesian Model Selection, meta-priors, active inference.

Exam: Oral, appointments via Mail to [pruefung-isas@kit.edu](mailto:pruefung-isas@kit.edu). Don't forget the additional registration in [CAS](#).

**Organizational issues**

Enthält eine digitale Übung mit Programmieraufgaben.

**T****6.481 Module component: Tools for Probabilistic Machine Learning - Pass [T-INFO-113764]**

**Coordinators:** Prof. Dr.-Ing. Uwe Hanebeck  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-106870 - Tools for Probabilistic Machine Learning](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 0 CP    | graded  | Each winter term | 1       |

| Courses  |         |                                                                 |       |                                                                                                         |          |
|----------|---------|-----------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------|----------|
| WT 25/26 | 2400215 | <a href="#">Tools for Probabilistic Machine Learning</a>        | 3 SWS | Lecture / Practice /  | Frisch   |
| Exams    |         |                                                                 |       |                                                                                                         |          |
| WT 25/26 | 7500096 | <a href="#">Tools for Probabilistic Machine Learning - Pass</a> |       |                                                                                                         | Hanebeck |
| ST 2026  | 7500488 | <a href="#">Tools for Probabilistic Machine Learning - Pass</a> |       |                                                                                                         | Hanebeck |

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

Below you will find excerpts from courses related to this module component:

**V****Tools for Probabilistic Machine Learning**

2400215, WS 25/26, 3 SWS, Language: German, [Open in study portal](#)

Lecture / Practice (VÜ)  
Blended (On-Site/Online)

**Content**

The module is designed to teach students the theoretical and practical aspects of probabilistic machine learning. A broad selection of tools from estimation theory is presented in such a way that both a formal, academic as well as a clear, intuitive understanding of the basic principle is attained. Furthermore, the functionality of state-of-art implementations in the relevant libraries will be reviewed. The focus is on the ability to solve a wide range of problems by linking individual numerical and theoretical tools in a modular fashion to form a formally correct and numerically computable processing pipeline. In each case, we examine the reliability of the results. All this is supported by a purely digital exercise with calculation and programming tasks.

Presented numerical tools are interpolation, regression (linear and spline, Gaussian process), Deep Learning (Feed Forward Neural Network, Bayesian Neural Network), non-linear optimization (steepest descent, Newton), sampling (independent random, deterministic), cubature (Monte Carlo, quasi-Monte Carlo).

Theoretical tools presented are factorization of the joint density with acyclic graphs, density representation (Gaussian, Exponential Family), least squares, maximum likelihood, risk minimization, error-tolerant estimation, Bayesian Model Selection, meta-priors, active inference.

Exam: Oral, appointments via Mail to [pruefung-isas@kit.edu](mailto:pruefung-isas@kit.edu). Don't forget the additional registration in [CAS](#).

**Organizational issues**

Enthält eine digitale Übung mit Programmieraufgaben.

## T

**6.482 Module component: Topics in Experimental Economics [T-WIWI-102863]**

**Coordinators:** Prof. Dr. Johannes Philipp Reiß  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101505 - Experimental Economics](#)

| Type                | Credits | Grading | Term offered | Version |
|---------------------|---------|---------|--------------|---------|
| Written examination | 4,5 CP  | graded  | Irregular    | 1       |

**Assessment**

The assessment consists of a written exam (following §4(2), 1 of the examination regulation).

**Prerequisites**

None

**Recommendations**

Basic knowledge of Experimental Economics is assumed. Therefore, it is strongly recommended to attend the course Experimental Economics beforehand.

**Additional Information**

The repeat examination can be taken at any later, regular examination date. The examination dates are only offered in the semester in which the course is offered and in the semester immediately following. The subject matter relates to the last course held.

**Workload**

135 hours



**T****6.483 Module component: Topics in Stochastic Optimization [T-WIWI-112109]****Coordinators:** Prof. Dr. Steffen Rebennack**Organisation:** KIT Department of Business and Economics

**Part of:** [M-WIWI-101473 - Mathematical Programming](#)  
[M-WIWI-101637 - Analytics and Statistics](#)  
[M-WIWI-102832 - Operations Research in Supply Chain Management](#)  
[M-WIWI-103289 - Stochastic Optimization](#)

| Type                        | Credits | Grading | Term offered     | Version |
|-----------------------------|---------|---------|------------------|---------|
| Examination of another type | 4,5 CP  | graded  | Each winter term | 1       |

**Assessment**

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.

**Recommendations**

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.

**Additional Information**

Teaching and learning format: Lecture and exercise

**Workload**

135 hours

## T

**6.484 Module component: Trademark and Unfair Competition Law [T-INFO-101313]****Coordinators:** Dr. Yvonne Matz**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-101215 - Intellectual Property Law](#)**Type**  
Written examination**Credits**  
3 CP**Grading**  
graded**Term offered**  
Each term**Version**  
1

| Courses  |         |                                                      |       |                                                                                               |      |
|----------|---------|------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|------|
| WT 25/26 | 2424136 | <a href="#">Trademark and Unfair Competition Law</a> | 2 SWS | Lecture /  | Matz |
| ST 2026  | 24609   | <a href="#">Trademark and Unfair Competition Law</a> | 2 SWS | Lecture /  | Matz |
| Exams    |         |                                                      |       |                                                                                               |      |
| WT 25/26 | 7500061 | <a href="#">Trademark and Unfair Competition Law</a> | Matz  |                                                                                               |      |
| ST 2026  | 7500051 | <a href="#">Trademark and Unfair Competition Law</a> | Matz  |                                                                                               |      |

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

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 60 minutes.

**Prerequisites**

None.

## T

**6.485 Module component: Transport Economics [T-WIWI-100007]**

**Coordinators:** Prof. Dr. Kay Mitusch  
Dr. Eckhard Szimba

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

**Part of:** [M-WIWI-101406 - Network Economics](#)  
[M-WIWI-101468 - Environmental Economics](#)  
[M-WIWI-101485 - Transport Infrastructure Policy and Regional Development](#)

**Type**  
Written examination

**Credits**  
4,5 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
1

| Courses  |         |                                            |       |          |                 |
|----------|---------|--------------------------------------------|-------|----------|-----------------|
| ST 2026  | 2560230 | <a href="#">Transport Economics</a>        | 2 SWS | Lecture  | Mitusch, Szimba |
| ST 2026  | 2560231 | <a href="#">Übung zu Transportökonomie</a> | 1 SWS | Practice | Krenn           |
| Exams    |         |                                            |       |          |                 |
| WT 25/26 | 7900232 | <a href="#">Transport Economics</a>        |       |          | Mitusch         |

**Assessment**

The assessment is made by a 60 minutes written examination during the semester break (according to §4(2), 1 ERSC). Examination is offered every semester and can be retried at any regular examination date.

*Below you will find excerpts from courses related to this module component:*

## V

**Transport Economics**

2560230, SS 2026, 2 SWS, Language: German, [Open in study portal](#)

**Lecture (V)**

**Content**

The course shall provide an overview of transport economics. It will be demonstrated, using new microeconomic models, which impacts regulation and pricing in transport have on the economic actions of individuals and logisticians and which benefits and costs apply. The following topics will be discussed:

- demand and supply in transport
- empirical analysis of transport demand
- assessment of transport infrastructure projects
- external effects in transport
- transport policy
- cost structures of transport infrastructure
- Project evaluation from the perspective of the public sector

**Literature****Literatur:**

Aberle, G: Transportwirtschaft: einzelwirtschaftliche und gesamtwirtschaftliche Grundlagen München; Wien: Oldenbourg, 2003.

Blauwens, G., De Baere, P. and Van der Voorde, E. (2006): Transport Economics.

Frerich, J; Müller, G: Europäische Verkehrspolitik, Landverkehrspolitik München; Wien: Oldenbourg, 2004.

Dasgupta, A, Pearce, D (1972): Cost-Benefit Analysis, MacMillan, London.

Europäische Kommission (2008): Guide to Cost Benefit Analysis of Investment Projects, online unter [http://ec.europa.eu/regional\\_policy/sources/Ben-Akiva](http://ec.europa.eu/regional_policy/sources/Ben-Akiva), M., Meerseman, H., and Van de Voorde, E. (2008): Recent developments in transport modelling: Lessons for the freight sector.

Ortúzar, J. d. D. and Willumsen, L. (1990): Modelling Transport.

## T

**6.486 Module component: Type Systems and Program Analysis [T-INFO-115016]****Coordinators:** Prof. Dr. Sebastian Erdweg**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107664 - Type Systems and Program Analysis](#)**Type**  
Written examination**Credits**  
6 CP**Grading**  
graded**Term offered**  
Irregular**Expansion**  
1 semesters**Version**  
1

| Courses |         |                                                                                    |        |                                                                                                |                    |
|---------|---------|------------------------------------------------------------------------------------|--------|------------------------------------------------------------------------------------------------|--------------------|
| ST 2026 | 2400188 | <a href="#">Type Systems and Static Program Analysis</a>                           | 2 SWS  | Lecture /   | Erdweg, Lego       |
| ST 2026 | 2400192 | <a href="#">Exercises for the lecture Type Systems and Static Program Analysis</a> | 2 SWS  | Practice /  | Erdweg, Lego, Marx |
| Exams   |         |                                                                                    |        |                                                                                                |                    |
| ST 2026 | 7500304 | <a href="#">Type Systems and Program Analysis</a>                                  | Erdweg |                                                                                                |                    |

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

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 120 minutes.

**Prerequisites**

None.

**Recommendations**

Knowledge of programming semantics is helpful but not required.

Knowledge of logic inference systems is helpful but not required.

## T

**6.487 Module component: Ubiquitous Computing [T-INFO-114188]****Coordinators:** Prof. Dr.-Ing. Michael Beigl**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-107161 - Ubiquitous Computing](#)  
[M-WIWI-107531 - Information Systems: Interactive Systems](#)**Type**  
Oral examination**Credits**  
5 CP**Grading**  
graded**Term offered**  
Each winter term**Version**  
1

| Courses  |                    |                                      |  |                    |                 |
|----------|--------------------|--------------------------------------|--|--------------------|-----------------|
| WT 25/26 | 2424146            | <a href="#">Ubiquitous Computing</a> |  | Lecture / Practice | Beigl, Röddiger |
| Exams    |                    |                                      |  |                    |                 |
| WT 25/26 | 7500342_06.02.2026 | <a href="#">Ubiquitous Computing</a> |  |                    | Beigl           |
| WT 25/26 | 7500367_07.11.2025 | <a href="#">Ubiquitous Computing</a> |  |                    | Beigl           |
| WT 25/26 | 7500372_05.02.2026 | <a href="#">Ubiquitous Computing</a> |  |                    | Beigl           |

**Assessment**

The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting 20 minutes.

**Prerequisites**

None.

*Below you will find excerpts from courses related to this module component:*

## V

**Ubiquitous Computing**2424146, WS 25/26, SWS, Language: English, [Open in study portal](#)**Lecture / Practice (VÜ)**

**Content**

In the practical part of the lecture, students deepen their understanding of ubiquitous systems through the practical application of the knowledge base of the lecture. To this end, students design and develop their own appliance and test it. The aim is to have gone through the steps towards a prototypical and possibly marketable appliance.

**Description:**

The lecture provides an overview of concepts, theories, and methods of ubiquitous information technology (ubiquitous computing).

Based on the appliance concept, students then develop their own appliance in the exercise. The necessary technical and methodological basics such as hardware for ubiquitous systems, software for ubiquitous systems, principles of context recognition for ubiquitous systems, networking of ubiquitous systems, and design principles such as design thinking are discussed. Methods of design and testing for human-machine interaction and human-machine interfaces developed in ubiquitous computing are explained in detail. An introduction to the economic aspects of a ubiquitous system is also provided.

In the practical part of the lecture, students deepen their understanding of ubiquitous systems by applying the knowledge gained in the lecture. Students design and develop their own appliance and test it. The aim is to go through the steps towards a prototypical and potentially marketable appliance.

**Course content:**

The lecture provides an overview of concepts, theories, and methods of ubiquitous information technology (ubiquitous computing). Based on the appliance concept, students then design their own appliances in the exercise, plan the construction, and then develop them. The necessary technical and methodological basics such as hardware for ubiquitous systems, software for ubiquitous systems, principles of context recognition for ubiquitous systems, networking of ubiquitous systems, and design of ubiquitous systems (e.g., design thinking) and topics related to the development of miniature electronics and 3D printing are discussed. Methods of design and testing for human-machine interaction and human-machine interfaces developed in ubiquitous computing are also explained. There is also an introduction to the economic aspects of a ubiquitous system.

In the practical part of the lecture, understanding of ubiquitous systems is deepened through practical application of the knowledge base of the lecture. Students design and develop their own devices, including electronics and programming, and test them. The goal is to go through the steps toward a prototypical and potentially marketable appliance.

**Workload:**

The total workload for this learning unit is approximately 150 hours (5.0 credits).

**Activity****Workload****Attendance time: Attendance at lectures**

15 x 90 min

22 h 30 min

**Attendance time: Attendance at exercises**

15 x 45 min

11 h 15 min

**Preparation/follow-up for lectures and exercises**

15 x 90 min

22 h 30 min

**Develop a self-developed concept for an information appliance.**

33 hours 45 min

**Go through the slide set twice.**

2 x 12 hours

24 hours

**Prepare for the exam.**

36 hours

**TOTAL**

**150 hours**

Workload for the learning unit "Ubiquitous Information Technologies"

**Learning objectives:**

The aim of the lecture is to impart knowledge about the fundamentals and advanced methods and techniques of ubiquitous computing. After completing the lecture, students will be able to

- Reproduce and discuss the knowledge they have acquired about existing ubiquitous computing systems.
- Evaluate general knowledge about ubiquitous systems and apply statements and principles to special cases.
- evaluate and assess different methods for design processes and user studies, and select suitable methods for developing new solutions.

- invent, plan, design, build (electronics, software, 3D printing) and evaluate new ubiquitous systems for use in everyday or industrial process environments, and assess the costs and technical implications.

**Organizational issues**

Mündliche Prüfung nach Vereinbarung.

Die Erfolgskontrolle erfolgt in Form einer mündlichen Prüfung im Umfang von 20 min. nach § 4 Abs. 2 Nr. 2 SPO.

Vorlesung: Dienstags, 11:30 bis 13:00 Uhr, Geb. 50.34, Raum -102

Übung: Mittwochs, 08:00 bis 09:30 Uhr, Geb. 07.07, Raum 222

Oral exam by arrangement.

Performance is assessed in the form of a 20-minute oral exam in accordance with § 4 (2) No. 2 SPO.

Lecture: Tuesdays, 11:30 a.m. to 1:00 p.m., Building 50.34, Room -102

Exercise: Wednesdays, 8:00 a.m. to 9:30 a.m., Building 07.07, Room 222

## T

## 6.488 Module component: Valuation [T-WIWI-102621]

**Coordinators:** Prof. Dr. Martin Ruckes

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

**Part of:** [M-WIWI-101480 - Finance 3](#)  
[M-WIWI-101482 - Finance 1](#)  
[M-WIWI-101483 - Finance 2](#)  
[M-WIWI-101510 - Cross-Functional Management Accounting](#)

| Type                | Credits | Grading | Term offered     | Version |
|---------------------|---------|---------|------------------|---------|
| Written examination | 4,5 CP  | Graded  | Each winter term | 1       |

| Courses  |         |                                      |       |                                                                                                |                  |
|----------|---------|--------------------------------------|-------|------------------------------------------------------------------------------------------------|------------------|
| WT 25/26 | 2530212 | <a href="#">Valuation</a>            | 2 SWS | Lecture /   | Ruckes           |
| WT 25/26 | 2530213 | <a href="#">Übungen zu Valuation</a> | 1 SWS | Practice /  | Ruckes, Luedecke |
| Exams    |         |                                      |       |                                                                                                |                  |
| WT 25/26 | 7900057 | <a href="#">Valuation</a>            |       |                                                                                                | Ruckes           |
| ST 2026  | 7900072 | <a href="#">Valuation</a>            |       |                                                                                                | Ruckes           |

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

### Assessment

See German version.

### Prerequisites

None

### Recommendations

None

Below you will find excerpts from courses related to this module component:

## V

### Valuation

2530212, WS 25/26, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
On-Site

### Literature

#### Weiterführende Literatur

Titman/Martin (2013): *Valuation - The Art and Science of Corporate Investment Decisions*, 2nd. ed. Pearson International.



## T

**6.489 Module component: Virtual Systems [T-INFO-101612]**

**Coordinators:** Prof. Dr.-Ing. Frank Bellosa  
**Organisation:** KIT Department of Informatics  
**Part of:** [M-INFO-100867 - Virtual Systems](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 3 CP    | Graded  | Each winter term | 1       |

| Courses  |         |                                 |       |                                                                                               |         |
|----------|---------|---------------------------------|-------|-----------------------------------------------------------------------------------------------|---------|
| WT 25/26 | 2400028 | <a href="#">Virtual Systems</a> | 2 SWS | Lecture /  | Bellosa |
| Exams    |         |                                 |       |                                                                                               |         |
| WT 25/26 | 7500028 | <a href="#">Virtual Systems</a> |       |                                                                                               | Bellosa |
| ST 2026  | 7500189 | <a href="#">Virtual Systems</a> |       |                                                                                               | Bellosa |

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

Below you will find excerpts from courses related to this module component:

## V

**Virtual Systems**

2400028, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)

**Lecture (V)**  
On-Site

## T

## 6.490 Module component: Visualization [T-INFO-101275]

**Coordinators:** Prof. Dr.-Ing. Carsten Dachsbacher

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-100738 - Visualization](#)

| Type             | Credits | Grading | Term offered     | Version |
|------------------|---------|---------|------------------|---------|
| Oral examination | 5 CP    | Graded  | Each summer term | 1       |

| Courses  |         |                                |       |                                                                                               |             |
|----------|---------|--------------------------------|-------|-----------------------------------------------------------------------------------------------|-------------|
| ST 2026  | 2400175 | <a href="#">Visualisierung</a> | 2 SWS | Lecture /  | Dachsbacher |
| Exams    |         |                                |       |                                                                                               |             |
| WT 25/26 | 7500563 | <a href="#">Visualization</a>  |       |                                                                                               | Dachsbacher |
| ST 2026  | 7500193 | <a href="#">Visualization</a>  |       |                                                                                               | Dachsbacher |

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

## T

**6.491 Module component: Wearable Robotic Technologies [T-INFO-114145]**

**Coordinators:** Prof. Dr.-Ing. Tamim Asfour  
Prof. Dr.-Ing. Michael Beigl

**Organisation:** KIT Department of Informatics

**Part of:** [M-INFO-107113 - Wearable Robotic Technologies](#)

**Type**  
Written examination

**Credits**  
4 CP

**Grading**  
graded

**Term offered**  
Each summer term

**Version**  
1

| Courses  |         |                                               |       |                                                                                               |               |
|----------|---------|-----------------------------------------------|-------|-----------------------------------------------------------------------------------------------|---------------|
| ST 2026  | 2400062 | <a href="#">Wearable Robotic Technologies</a> | 2 SWS | Lecture /  | Asfour, Beigl |
| Exams    |         |                                               |       |                                                                                               |               |
| WT 25/26 | 7500073 | <a href="#">Wearable Robotic Technologies</a> |       |                                                                                               | Asfour        |
| ST 2026  | 7500219 | <a href="#">Wearable Robotic Technologies</a> |       |                                                                                               | Asfour, Beigl |

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

**Assessment**

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 60 minutes.

**Modeled Prerequisites**

The following conditions have to be fulfilled:

1. The module component [T-INFO-106557 - Wearable Robotic Technologies](#) must not have been started.

Below you will find excerpts from courses related to this module component:

## V

**Wearable Robotic Technologies**

2400062, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

**Lecture (V)**  
On-Site

**Content**

The lecture provides a comprehensive introduction to wearable robotic technologies. It covers human anatomy and biomechanics as foundations for wearable robot design. Joint biomechanics, locomotion and gait analysis, the neuromuscular system, and models of the human body are discussed to understand how wearable robots can be designed and controlled.

Design principles and mechanisms of wearable robots are addressed. Actuation technologies are covered in depth: requirements analysis based on human motion and user needs, compliant actuation approaches (serial elastic, parallel elastic, variable stiffness actuation), and strategies for increasing efficiency such as energy harvesting, multi-articulation, and underactuation.

The lecture covers wearable computing principles such as body signals and phenomena, design principles for body-worn systems, attachment considerations based on body maps for heat tolerance, weight distribution, and flexibility, and fabric design with textile-embedded electronics.

Exoskeleton systems are presented, covering application areas, design challenges such as redundancy, kinematic compatibility, and misalignments, various types of exoskeletons, and the general design process. Prosthetic systems cover types of hand and lower limb prostheses, hand synergies for control, and mechanical interfaces through socket design.

Human-robot interaction addresses both physical and cognitive interfaces. Control strategies are presented for prosthetic systems (semi-autonomous grasping) and exoskeleton systems (hierarchical control, assistance evaluation). The concept of body schema from both neuroscience and robotics perspectives is discussed, emphasizing symbiotic human-machine interaction in tightly coupled wearable systems. State-of-the-art examples across various application domains illustrate current research and developments.

**Learning Objectives:**

Students can explain the fundamentals, motivation, and applications of wearable robotic technologies including exoskeletons, orthoses, and prostheses. They have comprehensive knowledge of human anatomy, biomechanics, and the neuromuscular system relevant to wearable robot design.

Students understand the core components and challenges associated with the design of wearable robotic technologies, including mechanisms, actuation technologies, sensing approaches, and wearable computing concepts. They can analyze design requirements and challenges including kinematic compatibility and human-robot interfaces for wearable robots.

Students can explain control strategies for prosthetic and exoskeleton systems, understand both physical and cognitive aspects of human-robot interaction, and comprehend concepts such as body schema and symbiotic human-machine interaction in wearable systems.

**Organizational issues**

Success is assessed in the form of a written examination, usually lasting 60 minutes in accordance with § 4 (2) No. 1 SPO

**Workload:**

120 h

- approx.  $15 * 2 \text{ h} = 30 \text{ h}$  attendance in the lecture
- approx.  $15 * 3 \text{ h} = 45 \text{ h}$  preparation and follow-up of the lecture
- approx. 45 h preparation for the exam and exam itself

**Literature**

Lecture slides and selected current literature references will be given in the lecture and made available in ILIAS.

**T****6.492 Module component: Web App Programming for Finance [T-WIWI-110933]**

**Coordinators:** Prof. Dr. Julian Thimme  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-101480 - Finance 3](#)

| Type                | Credits | Grading | Term offered | Version |
|---------------------|---------|---------|--------------|---------|
| Written examination | 4,5 CP  | graded  | Once         | 1       |

**Assessment**

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

**Recommendations**

The content of the bachelor course Investments is assumed to be known and necessary to follow the course.

**Workload**

135 hours

**T****6.493 Module component: Web Applications and Service-Oriented Architectures (II) [T-INFO-101271]****Coordinators:** Prof. Dr. Sebastian Abeck**Organisation:** KIT Department of Informatics**Part of:** [M-INFO-100734 - Web Applications and Service-Oriented Architectures \(II\)](#)  
[M-WIWI-107529 - Information Systems: Software & Systems Engineering](#)**Type**  
Oral examination**Credits**  
4 CP**Grading**  
graded**Term offered**  
Each summer term**Version**  
1

| Courses |         |                                                                          |       |                                                                                               |                           |
|---------|---------|--------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|---------------------------|
| ST 2026 | 24677   | <a href="#">Web Applications and Service oriented Architectures (II)</a> | 2 SWS | Lecture /  | Abeck, Schneider, Throner |
| Exams   |         |                                                                          |       |                                                                                               |                           |
| ST 2026 | 7500138 | <a href="#">Web Applications and Service-oriented Architectures (II)</a> |       |                                                                                               | Abeck                     |

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

**T****6.494 Module component: Workshop Business Wargaming – Analyzing Strategic Interactions [T-WIWI-106189]**

**Coordinators:** Prof. Dr. Hagen Lindstädt  
**Organisation:** KIT Department of Business and Economics  
**Part of:** [M-WIWI-103119 - Advanced Topics in Strategy and Management](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 3 CP    | graded  | Irregular    | 1       |

| Courses |         |                                                                                            |       |                                                                                               |           |
|---------|---------|--------------------------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|-----------|
| ST 2026 | 2577922 | <a href="#">Workshop Business Wargaming - Analyse strategischer Interaktionen (Master)</a> | 2 SWS | Lecture /  | Lindstädt |
| Exams   |         |                                                                                            |       |                                                                                               |           |
| ST 2026 | 7900071 | <a href="#">Workshop Business Wargaming – Analyzing Strategic Interactions</a>             |       |                                                                                               | Lindstädt |

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

**Assessment**

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

**Recommendations**

Basic knowledge as conveyed in the bachelor module „Strategy and Organization“ is recommended.

**Additional Information**

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.

**Workload**

90 hours

Below you will find excerpts from courses related to this module component:

**V****Workshop Business Wargaming - Analyse strategischer Interaktionen (Master)**

2577922, SS 2026, 2 SWS, Language: English, [Open in study portal](#)

Lecture (V)  
On-Site

**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

**Competence Certificate:**

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.

**Note:**

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**

IBU-Seminarraum, Geb. 05.20, Raum 2A-12.1



**T****6.495 Module component: Workshop Current Topics in Strategy and Management [T-WIWI-106188]****Coordinators:** Prof. Dr. Hagen Lindstädt**Organisation:** KIT Department of Business and Economics**Part of:** [M-WIWI-103119 - Advanced Topics in Strategy and Management](#)

| Type                        | Credits | Grading | Term offered | Version |
|-----------------------------|---------|---------|--------------|---------|
| Examination of another type | 3 CP    | graded  | Irregular    | 1       |

| Courses  |         |                                                                            |       |                                                                                               |           |
|----------|---------|----------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------|-----------|
| WT 25/26 | 2577923 | <a href="#">Workshop aktuelle Themen Strategie und Management (Master)</a> | 2 SWS | Lecture /  | Lindstädt |
| Exams    |         |                                                                            |       |                                                                                               |           |
| WT 25/26 | 7900171 | <a href="#">Workshop Current Topics in Strategy and Management</a>         |       |                                                                                               | Lindstädt |

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

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

**Recommendations**

Basic knowledge as conveyed in the bachelor module „Strategy and Organization“ is recommended.

**Additional Information**

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.

**Workload**

90 hours

Below you will find excerpts from courses related to this module component:

**V****Workshop aktuelle Themen Strategie und Management (Master)**2577923, WS 25/26, 2 SWS, Language: German, [Open in study portal](#)Lecture (V)  
On-Site

**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

**Competence Certificate:**

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.