Karlsruher Institut für Technologie

Module Handbook
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KIT DEPARTMENT OF ECONOMICS AND MANAGEMENT / KIT DEPARTMENT OF INFORMATICS

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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.

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, 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.

2 General Information

2.1 Study program details

KIT-Department	KIT Department of Economics and Management / 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 www.wirtschaftsinformatik.kit.edu/studiengang.php Department www.wirtschaftsinformatik.kit.edu/studiengang.php

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 Economics and Management 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 Criterias

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
1. **Firstsemester:** 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
1st semester: 15 July for the winter semester, 15 January for the summer semester.**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
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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 Economics and Management 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	Module 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 neu	EN	WS+SS	9 CP
M-WIWI-107528	Information Systems: Digital Markets & Services neu	DE/EN	WS+SS	9 CP
M-WIWI-107531	Information Systems: Interactive Systems neu	DE/EN	WS+SS	9 CP
M-WIWI-107529	Information Systems: Software & Systems Engineering neu	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-107198	Advanced Artificial Intelligence	EN	SS	6 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 neu	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-107431	Selected Aspects in Real-time Systems neu	DE	WS	3 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-106019	Automotive Software Engineering (ASE)	DE/EN	WS	4 CP
M-INFO-107599	Beating the Worst-Case in Practice: Unexpectedly Efficient Algorithms neu	EN	Irreg.	6 CP
M-INFO-106824	Coding Theory	DE	WS	3 CP
M-INFO-106966	Compiler Design neu	EN	Irreg.	9 CP
M-INFO-107228	Computational Geometry	EN	Irreg.	6 CP
M-INFO-106190	Computational Imaging neu	EN	WS	5 CP
M-INFO-100856	Computer Graphics	DE	WS	6 CP
M-INFO-106685	Computer Graphics 2 neu	DE/EN	SS	5 CP
M-INFO-106256	Constructive Logic neu	EN	SS	5 CP
M-WIWI-106631	Cooperative Autonomous Vehicles	EN	WS+SS	9 CP
M-INFO-106655	Data Science and Artificial Intelligence for Energy Systems neu	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-105753	Deep Learning for Computer Vision I: Basics	DE/EN	SS	3 CP
M-INFO-105755	Deep Learning for Computer Vision II: Advanced Topics	DE/EN	WS	3 CP
M-INFO-106642	The de-Casteljau Algorithm neu	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-100798	Empirical Software Engineering	DE	WS	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-106495	Research Practical Course: Explainable Artificial Intelligence neu	EN	WS	6 CP

M-INFO-105723	Advanced Algorithmic Programming neu	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 neu	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-107152	Humanoid Robots - Seminar neu	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-100742	Cryptographic Voting Schemes	DE	Irreg.	3 CP
M-INFO-107176	Lab Project: Speech Translation	EN	WS	6 CP
M-INFO-106102	Logical Foundations of Cyber-Physical Systems	EN	WS	6 CP
M-INFO-100840	Localization of Mobile Agents	DE	SS	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	WS	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 neu	EN	SS	3 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-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 neu	EN	Irreg.	6 CP
M-INFO-107244	Practical Course on Network Security Research	EN	Irreg.	3 CP
M-INFO-107597	Practical Course on Telematics neu	EN	WS	3 CP
M-INFO-107220	Practical Course on Telematics Research neu	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	4 CP

M-INFO-107265	Practical Course: Chip Design I neu	EN	WS+SS	3 CP
M-INFO-107266	Practical Course: Chip Design II neu	EN	WS+SS	3 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-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-107494	Practical Course: Interactive Theorem Proving neu	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-107177	Practical Course: Natural Language Dialog Systems	EN	Irreg.	6 CP
M-INFO-107600	Practical Course: Route Planning neu	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 neu	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-102411	Practical Course Automatic Speech Recognition	DE	WS	3 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-103143	Practical Course: Neural Network Exercises	DE/EN	WS	3 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-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-104254	Practical Course: Engineering Approaches to Software Development	DE	WS+SS	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 neu	DE/EN	WS+SS	6 CP
M-INFO-106687	Practical Course: Rendering in CGI neu	DE/EN	WS+SS	6 CP
M-INFO-106686	Practical Course: Scientific Visualization neu	DE/EN	WS+SS	6 CP
M-INFO-103235	Practical Course: Smart Data Analytics	DE	SS	6 CP
M-INFO-101635	Practical Course: Web Applications and Service-Oriented Architectures (II)	DE	SS	5 CP
M-INFO-104893	Practical Course: Tools for Agile Modelling neu	DE/EN	WS+SS	6 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	WS	3 CP
M-INFO-106654	Research Focus Class: Blockchain & Cryptocurrencies	EN	Irreg.	6 CP
M-INFO-106300	Research Practical Course: Interactive Learning	EN	SS	6 CP
M-INFO-107174	Research Project Deep Learning for Robotics neu	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 neu	EN	WS	6 CP
M-INFO-107598	RIG Lecture Series neu	EN	WS	3 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-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 neu	EN	WS	4 CP
M-INFO-106301	Seminar: Interactive Learning	EN	SS	3 CP
M-INFO-104877	Safe Human-Robot-Collaboration neu	DE	WS	3 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-100829	Stochastic Information Processing	DE	WS	6 CP
M-INFO-107243	Telematics	EN	WS	6 CP
M-INFO-100851	Testing Digital Systems I	EN	SS	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-106293	Timed Systems neu	EN	SS	6 CP
M-INFO-106870	Tools for Probabilistic Machine Learning	DE	WS	6 CP
M-INFO-107161	Ubiquitous Computing	EN	Irreg.	5 CP
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
18

Business Administration (Election:)				
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 neu	EN	WS+SS	9 CP
M-WIWI-101498	Management Accounting	EN	WS+SS	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 neu	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 neu	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 neu	EN	WS	9 CP
Economics (Election:)				
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
Operations Research (Election:)				
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
Statistics (Election:)				
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	WS+SS	9 CP
M-WIWI-105414	Statistics and Econometrics II	DE/EN	WS+SS	9 CP

4.5 Law

Credits
18

Compulsory Elective Module in Law (Election:)				
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-INFO-102822	Seminar Module Informatics	DE/EN	WS+SS	3 CP
M-INFO-101218	Seminar Module Law	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

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

Σ = 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	Grading	Recurrence	Duration	Language	Level	Version
6 CP	graded	Each winter term	1 term	German	4	2

Mandatory			
T-INFO-111399	Advanced Algorithmic Programming	6 CP	Bläsius

M 5.3 Module: Advanced Artificial Intelligence [M-INFO-107198]

Coordinators: Prof. Dr. Jan Niehues
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-114220	Advanced Artificial Intelligence	6 CP	Niehues

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
- The students know the relevant elements of a technical cognitive system.
- The students understand the algorithms and methods of AI to model 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.

Content
Due to the successes in research, 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 “Introduction to AI”, 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 lecture investigates method of perception using different modalities. 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 that enable AI systems to generate content 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
approx. 30 hours exam preparation

M 5.4 Module: Advanced Bayesian Data Analysis [M-INFO-106812]

Coordinators: Prof. Dr. Nadja Klein
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-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 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, Economathematics, 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
150h

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

M 5.5 Module: Advanced Data Structures [M-INFO-107200]

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	1

Mandatory			
T-INFO-114223	Advanced Data Structures	4 CP	Sanders
T-INFO-114224	Advanced Data Structures Project/Experiment	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 5.6 Module: Advanced Machine Learning and Data Science [M-WIWI-105659]

Coordinators: Prof. Dr. Maxim Ulrich
Organisation: KIT Department of Economics and Management
Part of: Economics and Management (Business Administration)

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

Mandatory			
T-WIWI-111305	Advanced Machine Learning and Data Science	9 CP	Ulrich

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

Prerequisites
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

M 5.7 Module: Advanced Topics in AI: Graph Neural Networks and Language Models [M-WIWI-106804]

Coordinators: Dr.-Ing. Tobias Käfer
Organisation: KIT Department of Economics and Management
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 5.8 Module: Advanced Topics in AI: Knowledge Graphs and the Web [M-WIWI-106803]

Coordinators: Dr.-Ing. Tobias Käfer
Organisation: KIT Department of Economics and Management
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: 2 items)			
T-WIWI-110848	Semantic Web Technologies	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.

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

Coordinators: Prof. Dr. Berthold Wigger
Organisation: KIT Department of Economics and Management
Part of: Economics and Management (Economics)

Credits	Grading	Recurrence	Duration	Language	Level	Version
9 CP	graded	Each term	2 terms	German	4	7

Electives (Election: between 1 and 2 items)			
T-WIWI-108711	Basics of German Company Tax Law and Tax Planning	4,5 CP	Gutekunst, Wigger
T-WIWI-102740	Public Management	4,5 CP	Wigger
Supplementary Courses (Election: between 0 and 1 items)			
T-WIWI-111304	Fundamentals of National and International Group Taxation	4,5 CP	Wigger
T-WIWI-102739	Public Revenues	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 5.10 Module: Advanced Topics in Strategy and Management [M-WIWI-103119]

Coordinators: Prof. Dr. Hagen Lindstädt
Organisation: KIT Department of Economics and Management
Part of: Economics and Management (Business Administration)

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

Compulsory Elective Courses (Election: 9 credits)			
T-WIWI-106188	Workshop Current Topics in Strategy and Management	3 CP	Lindstädt
T-WIWI-106189	Workshop Business Wargaming – Analyzing Strategic Interactions	3 CP	Lindstädt
T-WIWI-106190	Strategy and Management Theory: Developments and "Classics"	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 5.11 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 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 5.12 Module: Algorithmic Graph Theory [M-INFO-106960]

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	English	4	1

Mandatory			
T-INFO-113918	Algorithmic Graph Theory	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, 5LP

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 5.13 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 5.14 Module: Algorithms for Routing [M-INFO-100031]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
5 CP	graded	Each summer term	1 term	German	4	1

Mandatory			
T-INFO-100002	Algorithms for Routing	5 CP	Bläsius

M 5.15 Module: Algorithms for Visualization of Graphs [M-INFO-106961]

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	English	4	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 5.16 Module: Algorithms II [M-INFO-107201]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
6 CP	graded	Each winter term	1 term	English	4	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 5.17 Module: Analytics and Statistics [M-WIWI-101637]

Coordinators: Prof. Dr. Oliver Grothe
Organisation: KIT Department of Economics and Management
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	Advanced Statistics	4,5 CP	Grothe
Supplementary Courses (Election: between 4,5 and 5 credits)			
T-WIWI-114746	Selected Topics in Statistics and Analytics: Seminal Papers in Theory and Methods	4,5 CP	Grothe
T-WIWI-106341	Machine Learning 2 - Advanced Methods	4,5 CP	Zöllner
T-WIWI-111247	Mathematics for High Dimensional Statistics	4,5 CP	Grothe
T-WIWI-103124	Multivariate Statistical Methods	4,5 CP	Grothe
T-WIWI-112109	Topics in Stochastic Optimization	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 seperately.

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

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

Exception for Students of Econmathematics: Students enrolled in the Econmathematics 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 Econmathematics 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 5.18 Module: Applied Strategic Decisions [M-WIWI-101453]

Coordinators: Prof. Dr. Johannes Philipp Reiß
Organisation: KIT Department of Economics and Management
Part of: Economics and Management (Economics)

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

Mandatory			
T-WIWI-102861	Advanced Game Theory	4,5 CP	Ehrhart, Puppe, Reiß
Supplementary Courses (Election: between 4,5 and 5 credits)			
T-WIWI-113469	Advanced Corporate Finance	4,5 CP	Ruckes
T-WIWI-102613	Auction Theory	4,5 CP	Ehrhart
T-WIWI-102614	Experimental Economics	4,5 CP	Weinhardt
T-WIWI-102623	Financial Intermediation	4,5 CP	Ruckes
T-WIWI-112823	Platform & Market Engineering: Commerce, Media, and Digital Democracy	4,5 CP	Weinhardt
T-WIWI-102862	Predictive Mechanism and Market Design	4,5 CP	Reiß
T-WIWI-105781	Incentives in Organizations	4,5 CP	Nieken

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 5.19 Module: Artificial Intelligence [M-WIWI-105366]

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

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

Compulsory Elective Courses (Election: at least 2 items)			
T-WIWI-102666	Knowledge Discovery	4,5 CP	Käfer
T-WIWI-110848	Semantic Web Technologies	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

- understands the koncepts 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 5.20 Module: Automated Planning and Scheduling [M-INFO-104447]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
5 CP	graded	Irregular	1 term	English	4	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 5.21 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	Grading	Recurrence	Duration	Language	Level	Version
6 CP	graded	Each winter term	1 term	German	4	1

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

M 5.22 Module: Automotive Software Engineering (ASE) [M-INFO-106019]

Coordinators: Prof. Dr.-Ing. Ina Schaefer
Organisation: KIT Department of Informatics
Part of: Informatics

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

Mandatory			
T-INFO-112204	Automotive Software Engineering (ASE) - Pass	0 CP	Schaefer
T-INFO-112203	Automotive Software Engineering (ASE)	4 CP	Schaefer

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 Economics and Management
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	Digital Democracy	4,5 CP	Fegert
T-WIWI-112757	Digital Services: Innovation & Business Models	4,5 CP	Satzger
T-WIWI-110887	Practical Seminar: Service Innovation	4,5 CP	Satzger
T-WIWI-102847	Recommender Systems	4,5 CP	Geyer-Schulz
T-WIWI-113724	Special Topics in Information Systems	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 .

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	Grading	Recurrence	Duration	Language	Level	Version
3 CP	graded	Each winter term	1 term	German	4	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 Economics and Management
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:)			
T-WIWI-102740	Public Management	4,5 CP	Wigger
T-WIWI-102859	Social Choice Theory	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 seperately.

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

Prerequisites
None

Competence Goal
Students

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

Content
The focus of the module is on mechanisms for public decision making including voting and the aggregation of preferences and judgements.

Workload
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	Grading	Recurrence	Duration	Language	Level	Version
9 CP	graded	Irregular	1 term	English	4	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	Grading	Recurrence	Duration	Language	Level	Version
6 CP	graded	Irregular	1 term	German	4	1

Mandatory			
T-INFO-103014	Computational Complexity Theory, with a View Towards Cryptography	6 CP	Hofheinz, Müller-Quade

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

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-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 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	Grading	Recurrence	Duration	Language	Level	Version
5 CP	graded	Each winter term	1 term	English	4	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	Grading	Recurrence	Duration	Language	Level	Version
6 CP	graded	Each summer term	1 term	German	4	1

Mandatory			
T-INFO-101355	Computer Architecture	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	Grading	Recurrence	Duration	Language	Level	Version
6 CP	graded	Each winter term	1 term	German	4	2

Mandatory			
T-INFO-101393	Computer Graphics	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	Grading	Recurrence	Duration	Language	Level	Version
5 CP	graded	Each summer term	1 term	German/English	4	1

Mandatory			
T-INFO-113441	Computer Graphics 2	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	Grading	Recurrence	Duration	Language	Level	Version
5 CP	graded	Each summer term	1 term	English	4	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 Economics and Management
Part of: Economics and Management (Business Administration)

Credits	Grading	Recurrence	Duration	Language	Level	Version
9 CP	graded	Each term	2 terms	English	4	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	KD²Lab 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	Grading	Recurrence	Duration	Language	Level	Version
5 CP	graded	Each summer term	1 term	German	4	2

Mandatory			
T-INFO-107499	Context Sensitive Systems	5 CP	Beigl

M 5.37 Module: Cooperative Autonomous Vehicles [M-WIWI-106631]

Coordinators: Prof. Dr. Alexey Vinel
Organisation: KIT Department of Economics and Management
Part of: Informatics

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

Compulsory Elective Courses (Election:)			
T-WIWI-113363	Collective Perception in Autonomous Driving	4,5 CP	Vinel
T-WIWI-112690	Cooperative Autonomous Vehicles	4,5 CP	Vinel
T-WIWI-113059	Human Factors in Autonomous Driving	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 Economics and Management
Part of: Economics and Management (Business Administration)

Credits	Grading	Recurrence	Duration	Language	Level	Version
9 CP	graded	Each term	1 term	English	4	14

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

M 5.39 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	Cryptographic Voting Schemes	3 CP	Müller-Quade

M 5.40 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 5.41 Module: Data Science for Finance [M-WIWI-105032]

Coordinators: Prof. Dr. Maxim Ulrich
Organisation: KIT Department of Economics and Management
Part of: Economics and Management (Business Administration)

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

Mandatory			
T-WIWI-102878	Computational Risk and Asset Management	4,5 CP	Ulrich
T-WIWI-110213	Python for Computational Risk and Asset Management	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 Ipython notebooks, active and interactive "Python Data Sessions" and reading literature you have heard.

Recommendations
Basic knowledge of capital markt theory.

M 5.42 Module: Data Science: Data-Driven Information Systems [M-WIWI-103117]

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

Organisation: KIT Department of Economics and Management

Part of: Economics and Management (Business Administration)

Credits	Grading	Recurrence	Duration	Language	Level	Version
9 CP	graded	Each term	1 term	English	4	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 availabe 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 tremendeous 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 understands 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 hetergeneous, 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

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 module requires a basic understanding of the tasks, systems and processes in business informatics. It is therefore recommended that students attend the course Fundamentals of Information Systems [2540450] beforehand. Furthermore, basic knowledge of operations research as well as descriptive and inferential statistics is required.

M 5.43 Module: Data Science: Data-Driven User Modeling [M-WIWI-103118]

Coordinators: Prof. Dr. Christof Weinhardt
Organisation: KIT Department of Economics and Management
Part of: Economics and Management (Business Administration)

Credits	Grading	Recurrence	Duration	Language	Level	Version
9 CP	graded	Each term	1 term	English	4	8

Compulsory Elective Courses (Election: at least 9 credits)			
T-WIWI-114089	Data Science for Business	4,5 CP	Pfeiffer
T-WIWI-113160	Digital Democracy	4,5 CP	Fegert
T-WIWI-102614	Experimental Economics	4,5 CP	Weinhardt
T-WIWI-111109	KD²Lab 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
T-WIWI-108765	Practical Seminar: Advanced Analytics	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 5.44 Module: Data Science: Evidence-based Marketing [M-WIWI-101647]

Coordinators: Prof. Dr. Martin Klarmann
Organisation: KIT Department of Economics and Management
Part of: Economics and Management (Business Administration)

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

Compulsory Elective Courses (Election: 9 credits)			
T-WIWI-103139	Marketing Analytics	4,5 CP	Klarmann
T-WIWI-107720	Market Research	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 5.45 Module: Data Science: Intelligent, Adaptive, and Learning Information Services [M-WIWI-105661]

Coordinators: Prof. Dr. Andreas Geyer-Schulz
Organisation: KIT Department of Economics and Management
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	Advanced Machine Learning	4,5 CP	Geyer-Schulz, Nazemi
T-WIWI-114209	Artificial Intelligence in Service Systems II: Generative AI Applications & Adoption	4,5 CP	Satzger
T-WIWI-102762	Business Dynamics	4,5 CP	Geyer-Schulz, Glenn
T-WIWI-111267	Intelligent Agent Architectures	4,5 CP	Geyer-Schulz
T-WIWI-110915	Intelligent Agents and Decision Theory	4,5 CP	Geyer-Schulz
T-WIWI-102847	Recommender Systems	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 seperately.

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

Prerequisites
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 5.46 Module: Decentralized Systems: Fundamentals, Modeling, and Applications [M-INFO-105334]

Coordinators: Prof. Dr. Hannes Hartenstein
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	4

Mandatory			
T-INFO-110820	Decentralized Systems: Fundamentals, Modeling, and Applications	6 CP	Hartenstein

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
1. Fundamentals & Modeling

1. The student is able to recognize and distinguish distributed, federated, and decentralized systems.
2. The student understands 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 for leader election and mutual exclusion 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, notably silent and noisy crash as well as byzantine 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 various models for and levels of consistency.

2. Applications

1. The student understands conflict-free replicated data types and their use in decentralized systems like Matrix.
2. The student has a fundamental understanding of blockchain-based cryptocurrencies (e.g. Bitcoin/Ethereum), Payment Channels, and decentralized communication systems like Matrix.
3. The student understands trust relations in distributed and decentralized systems and applications.
4. The student is able to understand how the previously introduced theoretical foundations relate to networked and decentralized systems in practice.
5. The student understands concepts of decentralized storage systems.

Content
Decentralized Systems (like blockchain-based systems) represent distributed systems that are controlled by multiple parties who make their own independent 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, and Matrix. As a research-oriented lecture, we may cover additional current topics like verifiable computing and/or identity and access management in decentralized settings.
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 mutual exclusion in decentralized systems based on different models for node 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
  - The Matrix decentralized messaging platform
  - Distributed Ledgers and Blockchains at the examples of Bitcoin and Ethereum, in particular Proof-of-Work and Proof-of-Stake consensus
  - Payment Channel Networks and Rollups
  - Decentralized storage systems, at the example of IPFS

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
Σ = 180h = 6 ECTS

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

M 5.47 Module: Deep Learning and Neural Networks [M-INFO-107197]

Coordinators: Prof. Dr. Jan Niehues
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-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
180h.

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

M 5.48 Module: Deep Learning for Computer Vision I: Basics [M-INFO-105753]

Coordinators: Prof. Dr.-Ing. Rainer Stiefelhagen
Organisation: KIT Department of Informatics
Part of: Informatics

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

Mandatory			
T-INFO-111491	Deep Learning for Computer Vision I: Basics	3 CP	Stiefelhagen

Competence Goal
Students should be able to grasp the underlying concepts in the field of deep learning and its various applications.

- Understand the theoretical basis of deep learning
- Understand the Convolutional Neural Networks (CNN)
- Develop basis for the concepts and algorithms used in building and training the CNNs.
- Able to apply deep learning in different computer vision applications.

Content
In recent years tremendous progress has been made in analysing and understanding image and video content. The dominant approach in Computer Vision today are deep learning approaches, in particular the usage of Convolutional Neural Networks.

The lecture introduces the basics, as well as advanced aspects of deep learning methods and their application for a number of computer vision tasks. The following topics will be addressed in the lecture:

- Introduction to Deep Learning
- Convolutional Neural Networks (CNN): Background
- CNNs: basic architectures and learning algorithms
- Object Recognition with CNN
- Image Segmentation with CNN
- Recurrent Neural Networks
- Generating image descriptions (Image Captioning)
- Automatic question answering (Visual Question Answering)
- Generative Adversarial Networks (GAN) and their applications
- Deep Learning platforms and tools

Additional Information
The course is partially given in German and English.

M 5.49 Module: Deep Learning for Computer Vision II: Advanced Topics [M-INFO-105755]

Coordinators: Prof. Dr.-Ing. Rainer Stiefelhagen
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	4

Mandatory			
T-INFO-111494	Deep Learning for Computer Vision II: 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 assumed.

M 5.50 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
90h

M 5.51 Module: Designing Interactive Information Systems [M-WIWI-104080]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
9 CP	graded	Each term	1 term	English	4	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	KD²Lab 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 "Enineering 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 5.52 Module: Development of Business Information Systems [M-WIWI-101477]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
9 CP	graded	Each term	1 term	German	4	8

Compulsory Elective Courses (Election: between 1 and 2 items)			
T-WIWI-102661	Database Systems and XML	4,5 CP	Oberweis
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 acceptation 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 5.53 Module: Digital Accessibility and Assistive Technologies [M-INFO-105882]

Coordinators: Prof. Dr.-Ing. Rainer Stiefelhagen
Organisation: KIT Department of Informatics
Part of: Informatics

Credits	Grading	Recurrence	Duration	Language	Level	Version
3 CP	graded	Each summer term	1 term	German/English	4	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 5.54 Module: Digital Marketing [M-WIWI-106258]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
9 CP	graded	Each term	2 terms	English	4	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	Klarmann

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

Workload
Total effort for 9 credit points: approx. 270 hours.
The exact distribution is done according to the credit points of the courses of the module.

M 5.55 Module: Digital Service Systems in Industry [M-WIWI-102808]

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

Organisation: KIT Department of Economics and Management

Part of: Economics and Management (Business Administration)

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

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 5.56 Module: Distributed Computing [M-INFO-107215]

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

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

Mandatory			
T-INFO-114235	Distributed Computing	4 CP	Streit

Assessment
See partial achivements (Teilleistung)

Prerequisites
See partial achivements (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 5.57 Module: Econometrics and Statistics I [M-WIWI-101638]

Coordinators: Prof. Dr. Melanie Schienle
Organisation: KIT Department of Economics and Management
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	Applied Econometrics	4,5 CP	Krüger
Supplementary Courses (Election: between 4,5 and 5 credits)			
T-WIWI-103064	Financial Econometrics	4,5 CP	Schienle
T-WIWI-103126	Non- and Semiparametrics	4,5 CP	Schienle
T-WIWI-103127	Panel Data	4,5 CP	Heller
T-WIWI-110868	Predictive Modeling	4,5 CP	Krüger
T-WIWI-111387	Probabilistic Time Series Forecasting Challenge	4,5 CP	Krüger
T-WIWI-103065	Statistical Modeling of Generalized Regression Models	4,5 CP	Heller
T-WIWI-110939	Financial Econometrics II	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 5.58 Module: Econometrics and Statistics II [M-WIWI-101639]

Coordinators: Prof. Dr. Melanie Schienle
Organisation: KIT Department of Economics and Management
Part of: Economics and Management (Statistics)

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

Election Notes

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

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

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

At least one course must be chosen from the compulsory elective programme.

Competence Goal

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

Content

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

Workload

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

Coordinators: Prof. Dr. Kay Mitusch
Organisation: KIT Department of Economics and Management
Part of: Economics and Management (Economics)

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

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

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

Coordinators: Prof. Dr. Ingrid Ott
Organisation: KIT Department of Economics and Management
Part of: Economics and Management (Economics)

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

Mandatory			
T-WIWI-103107	Spatial Economics	4,5 CP	Ott
Compulsory Elective Courses (Election: at most 1 item)			
T-WIWI-102609	Advanced Topics in Economic Theory	4,5 CP	Brumm, Mitusch
T-WIWI-111388	Applied Econometrics	4,5 CP	Krüger
T-WIWI-109194	Dynamic Macroeconomics	4,5 CP	Brumm
T-WIWI-112822	Economics of Innovation	4,5 CP	Ott
T-WIWI-112816	Growth and Development	4,5 CP	Ott
T-WIWI-113147	Telecommunications and Internet – Economics and Policy	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 5.61 Module: Economics of Innovation and Growth [M-WIWI-107011]

Coordinators: Prof. Dr. Ingrid Ott
Organisation: KIT Department of Economics and Management
Part of: Economics and Management (Economics)

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

Compulsory Elective Courses (Election: at least 1 item)			
T-WIWI-112822	Economics of Innovation	4,5 CP	Ott
T-WIWI-112816	Growth and Development	4,5 CP	Ott
Supplementary Courses (Election:)			
T-WIWI-102609	Advanced Topics in Economic Theory	4,5 CP	Brumm, Mitusch
T-WIWI-111388	Applied Econometrics	4,5 CP	Krüger
T-WIWI-109194	Dynamic Macroeconomics	4,5 CP	Brumm
T-WIWI-114054	Methods in Economics	1,5 CP	Ott
T-WIWI-102789	Seminar in Economic Policy	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 5.62 Module: eEnergy: Markets, Services and Systems [M-WIWI-103720]

Coordinators: Prof. Dr. Christof Weinhardt
Organisation: KIT Department of Economics and Management
Part of: Economics and Management (Business Administration)

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

Compulsory Elective Courses (Election: at least 9 credits)			
T-WIWI-107501	Energy Market Engineering	4,5 CP	Weinhardt
T-WIWI-107503	Energy Networks and Regulation	4,5 CP	Weinhardt
T-WIWI-107504	Smart Grid Applications	4,5 CP	Weinhardt
T-WIWI-113726	Special Topics in Information Systems	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 aproaches,
- 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 5.63 Module: Electronic Markets [M-WIWI-101409]

Coordinators: Prof. Dr. Andreas Geyer-Schulz
Organisation: KIT Department of Economics and Management
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 seperately.

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

Prerequisites
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 5.64 Module: Empirical Software Engineering [M-INFO-100798]

Coordinators: Prof. Dr. Ralf Reussner
Organisation: KIT Department of Informatics
Part of: Informatics

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

Mandatory			
T-INFO-101335	Empirical Software Engineering	4 CP	Gerking

M 5.65 Module: Energy Economics and Energy Markets [M-WIWI-101451]

Coordinators: Prof. Dr. Wolf Fichtner
Organisation: KIT Department of Economics and Management
Part of: Economics and Management (Business Administration)

Credits	Grading	Recurrence	Duration	Language	Level	Version
9 CP	graded	Each term	1 term	German/English	4	8

Mandatory			
T-WIWI-107043	Liberalised Power Markets	5,5 CP	Fichtner
Supplementary Courses (Election:)			
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
T-WIWI-113935	Social Dimensions of Energy Transitions	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 seperately.

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

Prerequisites
The lecture Liberalised Power Markets has to be examined.

Competence Goal
The student

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

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

Workload
The total workload for this module is 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 5.66 Module: Energy Economics and Technology [M-WIWI-101452]

Coordinators: Prof. Dr. Wolf Fichtner
Organisation: KIT Department of Economics and Management
Part of: Economics and Management (Business Administration)

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

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

Prerequisites
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 Systems Analysis: Interdependencies in energy economics, energy systems modelling approaches in energy economics
Energy and Environment: emission factors, emission reduction measures, environmental impact
Efficient Energy Systems and Electric Mobility: concepts and current trends in energy efficiency, Overview of and economical, ecological and social impacts through electric mobility

Workload
The total workload for this module is 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 5.67 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

M 5.68 Module: Engineering Self-Adaptive Systems [M-INFO-106626]

Coordinators: Prof. Dr. Raffaela Mirandola
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-113349	Engineering Self-Adaptive Systems	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 5.69 Module: Entrepreneurship (EnTechnon) [M-WIWI-101488]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
9 CP	graded	Each term	2 terms	German/English	4	15

Mandatory part (Election: 1 item)			
T-WIWI-102864	Entrepreneurship	3 CP	Terzidis
Compulsory Elective Courses (Election: between 1 and 2 items)			
T-WIWI-102866	Design Thinking	3 CP	Terzidis
T-WIWI-113151	Entrepreneurship Seasonal School	3 CP	Terzidis
T-WIWI-102865	Business Planning	3 CP	Terzidis
T-WIWI-109064	Joint Entrepreneurship Summer School	6 CP	Terzidis
T-WIWI-111561	Startup Experience	6 CP	Terzidis
T-WIWI-114893	International Entrepreneurship and Brand Development	6 CP	Kupfer, 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
T-WIWI-113849	AI Innovation Ecosystems	3 CP	Beyer, Scheydt
T-WIWI-102612	Managing New Technologies	3 CP	Reiß

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 Business Development and Sales
- Founding in the field of IT security
- Entrepreneurial Leadership & Innovation Management

The latter five 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 on 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 5.70 Module: Environmental Economics [M-WIWI-101468]

Coordinators: Prof. Dr. Kay Mitusch
Organisation: KIT Department of Economics and Management
Part of: Economics and Management (Economics)

Credits	Grading	Recurrence	Duration	Language	Level	Version
9 CP	graded	Each term	1 term	German	4	2

Compulsory Elective Courses (Election: at least 9 credits)			
T-WIWI-102650	Energy and Environment	3,5 CP	Karl
T-WIWI-100007	Transport Economics	4,5 CP	Mitusch, Szimba
T-WIWI-102615	Environmental Economics and Sustainability	3 CP	Walz
T-WIWI-102616	Environmental and Resource Policy	4 CP	Walz
T-BGU-111102	Environmental Law	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 offerd at every ordinary examination date. The assessment procedures are described for each course of the module seperately.

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

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

Organisation: KIT Department of Economics and Management

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 5.72 Module: Experimental Economics [M-WIWI-101505]

Coordinators: Prof. Dr. Johannes Philipp Reiß
Organisation: KIT Department of Economics and Management
Part of: Economics and Management (Economics)

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

Compulsory Elective Courses (Election: 2 items)			
T-WIWI-102614	Experimental Economics	4,5 CP	Weinhardt
T-WIWI-105781	Incentives in Organizations	4,5 CP	Nieken
T-WIWI-102862	Predictive Mechanism and Market Design	4,5 CP	Reiß
T-WIWI-102863	Topics in Experimental Economics	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 5.73 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	Grading	Recurrence	Duration	Language	Level	Version
3 CP	graded	Each summer term	1 term	English	4	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 5.74 Module: Finance 1 [M-WIWI-101482]

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

Organisation: KIT Department of Economics and Management

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	Derivatives	4,5 CP	Uhrig-Homburg
T-WIWI-102621	Valuation	4,5 CP	Ruckes
T-WIWI-102647	Asset Pricing	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 seperately.

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

Prerequisites
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 5.75 Module: Finance 2 [M-WIWI-101483]

Coordinators: Prof. Dr. Martin Ruckes
Prof. Dr. Marliese Uhrig-Homburg
Organisation: KIT Department of Economics and Management
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

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

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Compulsory Elective Courses (Election: at least 9 credits)			
T-WIWI-113469	Advanced Corporate Finance	4,5 CP	Ruckes
T-WIWI-110513	Advanced Empirical Asset Pricing	4,5 CP	Thimme
T-WIWI-102647	Asset Pricing	4,5 CP	Ruckes, Uhrig-Homburg
T-WIWI-110995	Bond Markets	4,5 CP	Uhrig-Homburg
T-WIWI-110997	Bond Markets - Models & Derivatives	3 CP	Uhrig-Homburg
T-WIWI-110996	Bond Markets - Tools & Applications	1,5 CP	Uhrig-Homburg
T-WIWI-109050	Corporate Risk Management	4,5 CP	Ruckes
T-WIWI-102643	Derivatives	4,5 CP	Uhrig-Homburg
T-WIWI-110797	eFinance: Information Systems for Securities Trading	4,5 CP	Weinhardt
T-WIWI-102900	Financial Analysis	4,5 CP	Luedecke
T-WIWI-102623	Financial Intermediation	4,5 CP	Ruckes
T-WIWI-102646	International Finance	3 CP	Uhrig-Homburg
T-WIWI-102621	Valuation	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 seperately.

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

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

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

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

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

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

M 5.76 Module: Finance 3 [M-WIWI-101480]

Coordinators: Prof. Dr. Martin Ruckes
Prof. Dr. Marliese Uhrig-Homburg
Organisation: KIT Department of Economics and Management
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

Election Notes

++

This module will not count towards the degree until the modules *Finance 1* and *Finance 2* have also been successfully completed. If the modules *Finance 1* and/or *Finance 2* are booked out to the additional examinations, the *Finance 3* module loses its curricular validity/valuation for the degree.

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Compulsory Elective Courses (Election: at least 9 credits)			
T-WIWI-113469	Advanced Corporate Finance	4,5 CP	Ruckes
T-WIWI-110513	Advanced Empirical Asset Pricing	4,5 CP	Thimme
T-WIWI-102647	Asset Pricing	4,5 CP	Ruckes, Uhrig-Homburg
T-WIWI-110995	Bond Markets	4,5 CP	Uhrig-Homburg
T-WIWI-110997	Bond Markets - Models & Derivatives	3 CP	Uhrig-Homburg
T-WIWI-110996	Bond Markets - Tools & Applications	1,5 CP	Uhrig-Homburg
T-WIWI-109050	Corporate Risk Management	4,5 CP	Ruckes
T-WIWI-102643	Derivatives	4,5 CP	Uhrig-Homburg
T-WIWI-110797	eFinance: Information Systems for Securities Trading	4,5 CP	Weinhardt
T-WIWI-102900	Financial Analysis	4,5 CP	Luedecke
T-WIWI-102623	Financial Intermediation	4,5 CP	Ruckes
T-WIWI-102646	International Finance	3 CP	Uhrig-Homburg
T-WIWI-102621	Valuation	4,5 CP	Ruckes
T-WIWI-110933	Web App Programming for Finance	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 seperately.

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

Prerequisites

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

Competence Goal

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

Content

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

Workload

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

M 5.77 Module: Formal Systems [M-INFO-100799]

Coordinators: Prof. Dr. Bernhard Beckert
Organisation: KIT Department of Informatics
Part of: Informatics

Credits	Grading	Recurrence	Duration	Language	Level	Version
6 CP	graded	Each winter term	1 term	German	4	1

Mandatory			
T-INFO-101336	Formal Systems	6 CP	Beckert

M 5.78 Module: Formal Systems II: Application [M-INFO-100744]

Coordinators: Prof. Dr. Bernhard Beckert
Organisation: KIT Department of Informatics
Part of: Informatics

Credits	Grading	Recurrence	Duration	Language	Level	Version
5 CP	graded	Each summer term	1 term	German	4	1

Mandatory			
T-INFO-101281	Formal Systems II: Application	5 CP	Beckert

M 5.79 Module: Formal Systems II: Theory [M-INFO-100841]

Coordinators: Prof. Dr. Bernhard Beckert
Organisation: KIT Department of Informatics
Part of: Informatics

Credits	Grading	Recurrence	Duration	Language	Level	Version
5 CP	graded	Each summer term	1 term	German	4	1

Mandatory			
T-INFO-101378	Formal Systems II: Theory	5 CP	Beckert

M 5.80 Module: Foundations for Advanced Financial -Quant and -Machine Learning Research [M-WIWI-105894]

Coordinators: Prof. Dr. Maxim Ulrich
Organisation: KIT Department of Economics and Management
Part of: Economics and Management (Business Administration)

Credits	Grading	Recurrence	Duration	Language	Level	Version
9 CP	graded	see Annotations	1 term	English	4	1

Mandatory			
T-WIWI-111846	Fundamentals for Financial -Quant and -Machine Learning Research	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.

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.

M 5.81 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 5.82 Module: Hands-on Bioinformatics Practical [M-INFO-101573]

Coordinators: Prof. Dr. Alexandros Stamatakis
Organisation: KIT Department of Informatics
Part of: Informatics

Credits	Grading	Recurrence	Duration	Language	Level	Version
3 CP	graded	Irregular	1 term	English	4	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 5.83 Module: Heterogeneous Parallel Computing Systems [M-INFO-100822]

Coordinators: Prof. Dr. Wolfgang Karl
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-101359	Heterogeneous Parallel Computing Systems	3 CP	Karl

M 5.84 Module: HRI and Social Robotics [M-INFO-106650]

Coordinators: TT-Prof. Dr. Barbara Bruno
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-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 5.85 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

M 5.86 Module: Human Computer Interaction [M-INFO-107166]

Coordinators: Prof. Dr.-Ing. Michael Beigl
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-114192	Human-Computer-Interaction	6 CP	Beigl
T-INFO-114193	Human-Computer-Interaction Pass	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 5.87 Module: Human Factors in Security and Privacy [M-WIWI-104520]

Coordinators: Prof. Dr. Melanie Volkamer
Organisation: KIT Department of Economics and Management
Part of: Informatics

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

Mandatory			
T-WIWI-109270	Human Factors in Security and Privacy	4,5 CP	Volkamer
T-WIWI-108439	Advanced Lab Security, Usability and Society	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 5.88 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

M 5.89 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 5.90 Module: Humanoid Robots - Seminar [M-INFO-107152]

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 winter term	1 term	English	4	1

Mandatory			
T-INFO-114170	Humanoid Robots - Seminar	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 5.91 Module: Incentives, Interactivity & Decisions in Organizations [M-WIWI-105923]

Coordinators: Prof. Dr. Petra Nieken
Organisation: KIT Department of Economics and Management
Part of: Economics and Management (Business Administration)

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

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-102614	Experimental Economics	4,5 CP	Weinhardt
T-WIWI-105781	Incentives in Organizations	4,5 CP	Nieken
T-WIWI-111109	KD²Lab 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 5.92 Module: Industrial Production II [M-WIWI-101471]

Coordinators: Prof. Dr. Frank Schultmann
Organisation: KIT Department of Economics and Management
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 5.93 Module: Industrial Production III [M-WIWI-101412]

Coordinators: Prof. Dr. Frank Schultmann
Organisation: KIT Department of Economics and Management
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 mail 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 5.94 Module: Information Engineering [M-WIWI-101411]

Coordinators: Prof. Dr. Christof Weinhardt
Organisation: KIT Department of Economics and Management
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

Supplementary Courses (Election:)			
T-WIWI-107501	Energy Market Engineering	4,5 CP	Weinhardt
T-WIWI-112823	Platform & Market Engineering: Commerce, Media, and Digital Democracy	4,5 CP	Weinhardt
T-WIWI-113727	Special Topics in Information Systems	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.

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 5.95 Module: Information Systems in Organizations [M-WIWI-104068]

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

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

Compulsory Elective Courses (Election: at least 9 credits)			
T-WIWI-105777	Business Intelligence Systems	4,5 CP	Mädche
T-WIWI-113465	Designing Interactive Systems: Human-AI Interaction	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

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

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

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

Additional Information
New module starting summer term 2018.

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

M 5.96 Module: Information Systems: AI & Data Science [M-WIWI-107530]

Coordinators: Prof. Dr. Alexander Mädche
Prof. Dr. Jella Pfeiffer

Organisation: KIT Department of Economics and Management

Part of: Information Systems

Credits	Grading	Recurrence	Duration	Language	Level	Version
9 CP	graded	Each term	2 terms	English	4	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 5.97 Module: Information Systems: Digital Markets & Services [M-WIWI-107528]

Coordinators: Prof. Dr. Gerhard Satzger
Prof. Dr. Christof Weinhardt

Organisation: KIT Department of Economics and Management

Part of: Information Systems

Credits	Grading	Recurrence	Duration	Language	Level	Version
9 CP	graded	Each term	2 terms	German/English	4	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 5.98 Module: Information Systems: Interactive Systems [M-WIWI-107531]

Coordinators: Prof. Dr. Alexander Mädche
Prof. Dr. Jella Pfeiffer

Organisation: KIT Department of Economics and Management

Part of: Information Systems

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

Compulsory Elective Area (Election:)			
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
T-INFO-107499	Context Sensitive Systems	5 CP	Beigl
T-INFO-101266	Human-Machine-Interaction	6 CP	Beigl
T-WIWI-113459	Practical Seminar: Human-Centered Systems	4,5 CP	Mädche
T-INFO-101326	Ubiquitous Computing	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 5.99 Module: Information Systems: Software & Systems Engineering [M-WIWI-107529]

Coordinators: Prof. Dr. Sebastian Abeck
Prof. Dr. Alexander Mädche

Organisation: KIT Department of Economics and Management

Part of: Information Systems

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

Compulsory Elective Area (Election:)			
T-INFO-106061	Access Control Systems: Foundations and Practice	5 CP	Hartenstein
T-INFO-112775	Access Control Systems: Models and Technology	5 CP	Hartenstein
T-WIWI-109270	Human Factors in Security and Privacy	4,5 CP	Volkamer
T-INFO-101337	Internet of Everything	4 CP	Zitterbart
T-INFO-101323	IT-Security Management for Networked Systems	5 CP	Hartenstein
T-INFO-101381	Software Architecture and Quality	3 CP	Reussner
T-WIWI-102895	Software Quality Management	4,5 CP	Oberweis
T-INFO-101271	Web Applications and Service-Oriented Architectures (II)	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 5.100 Module: Innovation Management [M-WIWI-101507]

Coordinators: Prof. Dr. Marion Weissenberger-Eibl
Organisation: KIT Department of Economics and Management
Part of: Economics and Management (Business Administration)

Credits	Grading	Recurrence	Duration	Language	Level	Version
9 CP	graded	Each term	1 term	German/English	4	13

Mandatory			
T-WIWI-102893	Innovation Management: Concepts, Strategies and Methods	3 CP	Weissenberger-Eibl
Compulsory Elective Courses (Election: 1 item)			
T-WIWI-113664	Design Thinking in Practice	3 CP	Scheydt
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-113849	AI Innovation Ecosystems	3 CP	Beyer, Scheydt
T-WIWI-110263	Methods in Innovation Management	3 CP	Weissenberger-Eibl
T-WIWI-114184	Pioneering Leadership in German SMEs	3 CP	Schulz-Kamm
Supplementary Courses (Election: 1 item)			
T-WIWI-102866	Design Thinking	3 CP	Terzidis
T-WIWI-113664	Design Thinking in Practice	3 CP	Scheydt
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-113849	AI Innovation Ecosystems	3 CP	Beyer, Scheydt
T-WIWI-110263	Methods in Innovation Management	3 CP	Weissenberger-Eibl
T-WIWI-114184	Pioneering Leadership in German SMEs	3 CP	Schulz-Kamm
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 5.101 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	Innovative Concepts for Programming Industrial Robots	4 CP	Hein

M 5.102 Module: Intellectual Property Law [M-INFO-101215]

Coordinators: N.N.
Organisation: KIT Department of Informatics
Part of: Law

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

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 5.103 Module: Intelligent Systems and Services [M-WIWI-101456]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
9 CP	graded	Each term	1 term	German/English	4	8

Compulsory Elective Courses (Election: between 9 and 10 credits)			
T-WIWI-102661	Database Systems and XML	4,5 CP	Oberweis
T-WIWI-106423	Information Service Engineering	4,5 CP	Sack
T-WIWI-112685	Modeling and Simulation	4,5 CP	Lazarova-Molnar
T-WIWI-110548	Advanced Lab Informatics (Master)	4,5 CP	Professorenschaft des Instituts AIFB
T-WIWI-102666	Knowledge Discovery	4,5 CP	Käfer
T-WIWI-110848	Semantic Web Technologies	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 leaning 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 5.104 Module: Interactive Computer Graphics [M-INFO-100732]

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-101269	Interactive Computer Graphics	5 CP	Dachsbacher

M 5.105 Module: Internet of Everything [M-INFO-100800]

Coordinators: Prof. Dr. Martina Zitterbart
Organisation: KIT Department of Informatics
Part of: Informatics

Credits	Grading	Recurrence	Duration	Language	Level	Version
4 CP	graded	Each winter term	1 term	English	4	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 5.106 Module: Introduction to Bioinformatics for Computer Scientists [M-INFO-100749]

Coordinators: Prof. Dr. Alexandros Stamatakis
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-101286	Introduction to Bioinformatics for Computer Scientists	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 SWS lecture + 1.5 * 2 SWS follow-up) * 15 + 15 hours exam preparation = 90 hours = 3 ECTS

M 5.107 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	Introduction to Quantum Computing (IQC)	3 CP	Beckert, Schaefer

M 5.108 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	Introduction to Video Analysis	3 CP	Beyerer

M 5.109 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	Grading	Recurrence	Duration	Language	Level	Version
6 CP	graded	Each winter term	1 term	English	4	2

Mandatory			
T-INFO-113960	IT Security	6 CP	Müller-Quade, 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: Netzsicherheit (dpunkt)
• Anderson: Security Engineering (Wiley, and online)
• Stallings/Brown: Computer Security (Pearson)
• Pfleeger, Pfleeger, Margulies: Security in Computing (Prentice Hall)

M 5.110 Module: IT-Security Management for Networked Systems [M-INFO-100786]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
5 CP	graded	Each winter term	1 term	German	4	1

Mandatory			
T-INFO-101323	IT-Security Management for Networked Systems	5 CP	Hartenstein

M 5.111 Module: Lab Project: Speech Translation [M-INFO-107176]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
6 CP	graded	Each winter term	1 term	English	4	1

Mandatory			
T-INFO-114205	Lab Project: Speech Translation	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 5.112 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 5.113 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 5.114 Module: Laboratory in Cryptography [M-INFO-101558]

Coordinators: Prof. Dr. Jörn Müller-Quade
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-102989	Laboratory in Cryptography	3 CP	Müller-Quade

M 5.115 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	Introduction to Quantum Machine Learning	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 (OML) 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 Approximat 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 "Machine Learning 1 - Basic Methods" is recommended
- Attendance of the lecture "Introduction to Quantum Computing" is recommended
- Knowledge of linear algebra is recommended
- Programming skills in Python are helpful

M 5.116 Module: Localization of Mobile Agents [M-INFO-100840]

Coordinators: Prof. Dr.-Ing. Uwe Hanebeck
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	2

Mandatory			
T-INFO-101377	Localization of Mobile Agents	6 CP	Hanebeck
T-INFO-114169	Localization of Mobile Agents Pass	0 CP	Hanebeck

M 5.117 Module: Logical Foundations of Cyber-Physical Systems [M-INFO-106102]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
6 CP	graded	Each winter term	1 term	English	4	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 5.118 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	Low Power Design	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 5.119 Module: Machine Learning [M-WIWI-103356]

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

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

Compulsory Elective Courses (Election:)			
T-WIWI-106340	Machine Learning 1 - Basic Methods	4,5 CP	Zöllner
T-WIWI-106341	Machine Learning 2 - Advanced Methods	4,5 CP	Zöllner
T-WIWI-109985	Project Lab Cognitive Automobiles and Robots	5 CP	Zöllner
T-WIWI-109983	Project Lab Machine Learning	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 5.120 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 achivements (Teilleistung)

Prerequisites
See partial achivements (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

M 5.121 Module: Machine Learning for Natural Sciences [M-INFO-106959]

Coordinators: Prof. Dr. Pascal Friederich
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-113916	Machine Learning for Natural Sciences	3 CP	Friederich
T-INFO-113917	Machine Learning for Natural Sciences - Pass	3 CP	Friederich

Assessment
See partial achivements (Teilleistung)

Prerequisites
See partial achivements (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

M 5.122 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 winter 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 5.123 Module: Machine Translation [M-INFO-100848]

Coordinators: Prof. Dr. Jan Niehues
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	1

Mandatory			
T-INFO-101385	Machine Translation	6 CP	Niehues

M 5.124 Module: Management Accounting [M-WIWI-101498]

Coordinators: Prof. Dr. Marcus Wouters
Organisation: KIT Department of Economics and Management
Part of: Economics and Management (Business Administration)

Credits	Grading	Recurrence	Duration	Language	Level	Version
9 CP	graded	Each term	2 terms	English	4	3

Mandatory			
T-WIWI-102800	Management Accounting 1	4,5 CP	Wouters
T-WIWI-102801	Management Accounting 2	4,5 CP	Wouters

Assessment
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 following courses are part of this module:

- The course Management Accounting 1, which is offered in every sommer semester
- The course Management Accounting 2, which is offered in every winter semester

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 5.125 Module: Market Engineering [M-WIWI-101446]

Coordinators: Prof. Dr. Christof Weinhardt
Organisation: KIT Department of Economics and Management
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

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-102614	Experimental Economics	4,5 CP	Weinhardt
T-WIWI-111109	KD²Lab 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 5.126 Module: Marketing and Sales Management [M-WIWI-105312]

Coordinators: Prof. Dr. Martin Klarmann
Organisation: KIT Department of Economics and Management
Part of: Economics and Management (Business Administration)

Credits	Grading	Recurrence	Duration	Language	Level	Version
9 CP	graded	Each summer term	1 term	English	4	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	Klarmann
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
The aim of this module is to deepen central marketing contents in different areas.

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

M 5.127 Module: Mathematical Programming [M-WIWI-101473]

Coordinators: Prof. Dr. Oliver Stein
Organisation: KIT Department of Economics and Management
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	Mixed Integer Programming I	4,5 CP	Stein
T-WIWI-102726	Global Optimization I	4,5 CP	Stein
T-WIWI-103638	Global Optimization I and II	9 CP	Stein
T-WIWI-102856	Convex Analysis	4,5 CP	Stein
T-WIWI-111587	Multicriteria Optimization	4,5 CP	Stein
T-WIWI-102724	Nonlinear Optimization I	4,5 CP	Stein
T-WIWI-103637	Nonlinear Optimization I and II	9 CP	Stein
T-WIWI-102855	Parametric Optimization	4,5 CP	Stein
Supplementary Courses (Election: at most 2 items)			
T-WIWI-106548	Advanced Stochastic Optimization	4,5 CP	Rebennack
T-WIWI-102720	Mixed Integer Programming II	4,5 CP	Stein
T-WIWI-102727	Global Optimization II	4,5 CP	Stein
T-WIWI-102723	Graph Theory and Advanced Location Models	4,5 CP	Nickel
T-WIWI-106549	Large-scale Optimization	4,5 CP	Rebennack
T-WIWI-111247	Mathematics for High Dimensional Statistics	4,5 CP	Grothe
T-WIWI-103124	Multivariate Statistical Methods	4,5 CP	Grothe
T-WIWI-102725	Nonlinear Optimization II	4,5 CP	Stein
T-WIWI-102715	Operations Research in Supply Chain Management	4,5 CP	Nickel
T-WIWI-112109	Topics in Stochastic Optimization	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 seperately.

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

Prerequisites
At least one of the courses "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 makes suggestions to adapt them to practical problems.

Content
The modul focuses on theoretical foundations as well as solution algorithms for optimization problems with continuous and mixed integer decision variables.

Additional Information
The lectures are partly offered irregularly. The curriculum of the next three years is available online (www.ior.kit.edu).

For the lectures of Prof. Stein a grade of 30 % of the exercise course has to be fulfilled. The description of the particular lectures is more detailed.

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

M 5.128 Module: Microeconomic Theory [M-WIWI-101500]

Coordinators: Prof. Dr. Clemens Puppe
Organisation: KIT Department of Economics and Management
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	Advanced Topics in Economic Theory	4,5 CP	Brumm, Mitusch
T-WIWI-102861	Advanced Game Theory	4,5 CP	Ehrhart, Puppe, Reiß
T-WIWI-102613	Auction Theory	4,5 CP	Ehrhart
T-WIWI-105781	Incentives in Organizations	4,5 CP	Nieken
T-WIWI-113264	Matching Theory	4,5 CP	Puppe
T-WIWI-102859	Social Choice Theory	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 seperately.

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

Prerequisites
None

Competence Goal
Students

- are able to model practical microoeconomic 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
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 5.129 Module: Mobile Communication [M-INFO-107245]

Coordinators: Prof. Dr. Oliver Waldhorst
Prof. Dr. Martina Zitterbart
Organisation: KIT Department of Informatics
Part of: Informatics

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

Mandatory			
T-INFO-114271	Mobile Communication	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 5.130 Module: Model-Driven Software Development [M-INFO-106931]

Coordinators: Prof. Dr. Ralf Reussner
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	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 algebrae.

Workload
(2 SWS + 1.5 x 2 SWS) x 15 + 15 h exam preparation = 90 h

M 5.131 Module: Modeling the Dynamics of Financial Markets [M-WIWI-106660]

Coordinators: Prof. Dr. Maxim Ulrich
Organisation: KIT Department of Economics and Management
Part of: Economics and Management (Business Administration)

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

Mandatory			
T-WIWI-113414	Modeling the Dynamics of Financial Markets	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 5.132 Module: Module Master's Thesis [M-WIWI-104833]

Coordinators: Studiendekan der KIT-Fakultät für Informatik
Studiendekan des KIT-Studienganges

Organisation: KIT Department of Economics and Management

Part of: Master's Thesis

Credits	Grading	Recurrence	Duration	Language	Level	Version
30 CP	graded	Each term	1 term	German	3	1

Mandatory			
T-WIWI-103142	Master's Thesis	30 CP	Studiendekan der KIT-Fakultät für Informatik, 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 from the other faculty of the two participating departments (Department of Informatics, Department of Economics and Management). One of the two must be a junior professor or professor. 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 5.133 Module: Motion in Human and Machine - Seminar [M-INFO-102555]

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	3

Mandatory			
T-INFO-105140	Motion in Human and Machine - Seminar	3 CP	Asfour

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
The student knows procedures for modelling human motion, as well as possibilities for its processing and analysis. He/she knows methods for learning motion primitives and mapping human motion to robots that have different kinematics and dynamics and can apply them 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 deals with methods of modelling, generating and controlling movements in humans and robot systems. Students get an insight into this interdisciplinary field and learn the basics of biological motion, biomechanical simulation, robotics, and machine learning. In the introduction, motion generation as effect of muscle contraction is discussed. It will be shown how movement patterns can be identified and categorized based on the observation of human movements and how these patterns can be reproduced on a humanoid robot. Finally, methods for the learning of movement primitives from human demonstration will be presented and their application for the generation of motion for humanoid robots will be explained.

Additional Information
The block internship is an interdisciplinary event in co-operation with the University of Stuttgart and the University of Heidelberg.

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.

M 5.134 Module: Natural Language Processing [M-INFO-107178]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
6 CP	graded	Each winter term	1 term	English	4	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
180h

M 5.135 Module: Natural Language Processing and Software Engineering [M-INFO-107233]

Coordinators: Prof. Dr.-Ing. Anne Koziolek
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	Natural Language Processing and Software Engineering	3 CP	Koziolek

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 5.136 Module: Network Economics [M-WIWI-101406]

Coordinators: Prof. Dr. Kay Mitusch
Organisation: KIT Department of Economics and Management
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 5.137 Module: Network Security: Architectures and Protocols [M-INFO-107218]

Coordinators: 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-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 5.138 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 ofInternet-based communication and can apply this knowledge in practice. are familiar with concepts for quality of service support and group communicationsand can apply mechanisms for their implementation on the Internethave 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 andcan explain these using examples or apply them themselves when designing systems. In addition, students know theconcept of quality of service and important quality of service parameters, are familiar with basic mechanisms for supportingquality 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 congestioncontrol 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 explainhow they work in detail in their own words.
- Similarly, students know inherent trade-offs for routing in the Internetand 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) andcan analyze, explain, and apply technical procedures for their implementation.
- Moreover, students know propertiesof 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 5.139 Module: Operations Research in Supply Chain Management [M-WIWI-102832]

Coordinators: Prof. Dr. Stefan Nickel
Organisation: KIT Department of Economics and Management
Part of: Economics and Management (Operations Research)

Credits	Grading	Recurrence	Duration	Language	Level	Version
9 CP	graded	Each term	2 terms	German/English	4	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	Graph Theory and Advanced Location Models	4,5 CP	Nickel
T-WIWI-106200	Modeling and OR-Software: Advanced Topics	4,5 CP	Nickel
T-WIWI-102715	Operations Research in Supply Chain Management	4,5 CP	Nickel
Supplementary Courses (Election: at most 1 item)			
T-MACH-112213	Applied material flow simulation	4,5 CP	Baumann
T-WIWI-106546	Introduction to Stochastic Optimization	4,5 CP	Rebennack
T-WIWI-102718	Discrete-Event Simulation in Production and Logistics	4,5 CP	Spieckermann
T-WIWI-102719	Mixed Integer Programming I	4,5 CP	Stein
T-WIWI-102720	Mixed Integer Programming II	4,5 CP	Stein
T-WIWI-106549	Large-scale Optimization	4,5 CP	Rebennack
T-WIWI-111587	Multicriteria Optimization	4,5 CP	Stein
T-WIWI-114747	"Practical Seminar in Discrete Optimization: Implementing and Evaluating Solution Methods (with Python)"	4,5 CP	Bakker
T-WIWI-112109	Topics in Stochastic Optimization	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 seperately.

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

Prerequisites
At least one of the courses "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 Suppy Chain Mangement, 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 5.140 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	Grading	Recurrence	Duration	Language	Level	Version
3 CP	graded	Each winter term	1 term	English	4	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 hrs.

M 5.141 Module: Parallel Algorithms [M-INFO-107199]

Coordinators: Prof. Dr. Peter Sanders
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-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 ofa 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
The partial achievement **Parallel Algorithms Exercise** must be started before.

M 5.142 Module: Parallel Computer Systems and Parallel Programming [M-INFO-100808]

Coordinators: Prof. Dr. Achim Streit
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-101345	Parallel Computer Systems and Parallel Programming	4 CP	Streit

M 5.143 Module: Parameterized Algorithms [M-INFO-107167]

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-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.

M 5.144 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	2

Mandatory			
T-INFO-101362	Pattern Recognition	6 CP	Beyerer, Zander

M 5.145 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 5.146 Module: Photorealistic Rendering [M-INFO-100731]

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 winter term	1 term	German/English	4	2

Mandatory			
T-INFO-101268	Photorealistic Rendering	5 CP	Dachsbacher

M 5.147 Module: Practical Course Automatic Speech Recognition [M-INFO-102411]

Coordinators: Prof. Dr. Alexander Waibel
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-104775	Practical Course Automatic Speech Recognition	3 CP	Waibel

M 5.148 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	Grading	Recurrence	Duration	Language	Level	Version
6 CP	graded	Each summer term	1 term	German	4	3

Mandatory			
T-INFO-105943	Practical Course Computer Vision for Human-Computer Interaction	6 CP	Stiefelhagen

M 5.149 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	Grading	Recurrence	Duration	Language	Level	Version
4 CP	graded	Irregular	1 term	German	4	1

Mandatory			
T-INFO-106063	Practical Course Decentralized Systems and Network Services	4 CP	Hartenstein

M 5.150 Module: Practical Course on Network Security Research [M-INFO-107244]

Coordinators: Prof. Dr. Martina Zitterbart
Organisation: KIT Department of Informatics
Part of: Informatics

Credits	Grading	Recurrence	Duration	Language	Level	Version
3 CP	graded	Irregular	1 term	English	4	1

Mandatory			
T-INFO-114270	Practical Course on Network Security Research	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.

M 5.151 Module: Practical Course on Telematics [M-INFO-107597]

Coordinators: Prof. Dr. Martina Zitterbart
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-114894	Practical Course on Telematics	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 5.152 Module: Practical Course on Telematics Research [M-INFO-107220]

Coordinators: Prof. Dr. Martina Zitterbart
Organisation: KIT Department of Informatics
Part of: Informatics

Credits	Grading	Recurrence	Duration	Language	Level	Version
3 CP	graded	Irregular	1 term	English	3	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 5.153 Module: Practical Course Protocol Engineering [M-INFO-102092]

Coordinators: Prof. Dr. Martina Zitterbart
Organisation: KIT Department of Informatics
Part of: Informatics

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

Mandatory			
T-INFO-104386	Practical Course Protocol Engineering	4 CP	Zitterbart

M 5.154 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 achivements (Teilleitung)

Prerequisites
See partial achivements (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 COBaID/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 5.155 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	Practical Course: AI for Climate and Weather Predictions	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.

M 5.156 Module: Practical Course: Application Security [M-INFO-106996]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
4 CP	graded	Each winter term	1 term	English	4	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 5.157 Module: Practical Course: Chip Design I [M-INFO-107265]

Coordinators: Prof. Dr. Mehdi Baradaran Tahoori
Organisation: KIT Department of Informatics
Part of: Informatics

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

Mandatory			
T-INFO-114298	Practical Course: Chip Design I	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 T est
- other Emerging T echnologies
-
...
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 5.158 Module: Practical Course: Chip Design II [M-INFO-107266]

Coordinators: Prof. Dr. Mehdi Baradaran Tahoori
Organisation: KIT Department of Informatics
Part of: Informatics

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

Mandatory			
T-INFO-114299	Practical Course: Chip Design II	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 T est
- other Emerging T echnologies
-
...
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 5.159 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	Practical Course: Current Topics of Quantum Computing	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 5.160 Module: Practical Course: Data Science [M-INFO-105632]

Coordinators: Prof. Dr.-Ing. Klemens Böhm
Organisation: KIT Department of Informatics
Part of: Informatics

Credits	Grading	Recurrence	Duration	Language	Level	Version
6 CP	pass/fail	Each summer term	1 term	German	4	1

Mandatory			
T-INFO-111262	Practical Course: Data Science	6 CP	Böhm

M 5.161 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	pass/fail	Irregular	1 term	English	4	1

Mandatory			
T-INFO-112844	Practical Course: Data Science for Scientific Data	6 CP	Böhm

M 5.162 Module: Practical Course: Database Systems [M-INFO-101662]

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	Each winter term	1 term	German	4	1

Mandatory			
T-INFO-103201	Practical Course: Database Systems	4 CP	Böhm

M 5.163 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	Grading	Recurrence	Duration	Language	Level	Version
3 CP	graded	Each term	1 term	English	4	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 5.164 Module: Practical Course: Efficient Parallel C++ [M-INFO-107203]

Coordinators: Prof. Dr. Peter Sanders
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-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)

M 5.165 Module: Practical Course: Engineering Approaches to Software Development [M-INFO-104254]

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	German	4	1

Mandatory			
T-INFO-108791	Practical Course: Engineering Approaches to Software Development	6 CP	Reussner

M 5.166 Module: Practical Course: FPGA Programming [M-INFO-102661]

Coordinators: Prof. Dr. Mehdi Baradaran Tahoori
Organisation: KIT Department of Informatics
Part of: Informatics

Credits	Grading	Recurrence	Duration	Language	Level	Version
3 CP	graded	Each term	1 term	English	4	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 5.167 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	Grading	Recurrence	Duration	Language	Level	Version
3 CP	graded	Each term	1 term	English	4	3

Mandatory			
T-INFO-109914	Practical Course: General-Purpose Computation on Graphics Processing Units	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 5.168 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	Grading	Recurrence	Duration	Language	Level	Version
6 CP	graded	Irregular	1 term	German/English	4	1

Mandatory			
T-INFO-110872	Practical Course: Graphics and Game Development	6 CP	Dachsbacher

M 5.169 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	Grading	Recurrence	Duration	Language	Level	Version
6 CP	graded	Irregular	1 term	German/English	4	1

Mandatory			
T-INFO-109577	Practical Course: Hot Research Topics in Computer Graphics	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.

M 5.170 Module: Practical Course: Interactive Theorem Proving [M-INFO-107494]

Coordinators: Prof. Dr. Bernhard Beckert
Organisation: KIT Department of Informatics
Part of: Informatics

Credits	Grading	Recurrence	Duration	Language	Level	Version
3 CP	graded	Irregular	1 term	English	4	1

Mandatory			
T-INFO-114691	Practical Course: Interactive Theorem Proving	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 5.171 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	Grading	Recurrence	Duration	Language	Level	Version
4 CP	graded	Each term	1 term	English	4	1

Mandatory			
T-INFO-107493	Practical Course: Internet of Things (IoT)	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.

M 5.172 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 5.173 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

M 5.174 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	Practical Course: Model-Driven Software Development	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 5.175 Module: Practical Course: Natural Language Dialog Systems [M-INFO-107177]

Coordinators: Prof. Dr. Jan Niehues
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-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 5.176 Module: Practical Course: Neural Network Exercises [M-INFO-103143]

Coordinators: Prof. Dr. Alexander Waibel
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-106259	Practical Course: Neural Network Exercises	3 CP	Waibel

M 5.177 Module: Practical Course: Programme Verification [M-INFO-101537]

Coordinators: Prof. Dr. Bernhard Beckert
Organisation: KIT Department of Informatics
Part of: Informatics

Credits	Grading	Recurrence	Duration	Language	Level	Version
3 CP	graded	Irregular	1 term	German/English	4	1

Mandatory			
T-INFO-102953	Practical Course: Programme Verification	3 CP	Beckert

M 5.178 Module: Practical Course: Realtime Computer Graphics [M-INFO-106851]

Coordinators: Prof. Dr.-Ing. Carsten Dachsbacher
Organisation: KIT Department of Informatics
Part of: Informatics

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

Mandatory			
T-INFO-113737	Practical Course: Realtime Computer Graphics	6 CP	Dachsbacher

M 5.179 Module: Practical Course: Rendering in CGI [M-INFO-106687]

Coordinators: Prof. Dr.-Ing. Carsten Dachsbacher
Organisation: KIT Department of Informatics
Part of: Informatics

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

Mandatory			
T-INFO-113443	Practical Course: Rendering in CGI	6 CP	Dachsbacher

M 5.180 Module: Practical Course: Route Planning [M-INFO-107600]

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-114899	Practical Course: Route Planning	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 5.181 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 5.182 Module: Practical Course: Scientific Visualization [M-INFO-106686]

Coordinators: Prof. Dr.-Ing. Carsten Dachsbacher
Organisation: KIT Department of Informatics
Part of: Informatics

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

Mandatory			
T-INFO-113442	Practical Course: Scientific Visualization	6 CP	Dachsbacher

M 5.183 Module: Practical Course: Smart Data Analytics [M-INFO-103235]

Coordinators: Prof. Dr.-Ing. Michael Beigl
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	1

Mandatory			
T-INFO-106426	Practical Course: Smart Data Analytics	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

M 5.184 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	Waczowicz

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
After successfully completing the course, students will be able to
- be able to explain the structure and objectives of a smart grid using the Energy Lab 2.0 and the Smart Energy System Simulation and Control Centre (SEnSSiCC),
- be able to name and categorise current research issues in the field of innovative, application-oriented information, automation and system technology for sustainable energy systems,
- analyse a problem from the current research questions of SEnSSiCC as part of a project and develop a strategy for a solution together in a team and
- be able to check, analyse and evaluate the feasibility of results in a laboratory.

Content
As part of the preparation for the internship, project topics are derived from the current research questions of the Smart Energy System Simulation and Control Centre of the Energy Lab 2.0 (https://www.iai.kit.edu/RPE.php). The topics are made available to the participating students in advance of the internship as a list, on the basis of which the students can express their preferences for the respective topics. Based on their stated preferences, the students are assigned to the respective project topics.
The two-week internship begins with a joint kick-off event, which includes an introduction and tour of the Energy Lab 2.0 and the SEnSSiCC as well as a brief presentation of all project topics. Students are provided with current scientific papers on their research topic. During the two-week internship, the groups of students work on their project topics under the supervision of the respective scientists. The students use a laboratory set-up to test their concepts and solutions. Particularly promising approaches can be tested on the real system under the supervision of the scientists. The block course ends with a joint final event at which the students present their solutions and work results.

After the internship, the students follow up the project work by preparing a report on the project topic they have worked on, categorising the work results and reflecting on the work process.
Working in a team is another important aspect of all project topics.
The work placement consists of the following sections:
- Familiarisation with the topic
- Selection of a suitable project topic in consultation with the supervising scientists
- Practical realisation of the project topic
- Presentation of the results (colloquium, research report)

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.

M 5.185 Module: Practical Course: Software Defined Networking [M-INFO-107221]

Coordinators: Prof. Dr. Martina Zitterbart
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-114240	Practical Course: Software Defined Networking	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 5.186 Module: Practical Course: Tools for Agile Modelling [M-INFO-104893]

Coordinators: Prof. Dr.-Ing. Anne Koziolek
Organisation: KIT Department of Informatics
Part of: Informatics

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

Mandatory			
T-INFO-109925	Practical Course: Tools for Agile Modelling	6 CP	Koziolek

M 5.187 Module: Practical Course: Visual Computing [M-INFO-101567]

Coordinators: Prof. Dr.-Ing. Carsten Dachsbacher
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-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 5.188 Module: Practical Course: Wearable Computing [M-INFO-107527]

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

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

Mandatory			
T-INFO-114744	Practical Course: Wearable Computing	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 5.189 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	Grading	Recurrence	Duration	Language	Level	Version
5 CP	graded	Each summer term	1 term	German	4	2

Mandatory			
T-INFO-103121	Practical Course: Web Applications and Service-Oriented Architectures (II)	5 CP	Abeck

M 5.190 Module: Practical Introduction to Hardware Security [M-INFO-107241]

Coordinators: Prof. Dr. Mehdi Baradaran Tahoori
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-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 5.191 Module: Practical SAT Solving [M-INFO-107238]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
5 CP	graded	Irregular	1 term	English	4	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 5.192 Module: Private Business Law [M-INFO-101216]

Coordinators: N.N.
Organisation: KIT Department of Informatics
Part of: Law

Credits	Grading	Recurrence	Duration	Language	Level	Version
9 CP	graded	Each term	2 terms	German	4	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 provides the student with knowledge in special matters in business law, like employment law, tax law and business law, which are essential for managerial decisions.

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 5.193 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	Grading	Recurrence	Duration	Language	Level	Version
5 CP	graded	Each winter term	1 term	English	4	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.

M 5.194 Module: Project Lab Applied Machine Learning [M-WIWI-106491]

Coordinators: Prof. Dr.-Ing. Johann Marius Zöllner
Organisation: KIT Department of Economics and Management
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	Project Lab Cognitive Automobiles and Robots	5 CP	Zöllner
T-WIWI-109983	Project Lab Machine Learning	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 5.195 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	Grading	Recurrence	Duration	Language	Level	Version
6 CP	graded	Each summer term	1 term	German	4	1

Mandatory			
T-INFO-104746	Project Lab: Image Analysis and Fusion	6 CP	Beyerer

M 5.196 Module: Public Economic and Technology Law [M-INFO-106754]

Coordinators: TT-Prof. Dr. Frederike Zufall
Organisation: KIT Department of Informatics
Part of: Law

Credits	Grading	Recurrence	Duration	Language	Level	Version
9 CP	graded	Each term	2 terms	German/English	4	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 5.197 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	Grading	Recurrence	Duration	Language	Level	Version
6 CP	graded	Each winter term	1 term	English	4	2

Mandatory			
T-INFO-111255	Reinforcement Learning	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 5.198 Module: Reliable Computing I [M-INFO-100850]

Coordinators: Prof. Dr. Mehdi Baradaran Tahoori
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-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 SWS + 1,5 x 2 SWS) x 15 + 15 h preparation for the exam = 90 h = 3 ECTS

M 5.199 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	Research Focus Class: Blockchain & Cryptocurrencies	3 CP	Hartenstein
T-INFO-113401	Research Focus Class: Blockchain & Cryptocurrencies - Seminar	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 5.200 Module: Research Practical Course: Explainable Artificial Intelligence [M-INFO-106495]

Coordinators: TT-Prof. Dr. Rudolf Lioutikov
Organisation: KIT Department of Informatics
Part of: Informatics

Credits	Grading	Recurrence	Duration	Language	Level	Version
6 CP	graded	Each winter term	1 term	English	4	1

Mandatory			
T-INFO-113114	Research Practical Course: Explainable Artificial Intelligence	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
Arbeitsaufwand = 180h = 6 ECTS
- Präsenzzeit: 15h
- Projektarbeit: 135h
- Scientific Report schreiben + Päsentation vorbereiten: 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 5.201 Module: Research Practical Course: Interactive Learning [M-INFO-106300]

Coordinators: TT-Prof. Dr. Rudolf Lioutikov
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-112772	Research Practical Course: Interactive Learning	6 CP	Lioutikov

Assessment
See Partial achivements (Teilleistung).

Prerequisites
See Partial achivements (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 5.202 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	Grading	Recurrence	Duration	Language	Level	Version
10 CP	graded	Each term	2 terms	German	4	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 5.203 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	Grading	Recurrence	Duration	Language	Level	Version
10 CP	graded	Each term	2 terms	German	4	1

Mandatory			
T-INFO-110221	Research Project (Project, 2nd Semester) - Oral Exam	3 CP	Beckert
T-INFO-110222	Research Project (Project, 2nd Semester) - Presentation	3 CP	Beckert
T-INFO-110223	Research Project (Project, 2nd Semester) - Scientific Report	4 CP	Beckert

M 5.204 Module: Research Project Autonomous Learning Robots [M-INFO-105378]

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-110861	Research Project Autonomous Learning Robots	6 CP	Neumann

M 5.205 Module: Research Project Deep Learning for Robotics [M-INFO-107174]

Coordinators: Prof. Dr. Gerhard Neumann
Organisation: KIT Department of Informatics
Part of: Informatics

Credits	Grading	Recurrence	Duration	Language	Level	Version
6 CP	graded	Each winter term	1 term	English	4	1

Mandatory			
T-INFO-114203	Research Project Deep Learning for Robotics	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 5.206 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	Research Project: Generative AI for Autonomous Agents	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 5.207 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	Grading	Recurrence	Duration	Language	Level	Version
6 CP	graded	Each winter term	1 term	English	4	1

Mandatory			
T-INFO-113765	Research Project: Machine Learning for Autonomous Agents and Decision Making	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 5.208 Module: RIG 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	Grading	Recurrence	Duration	Language	Level	Version
3 CP	graded	Each winter term	1 term	English	4	1

Mandatory			
T-INFO-114895	RIG Lecture Series	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 5.209 Module: Robotics - Practical Course [M-INFO-107155]

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 summer term	1 term	English	4	1

Mandatory			
T-INFO-114172	Practical Course: Robotics	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 5.210 Module: Robotics I - Introduction to Robotics [M-INFO-107162]

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	English	4	1

Mandatory			
T-INFO-114190	Robotics I - Introduction to Robotics	6 CP	Asfour

Assessment
See partial achivements (Teilleistung)

Prerequisites
See partial achivements (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 * 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

M 5.211 Module: Robotics II - Humanoid Robotics [M-INFO-107123]

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-114152	Robotics II - Humanoid Robotics	3 CP	Asfour

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
The students have an overview of current research topics in autonomous learning robot systems using the example of humanoid robotics. They are able to classify and evaluate current developments in the field of cognitive humanoid robotics.

The students know the essential problems of humanoid robotics and are able to develop solutions on the basis of existing research.

Content
The lecture presents current work in the field of humanoid robotics that deals with the implementation of complex sensorimotor and cognitive abilities. In the individual topics different methods and algorithms, their advantages and disadvantages, as well as the current state of research are discussed.

The topics addressed are: Applications and real world examples of humanoid robots; biomechanical models of the human body, biologically inspired and data-driven methods of grasping, imitation learning and programming by demonstration; semantic representations of sensorimotor experience as well as cognitive software architectures of humanoid robots.

Workload
Lecture with 2 SWS, 3 CP.
3 LP corresponds to approx. 90 hours, thereof:
approx. 15 * 2h = 30 Std. Attendance time
approx. 15 * 2h = 30 Std. Self-study prior/after the lecture
approx. 30 Std. Preparation for the exam and exam itself

Recommendations
Having visited the lectures on Robotics I - Introduction to Robotics and Mechano-Informatics and Robotics is recommended.

M 5.212 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 achivements (Teilleistung)

Prerequisites
See partial achivements (Teilleistung)

Competence Goal
Students can name the main sensor principles used in robotics.

Students can explain the data flow from physical measurement through digitization to the use of the recorded data for feature extraction, state estimation and semantic scene understanding.

Students are able to propose and justify suitable sensor concepts for common tasks in robotics.

Content
The lecture supplements the lecture Robotics I with a broad overview of sensors used in robotics. The lecture focuses on visual perception, object recognition, semantic scene interpretation, and (inter-)active perception. The lecture is divided into two parts:

In the first part a comprehensive overview of current sensor technologies is given. A basic distinction is made between sensors for the perception of the environment (exteroceptive) and sensors for the perception of the internal state (proprioceptive).

The second part of the lecture concentrates on the use of exteroceptive sensors in robotics. The topics covered include tactile exploration and visual data processing, including advanced topics such as feature extraction, object localization,semantic scene interpretation, and (inter-)active perception.

Workload
Lecture with 2 SWS, 3 LP
3 LP corresponds to 90 hours, including
15 * 2 = 30 hours attendance time
15 * 2 = 30 hours self-study
30 hours preparation for the exam

Recommendations
Attending the lecture Robotics I – Introduction to Robotics is recommended.

M 5.213 Module: Safe Human-Robot-Collaboration [M-INFO-104877]

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 winter term	1 term	German	4	1

Mandatory			
T-INFO-109911	Safe Human-Robot-Collaboration	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

M 5.214 Module: Sampling Methods for Machine Learning [M-INFO-107090]

Coordinators: Prof. Dr.-Ing. Uwe Hanebeck
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-114133	Sampling Methods for Machine Learning	6 CP	Hanebeck
T-INFO-114134	Sampling Methods for Machine Learning - Pass	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 5.215 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	Grading	Recurrence	Duration	Language	Level	Version
5 CP	graded	Each winter term	1 term	English	4	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
Σ = 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 5.216 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	Grading	Recurrence	Duration	Language	Level	Version
3 CP	graded	Each winter term	1 term	German	3	1

Mandatory			
T-INFO-114599	Selected Aspects in Real-time Systems	3 CP	Längle

M 5.217 Module: Seminar Information Systems [M-WIWI-104815]

Coordinators: Studiendekan der KIT-Fakultät für Informatik
Studiendekan des KIT-Studienganges

Organisation: KIT Department of Economics and Management

Part of: Seminars

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

Mandatory			
T-WIWI-109827	Seminar in Information Systems (Master)	3 CP	Studiendekan der KIT-Fakultät für Informatik, 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 5.218 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	Grading	Recurrence	Duration	Language	Level	Version
3 CP	graded	Each summer term	1 term	German	4	1

Mandatory			
T-INFO-112105	Seminar Laboratory: Machine Learning and Intelligent Systems	3 CP	Fennel, Hanebeck

M 5.219 Module: Seminar Module Economic Sciences [M-WIWI-102736]

Coordinators: Studiendekan des KIT-Studienganges
Organisation: KIT Department of Economics and Management
Part of: Seminars

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

Compulsory Elective Courses (Election: 1 item)			
T-WIWI-103474	Seminar in Business Administration A (Master)	3 CP	Professorenschaft des Fachbereichs Betriebswirtschaftslehre
T-WIWI-103478	Seminar in Economics A (Master)	3 CP	Professorenschaft des Fachbereichs Volkswirtschaftslehre
T-WIWI-103481	Seminar in Operations Research A (Master)	3 CP	Nickel, Rebennack, Stein
T-WIWI-103483	Seminar in Statistics A (Master)	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 5.220 Module: Seminar Module Informatics [M-INFO-102822]

Coordinators: Studiendekan der KIT-Fakultät für Informatik
Studiendekan des KIT-Studienganges

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

Part of: Seminars

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

Election Notes
To register for a seminar at the AIFB Institute, please select the course T-WIWI-103480 "Seminar Informatik B (Master)".

Compulsory Elective Seminar in Informatics (Election: 1 item)			
T-WIWI-103480	Seminar in Informatics B (Master)	3 CP	Professorenschaft des Instituts AIFB
T-INFO-111205	Seminar Informatics Master	3 CP	

M 5.221 Module: Seminar Module Law [M-INFO-101218]

Coordinators: Dr. Yvonne Matz
Organisation: KIT Department of Informatics
Part of: Seminars

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

Mandatory			
T-INFO-101997	Seminar: Legal Studies I	3 CP	N.N.

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 5.222 Module: Seminar: Artificial Intelligence for Energy Systems [M-INFO-106490]

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

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

Mandatory			
T-INFO-113110	Seminar: Artificial Intelligence for Energy Systems	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 5.223 Module: Seminar: Interactive Learning [M-INFO-106301]

Coordinators: TT-Prof. Dr. Rudolf Lioutikov
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	2

Mandatory			
T-INFO-112773	Seminar: Interactive Learning	3 CP	Lioutikov

Assessment
See Partial Achivements (Teilleistung).

Prerequisites
See Partial Achivements (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 indentify 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.

M 5.224 Module: Service Analytics [M-WIWI-101506]

Coordinators: Prof. Dr. Gerhard Satzger
Prof. Dr. Christof Weinhardt

Organisation: KIT Department of Economics and Management

Part of: Economics and Management (Business Administration)

Credits	Grading	Recurrence	Duration	Language	Level	Version
9 CP	graded	Each term	2 terms	English	4	11

Compulsory Elective Courses (Election: 9 credits)			
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-105777	Business Intelligence Systems	4,5 CP	Mädche
T-WIWI-112152	Practical Seminar: Artificial Intelligence in Service Systems	4,5 CP	Satzger
T-WIWI-113725	Special Topics in Information Systems	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.

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

Recommendations
The course Service Analytics A [2595501] should be taken.

M 5.225 Module: Service Design Thinking [M-WIWI-101503]

Coordinators: Prof. Dr. Gerhard Satzger
Prof. Dr. Orestis Terzidis

Organisation: KIT Department of Economics and Management

Part of: Economics and Management (Business Administration)

Credits	Grading	Recurrence	Duration	Language	Level	Version
9 CP	graded	Each winter term	2 terms	English	4	1

Mandatory			
T-WIWI-102849	Service Design Thinking	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 5.226 Module: Service Economics and Management [M-WIWI-102754]

Coordinators: Prof. Dr. Gerhard Satzger
Prof. Dr. Christof Weinhardt

Organisation: KIT Department of Economics and Management

Part of: Economics and Management (Business Administration)

Credits	Grading	Recurrence	Duration	Language	Level	Version
9 CP	graded	Each term	2 terms	English	4	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.

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 5.227 Module: Service Innovation, Design & Engineering [M-WIWI-102806]

Coordinators: Prof. Dr. Alexander Mädche
Prof. Dr. Gerhard Satzger

Organisation: KIT Department of Economics and Management

Part of: Economics and Management (Business Administration)

Credits	Grading	Recurrence	Duration	Language	Level	Version
9 CP	graded	Each term	2 terms	English	4	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.

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].

M 5.228 Module: Service Management [M-WIWI-101448]

Coordinators: Prof. Dr. Gerhard Satzger
Prof. Dr. Christof Weinhardt

Organisation: KIT Department of Economics and Management

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	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-112757	Digital Services: Innovation & Business Models	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 5.229 Module: Service Operations [M-WIWI-102805]

Coordinators: Prof. Dr. Stefan Nickel
Organisation: KIT Department of Economics and Management
Part of: Economics and Management (Operations Research)

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

Election Notes
At least one of the fourcourses Operations Research in Supply Chain Management, Operations Research in Health Care Management, Practical seminar: Health Care Management orDiscrete-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	Discrete-Event Simulation in Production and Logistics	4,5 CP	Spieckermann
T-WIWI-102884	Operations Research in Health Care Management	4,5 CP	Nickel
T-WIWI-102715	Operations Research in Supply Chain Management	4,5 CP	Nickel
T-WIWI-102716	Practical Seminar: Health Care Management (with Case Studies)	4,5 CP	Nickel
Supplementary Courses (Election: at most 1 item)			
T-MACH-112213	Applied material flow simulation	4,5 CP	Baumann
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
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.

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 5.230 Module: Software Architecture and Quality [M-INFO-107237]

Coordinators: Prof. Dr. Ralf Reussner
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-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 5.231 Module: Software Engineering II [M-INFO-107235]

Coordinators: Prof. Dr.-Ing. Anne Koziolek
Prof. Dr. Raffaela Mirandola
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-114259	Software Engineering II	6 CP	Koziolek, Mirandola, 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 SWS + 1.5 x 4 SWS) x 15 + 30 h exam preparation = 180 h = 6 ECTS

M 5.232 Module: Software Lab Parallel Numerics [M-INFO-102998]

Coordinators: Prof. Dr. Wolfgang Karl
Organisation: KIT Department of Informatics
Part of: Informatics

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

Mandatory			
T-INFO-105988	Software Lab Parallel Numerics	6 CP	Karl

M 5.233 Module: Software Product Line Engineering [M-INFO-107212]

Coordinators: Prof. Dr.-Ing. Ina Schaefer
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-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 5.234 Module: Software Security Engineering [M-INFO-106344]

Coordinators: Prof. Dr. Ralf Reussner
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-112862	Software Security Engineering	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 5.235 Module: Software-Evolution [M-INFO-100719]

Coordinators: Prof. Dr. Ralf Reussner
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-101256	Software-Evolution	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 5.236 Module: Statistics and Econometrics II [M-WIWI-105414]

Coordinators: Prof. Dr. Melanie Schienle
Organisation: KIT Department of Economics and Management
Part of: Economics and Management (Economics)
Economics and Management (Statistics)

Credits	Grading	Recurrence	Duration	Language	Level	Version
9 CP	graded	Each term	1 term	German/English	4	5

Compulsory Elective Courses (Election:)			
T-WIWI-103063	Analysis of Multivariate Data	4,5 CP	Grothe
T-WIWI-114622	Introduction to Econometrics	5 CP	Schienle
T-WIWI-103064	Financial Econometrics	4,5 CP	Schienle
T-WIWI-110939	Financial Econometrics II	4,5 CP	Schienle
T-WIWI-112153	Microeconometrics	4,5 CP	Krüger
T-WIWI-103065	Statistical Modeling of Generalized Regression Models	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 techiques for regression, time series and multivariate analysis.

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

M 5.237 Module: Stochastic Information Processing [M-INFO-100829]

Coordinators: Prof. Dr.-Ing. Uwe Hanebeck
Organisation: KIT Department of Informatics
Part of: Informatics

Credits	Grading	Recurrence	Duration	Language	Level	Version
6 CP	graded	Each winter term	1 term	German	4	1

Mandatory			
T-INFO-101366	Stochastic Information Processing	6 CP	Hanebeck

M 5.238 Module: Stochastic Optimization [M-WIWI-103289]

Coordinators: Prof. Dr. Steffen Rebennack
Organisation: KIT Department of Economics and Management
Part of: Economics and Management (Operations Research)

Credits	Grading	Recurrence	Duration	Language	Level	Version
9 CP	graded	Each term	1 term	German/English	4	11

Compulsory Elective Courses (Election: between 1 and 2 items)			
T-WIWI-106546	Introduction to Stochastic Optimization	4,5 CP	Rebennack
T-WIWI-106548	Advanced Stochastic Optimization	4,5 CP	Rebennack
T-WIWI-106549	Large-scale Optimization	4,5 CP	Rebennack
Supplementary Courses (Election: at most 1 item)			
T-WIWI-102723	Graph Theory and Advanced Location Models	4,5 CP	Nickel
T-WIWI-102719	Mixed Integer Programming I	4,5 CP	Stein
T-WIWI-102720	Mixed Integer Programming II	4,5 CP	Stein
T-WIWI-111247	Mathematics for High Dimensional Statistics	4,5 CP	Grothe
T-WIWI-111587	Multicriteria Optimization	4,5 CP	Stein
T-WIWI-103124	Multivariate Statistical Methods	4,5 CP	Grothe
T-WIWI-102715	Operations Research in Supply Chain Management	4,5 CP	Nickel
T-WIWI-106545	Optimization under Uncertainty	4,5 CP	Rebennack
T-WIWI-112109	Topics in Stochastic Optimization	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 seperately.

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

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

Competence Goal
The student

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

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

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 5.239 Module: Student Innovation Lab (SIL) 1 [M-WIWI-105010]

Coordinators: Prof. Dr.-Ing. Sören Hohmann
Prof. Dr. Orestis Terzidis

Organisation: KIT Department of Economics and Management

Part of: Economics and Management (Business Administration)

Credits	Grading	Recurrence	Duration	Language	Level	Version
9 CP	graded	Each winter term	2 terms	English	4	1

Mandatory			
T-WIWI-102864	Entrepreneurship	3 CP	Terzidis
T-WIWI-110166	SIL Entrepreneurship Project	3 CP	Terzidis
T-WIWI-110287	SIL Entrepreneurship Emphasis	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/.

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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 5.240 Module: Telematics [M-INFO-107243]

Coordinators: Prof. Dr. Martina Zitterbart
Organisation: KIT Department of Informatics
Part of: Informatics

Credits	Grading	Recurrence	Duration	Language	Level	Version
6 CP	graded	Each winter term	1 term	English	4	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 5.241 Module: Testing Digital Systems I [M-INFO-100851]

Coordinators: Prof. Dr. Mehdi Baradaran Tahoori
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-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

M 5.242 Module: Testing Digital Systems II [M-INFO-102962]

Coordinators: Prof. Dr. Mehdi Baradaran Tahoori
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-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.

M 5.243 Module: The de-Casteljau Algorithm [M-INFO-106642]

Coordinators: Prof. Dr. Hartmut Prautzsch
Organisation: KIT Department of Informatics
Part of: Informatics

Credits	Grading	Recurrence	Duration	Language	Level	Version
3 CP	graded	Once	1 term	German/English	4	1

Mandatory			
T-INFO-113389	The de-Casteljau Algorithm	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

M 5.244 Module: Theoretical Foundations of Cryptography [M-INFO-105584]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
6 CP	graded	Each winter term	1 term	German	4	1

Mandatory			
T-INFO-111199	Theoretical Foundations of Cryptography	6 CP	Müller-Quade

M 5.245 Module: Timed Systems [M-INFO-106293]

Coordinators: Jun.-Prof. Dr. Maike Schwammberger
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	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 5.246 Module: Tools for Probabilistic Machine Learning [M-INFO-106870]

Coordinators: Prof. Dr.-Ing. Uwe Hanebeck
Organisation: KIT Department of Informatics
Part of: Informatics

Credits	Grading	Recurrence	Duration	Language	Level	Version
6 CP	graded	Each winter term	1 term	German	3	1

Mandatory			
T-INFO-113763	Tools for Probabilistic Machine Learning	6 CP	Hanebeck
T-INFO-113764	Tools for Probabilistic Machine Learning - Pass	0 CP	Hanebeck

M 5.247 Module: Transport Infrastructure Policy and Regional Development [M-WIWI-101485]

Coordinators: Prof. Dr. Kay Mitusch
Organisation: KIT Department of Economics and Management
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 5.248 Module: Ubiquitous Computing [M-INFO-107161]

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

Credits	Grading	Recurrence	Duration	Language	Level	Version
5 CP	graded	Irregular	1 term	English	4	1

Mandatory			
T-INFO-114188	Ubiquitous Computing	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 5.249 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	Visualization	5 CP	Dachsbacher

M 5.250 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	Grading	Recurrence	Duration	Language	Level	Version
4 CP	graded	Each summer term	1 term	English	4	1

Mandatory			
T-INFO-114145	Wearable Robotic Technologies	4 CP	Asfour, Beigl

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
The student has received fundamental knowledge about wearable robotic technologies and understands the requirements for the design, the interface to the human body and the control of wearable robots. He/she is able to describe methods for modelling the human neuromusculoskeletal system, the mechatronic design, fabrication and composition of interfaces to the human body. The student understands the symbiotic human–machine interaction as a core topic of Anthropomatics and has knowledge of state-of-the-art examples of exoskeletons, orthoses and prostheses.

Content
The lecture provides an overview of wearable robot technologies (exoskeletons, prostheses and ortheses) and their potentials. It starts with the basics of wearable robotics and introduces different approaches to the design of wearable robots and their related actuator and sensor technology. The lecture focuses on modeling the neuromusculoskeletal system of the human body, the interfaces of wearable robots to the human body and the physical and cognitive human-robot interaction for tightly-coupled hybrid human-robot systems. Examples of current research and various applications of lower, upper and full body exoskeletons as well as prostheses are presented.

Workload
Lecture with 2 SWS, 4 LP
4 LP corresponds to 120 hours, including
15 * 2 = 30 hours attendance time
15 * 3 = 45 self-study
45 hours preparation for the exam

Recommendations
Attendance of the lecture Mechano-Informatics in Robotics is recommended.

M 5.251 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	Grading	Recurrence	Duration	Language	Level	Version
4 CP	graded	Each summer term	1 term	German	4	1

Mandatory			
T-INFO-101271	Web Applications and Service-Oriented Architectures (II)	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 Economics and Management
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	Practical Seminar in Discrete Optimization: Implementing and Evaluating Solution Methods (with Python)	3 SWS	Others (sons / 🗣	Bakker

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 Economics and Management
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
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 Economics and Management
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 2025	2500015	(Gen)AI-based Automation in Organizations	3 SWS	Lecture /	Mädche, Benke
Exams					
ST 2025	7900308	(Gen)AI-based Automation in Organizations			Mädche

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

Assessment
Alternative exam assessment. It consists of a one-hour exam and the implementation of a capstone project.
The final grade is made up of 60% of the exam grade and 40% of the capstone project grade.
Details on the structure of the assessment will be announced during the lecture.

Workload
135 hours

Below you will find excerpts from courses related to this module component:

V **(Gen)AI-based Automation in Organizations**
2500015, SS 2025, 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 and Google Gemini for text and image generation, personal recommendations, or decision support. At the same time, organizations are challenged to leverage GenAI but also AI technology in general 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. For example, organizations can automate the creation of customer service responses, contract document reviewing in legal departments, application screening in human resources, or fraud detection in financial transactions.

This digital transformation process to higher levels of automation must be managed by organizations. While the goal is to free up capacity of employees from simple repetitive tasks for more complex ones, improce efficiency and extend innovation capabilities, organizations also must consider social and ethical aspects when implementing automation. Thus, a (Gen)AI integration strategy that benefits organizations must consider many facets, e.g., strategic objectives, business model adaptation, governance and risk management, implementation project portfolio management, and change management.
Summarizing, this course will teach concepts to support organizations and their employees to increase the level of automation leveraging (Gen)AI technologies under consideration of an economic and social perspective.

This course consists of the following major building blocks:

- Introduction to (Gen)AI concepts and technology.
- Overview of history and key concepts of automation in organizations.
- Organizational perspective on integrating (Gen)AI.
- Individual perspective on integrating (Gen)AI capabilities.
- Challenges and countermeasures to secure the integration of (Gen)AI capabilities into organizations from a socio-economic perspective.

The course is complemented with quizzes for knowledge recapture and hands-on activities in which the students apply the lecture content and implement the integration of (generative) AI capabilities in organizational processes and structures based on real-world case studies to increase organizational automation.

Learning goals
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 describe core concepts of automation to drive organizational efficiency and innovation.
- articulate (Gen)AI integration principles for effectively implementing automation in organizations.
- explore and prototype (Gen)AI-based applications to streamline individual tasks and workflows in the context of organizational automation.
- analyze best practices for addressing challenges to ensure adoption of (Gen)AI capabilities for organizational automation from a socio-economic perspective.

Prerequisites
No specific prerequisites are required for the lecture.

T 6.4 Module component: Access Control Systems: Foundations and Practice [T-INFO-106061]

Coordinators: Prof. Dr. Hannes Hartenstein
Organisation: KIT Department of Informatics
Part of: M-WIWI-107529 - Information Systems: Software & Systems Engineering

Type	Credits	Grading	Term offered	Version
Written examination	5 CP	graded	Each term	2

T 6.5 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	Credits	Grading	Term offered	Version
Written examination	5 CP	graded	Each summer term	1

Courses					
ST 2025	2400147	Access Control Systems: Models and Technology	3 SWS	Lecture / Practice (/ 🗣	Hartenstein, Leinweber
Exams					
ST 2025	7500155	Access Control Systems: Models and Technology			Hartenstein
WT 25/26	7500087	Access Control Systems: Models and Technology			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 2025, 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

Σ = 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 6.6 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	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Each winter term	2

Courses					
WT 25/26	2400145	ICPC: Advanced Algorithmic Programming	2 SWS	Lecture / 🗣	Künnemann, Angrick

Legend: 💻 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

T 6.7 Module component: Advanced Artificial Intelligence [T-INFO-114220]

Coordinators: Prof. Dr. Jan Niehues
Organisation: KIT Department of Informatics
Part of: M-INFO-107198 - Advanced Artificial Intelligence

Type	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each summer term	1

Courses					
ST 2025	2400141	Advanced Artificial Intelligence	4 SWS	Lecture / 🗣	Niehues, Lioutikov
Exams					
ST 2025	7500052	Advanced Artificial Intelligence			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 **Advanced Artificial Intelligence** — **Lecture (V) On-Site**
2400141, SS 2025, 4 SWS, Language: English, Open in study portal

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 6.8 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	Credits	Grading	Version
Written examination	5 CP	graded	1

Courses					
WT 25/26	2400120	Advanced Bayesian Data Analysis	3 SWS	Lecture / Practice (/ 🗣	Klein
Exams					
WT 25/26	7500059	Advanced Bayesian Data Analysis			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 6.9 Module component: Advanced Corporate Finance [T-WIWI-113469]

Coordinators: Prof. Dr. Martin Ruckes
Organisation: KIT Department of Economics and Management
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 summer term	1

Courses					
ST 2025	2530214	Advanced Corporate Finance	2 SWS	Lecture / 🗣	Ruckes
Exams					
ST 2025	7900317	Advanced Corporate Finance			Ruckes
WT 25/26	7900058	Advanced Corporate Finance			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 2025, 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-conceptional 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 6.10 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

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 6.11 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

Assessment
The examination takes place in the form of an 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 6.12 Module component: Advanced Empirical Asset Pricing [T-WIWI-110513]

Coordinators: Prof. Dr. Julian Thimme
Organisation: KIT Department of Economics and Management
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					
ST 2025	2530601	Advanced Empirical Asset Pricing Exercises	1 SWS	Practice /	Thimme
ST 2025	2530602	Advanced Empirical Asset Pricing	2 SWS	Lecture /	Thimme
Exams					
ST 2025	7900321	Advanced Empirical Asset Pricing			Thimme

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

Assessment
The success control takes place in form of a written examination (60 min) during the semester break. If the number of participants is low, an oral examination may also be offered. The examination is offered every semester and can be repeated at any regular examination date.

A bonus can be acquired by submitting exercise solutions to 80% of the assigned exercise tasks. If the grade of the written examination is between 4.0 and 1.3, the bonus improves the grade by up to one grade level (0.3 or 0.4). Details will be announced in the lecture.

Recommendations
We strongly recommend knowledge of the basic topics in investments (bachelor course), which will be necessary to be able to follow the course. In addition, prior participation in the Asset Pricing Master course is strongly recommended.

Additional Information
New course from winter semester 2019/2020.

Workload
135 hours

Below you will find excerpts from courses related to this module component:

V Advanced Empirical Asset Pricing

2530602, SS 2025, 2 SWS, Language: English, Open in study portal

Lecture (V)
Blended (On-Site/Online)

Content
In this course we will discuss the fundamentals of Asset Pricing and how to test them. Although this is an Empirical Asset Pricing course, we deal with some concepts from Asset Pricing Theory that we can test afterwards (CAPM, ICAPM, CCAPM, recursive utility). Besides, the course will cover the most important empirical methods to do so. For that purpose, we will discuss the overarching tool *Generalized Method of Moments*, and the special cases of OLS and FMB regressions. Every second week, we will meet for a programing session, in which we will look at the data to draw our own conclusions. An introduction to the software MATLAB will be given at the beginning of the course. Students should bring a laptop to these sessions. Programing skills are not required but helpful.

We start with a review of the Stochastic Discount Factor, which is already known from the course „Asset Pricing“. We then derive the CAPM and the Consumption-CAPM as special cases from the general consumption-savings optimization problem of the rational investor. In the first part of the course we discuss the CAPM and, as natural extensions, models with multiple factors. Prominent phenomena such as the value premium and momentum are discussed. In the second part of the lecture we will study extensions of Consumption-CAPM and study the implications of exotic preferences.

Organizational issues
Die Veranstaltung findet Dienstags um 14:00-15:30 im Raum 209 im Geb. 09.21 statt und endet nach ersten Semesterhälfte.

Literature
Basisliteratur

Asset pricing / Cochrane, J.H. - Rev. ed., Princeton Univ. Press, 2005.

zur Vertiefung/ Wiederholung

Investments and Portfolio Management / Bodie, Z., Kane, A., Marcus, A.J. - 9. ed., McGraw-Hill, 2011.

The econometrics of financial markets / Campbell, J.Y., Lo, A.W., MacKinlay, A.C. - 2. printing, with corrections, Princeton Univ. Press, 1997.

T 6.13 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 Economics and Management

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	Advanced Game Theory	2 SWS	Lecture / 🗣	Reiß
WT 25/26	2521534	Übung zu Advanced Game Theory	1 SWS	Practice / 🗣	Reiß, Peters, Potarca
Exams					
ST 2025	7900126	Advanced Game Theory			Puppe

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
Basic knowledge of mathematics and statistics is assumed.

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 6.14 Module component: Advanced Lab Informatics (Master) [T-WIWI-110548]

Coordinators: Professorenschaft des Instituts AIFB
Organisation: KIT Department of Economics and Management
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					
ST 2025	2512205	Lab Realisation of innovative services (Master)	3 SWS	Practical course / 🗣	Schiefer, Toussaint, Ullrich, Kruse
ST 2025	2512207	Smart Living Lab – IoT for Everyday (Master)	3 SWS	Practical course / 🗣	Oberweis, Rybinski
ST 2025	2512500	Project Lab Machine Learning	3 SWS	Practical course / 🧩	Daaboul, Zöllner, Schneider
ST 2025	2512555	Praktikum Security, Usability and Society (Master)	3 SWS	Practical course / 🧩	Volkamer, Strufe, Berens, Mossano, Hennig, Veit, Fallahi, Länge, Ballreich
ST 2025	2512600	Project lab Telling Data Stories with Semantic Technologies and Generative AI (Master)	3 SWS	Practical course / 🧩	Sack, Tietz
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

Exams			
ST 2025	7900020	Smart Living Lab – IoT for Everyday (Master)	Oberweis
ST 2025	7900030	Project Lab Telling Data Stories with Semantic Technologies and Generative AI (Master)	Sack
ST 2025	7900086	Project Lab Machine Learning	Zöllner
ST 2025	7900148	Advanced Lab Realization of innovative services (Master)	Oberweis
ST 2025	7900178	Practical Lab Security, Usability and Society (Master)	Volkamer, Strufe
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

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.

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:

V **Lab Realisation of innovative services (Master)**
2512205, SS 2025, 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 vor Praktikumsbeginn im Wiwi-Portal
https://portal.wiwi.kit.edu/ys

V **Smart Living Lab – IoT for Everyday (Master)**
2512207, SS 2025, 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.

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 wenden.

V **Project Lab Machine Learning**
2512500, SS 2025, 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.

V

Praktikum Security, Usability and Society (Master)

2512555, SS 2025, 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

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.

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.

V

Project lab Telling Data Stories with Semantic Technologies and Generative AI (Master)

2512600, SS 2025, 3 SWS, Language: English, Open in study portal

Practical course (P)
Blended (On-Site/Online)

Content
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 between entities, and provide narrative summaries that highlight the most relevant aspects of large datasets. This makes it easier for non-technical users to intuitively explore and interpret graph data, helping them discover insights they weren't specifically searching for.

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. Domain experts will share their insights into the data and help evaluate the effectiveness of the Data Stories.

In this course you have the chance to combine creativity and practical implementation tasks to develop solutions for real-world projects and problems.

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 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.

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.

V **Praktikum Security, Usability and Society (Master)** — **Practical course (P)** **Blended (On-Site/Online)**
2512555, WS 25/26, 3 SWS, Language: English, Open in study portal

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

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.

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.

V **Project lab Knowledge-driven Artificial Intelligence (Master)** — **Practical course (P)** **Blended (On-Site/Online)**
2512600, WS 25/26, 3 SWS, Language: English, Open in study portal

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) or Tabea Tietz (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/

T 6.15 Module component: Advanced Lab Realization of Innovative Services (Master) [T-WIWI-112914]

Coordinators: Prof. Dr. Andreas Oberweis
Organisation: KIT Department of Economics and Management
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					
ST 2025	2512205	Lab Realisation of innovative services (Master)	3 SWS	Practical course / 🗣	Schiefer, Toussaint, Ullrich, Kruse
WT 25/26	2512205	Lab Realisation of innovative services (Master)	3 SWS	Practical course / 🖧	Schiefer, Toussaint
Exams					
ST 2025	7900148	Advanced Lab Realization of innovative services (Master)			Oberweis
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

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, SS 2025, 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 vor Praktikumsbeginn im Wiwi-Portal
https://portal.wiwi.kit.edu/ys

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

T 6.16 Module component: Advanced Lab Security, Usability and Society [T-WIWI-108439]

Coordinators: Prof. Dr. Melanie Volkamer
Organisation: KIT Department of Economics and Management
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					
ST 2025	2512554	Practical Course: Security, Usability and Society	3 SWS	Practical course /	Volkamer, Strufe, Berens, Mossano, Hennig, Veit, Länge, Fallahi, Ballreich
ST 2025	2512555	Praktikum Security, Usability and Society (Master)	3 SWS	Practical course /	Volkamer, Strufe, Berens, Mossano, Hennig, Veit, Fallahi, Länge, Ballreich
WT 25/26	2512554	Praktikum Security, Usability and Society (Bachelor)	3 SWS	Practical course /	Volkamer, Strufe, Berens, Fallahi, Ballreich, Hennig, Länge, Mossano, Hilt
WT 25/26	2512555	Praktikum Security, Usability and Society (Master)	3 SWS	Practical course /	Volkamer, Strufe, Berens, Fallahi, Ballreich, Hennig, Länge, Mossano, Hilt
Exams					
ST 2025	7900029	Practical lab Security, Usability and Society (Bachelor)			Volkamer, Strufe
WT 25/26	7900116	Advanced Lab Security, Usability and Society (Bachelor)			Volkamer
WT 25/26	7900307	Advanced Lab Security, Usability and Society (Master)			Volkamer

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 **Practical Course: Security, Usability and Society**
2512554, SS 2025, 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

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.

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.

V

Praktikum Security, Usability and Society (Master)

2512555, SS 2025, 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

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.

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.

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

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.

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.

V

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

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.

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.

T 6.17 Module component: Advanced Machine Learning [T-WIWI-109921]

Coordinators: Prof. Dr. Andreas Geyer-Schulz
Dr. Abdolreza Nazemi

Organisation: KIT Department of Economics and Management

Part of: M-WIWI-105661 - Data Science: Intelligent, Adaptive, and Learning Information Services

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each summer term	1

Courses					
ST 2025	2540535	Advanced Machine Learning	2 SWS	Lecture	Nazemi
ST 2025	2540536	Exercise Advanced Machine Learning	1 SWS	Practice	Nazemi
Exams					
ST 2025	7900227	Advanced Machine Learning			Geyer-Schulz
WT 25/26	7900253	Advanced Machine Learning (Nachklausur SoSe 2025)			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

Below you will find excerpts from courses related to this module component:

V Advanced Machine Learning

2540535, SS 2025, 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 6.18 Module component: Advanced Machine Learning and Data Science [T-WIWI-111305]

Coordinators: Prof. Dr. Maxim Ulrich
Organisation: KIT Department of Economics and Management
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 2025	2500016	Advanced Machine Learning and Data Science	4 SWS	Project (P / ⛒	Ulrich

Legend: 🖥 Online, ⛒ Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
The assessment is carried out in form of a written thesis based on the course "Advanced Machine Learning and Data Science".

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=GS2swv7ueF5gAClUEs
- **Form link**: https://docs.google.com/forms/d/e/1FAIpQLSek36NGe9l7JyIIlc4iBnd-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:

V Advanced Machine Learning and Data Science

2500016, SS 2025, 4 SWS, Language: English, Open in study portal

Project (PRO)
Blended (On-Site/Online)

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
Topics will be presented during the kick-off meeting in the first week.

We prepare topics for students of computer science, engineering and mathematics.

Topics and student editors will be matched after the kick-off.

Literature
Literature and computer programs will be announced in the first lecture.

T 6.19 Module component: Advanced Management Accounting [T-WIWI-102885]

Coordinators: Prof. Dr. Marcus Wouters
Organisation: KIT Department of Economics and Management
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	Advanced Management Accounting	4 SWS	Lecture / 🗣	Wouters, Dickemann, Letmathe
Exams					
WT 25/26	79-2579907-M	Advanced Management Accounting			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).

Workload
135 hours

Below you will find excerpts from courses related to this module component:

V **Advanced Management Accounting** — **Lecture (V) On-Site**
2579907, WS 25/26, 4 SWS, Language: English, Open in study portal

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 6.20 Module component: Advanced Statistics [T-WIWI-103123]

Coordinators: Prof. Dr. Oliver Grothe
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101637 - Analytics and Statistics
M-WIWI-101639 - Econometrics and Statistics II

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each winter term	1

Courses					
WT 25/26	2550552	Advanced Statistical Techniques, Including Multivariate and Simulation Methods	2 SWS	Lecture / 🗣	Grothe
WT 25/26	2550553	Exercises and Computer Labs in Advanced Statistical Techniques	2 SWS	Practice / 🗣	Grothe
Exams					
ST 2025	7900253	Advanced Statistical Techniques, Including Multivariate and Simulation Methods			Grothe
WT 25/26	7900289	Advanced Statistical Techniques, Including Multivariate and Simulation Methods			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

Lecture (V) On-Site

2550552, WS 25/26, 2 SWS, Language: English, Open in study portal

Literature
Skript zur Vorlesung

T 6.21 Module component: Advanced Stochastic Optimization [T-WIWI-106548]

Coordinators: Prof. Dr. Steffen Rebennack
Organisation: KIT Department of Economics and Management
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	Advanced Stochastic Optimization	2 SWS	Lecture / 💻	Rebennack
WT 25/26	2550468	Übung zu Advanced Stochastic Optimization	1 SWS	Practice / 🛠	Rebennack
Exams					
ST 2025	7900034	Advanced Stochastic Optimization			Rebennack
WT 25/26	7900039	Advanced Stochastic Optimization			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 6.22 Module component: Advanced Topics in Digital Management [T-WIWI-111912]

Coordinators: Prof. Dr. Petra Nieken
Organisation: KIT Department of Economics and Management
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 2025	2573016	Advanced Topics in Digital Management	2 SWS	Colloquium (K / 🗣)	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** — **Colloquium (KOL) On-Site**
2573016, SS 2025, 2 SWS, Language: English, Open in study portal

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 6.23 Module component: Advanced Topics in Economic Theory [T-WIWI-102609]

Coordinators: Prof. Dr. Johannes Brumm
Prof. Dr. Kay Mitusch

Organisation: KIT Department of Economics and Management

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

Courses					
ST 2025	2520527	Advanced Topics in Economic Theory	2 SWS	Lecture / 🗣	Mitusch, Brumm
ST 2025	2520528	Übung zu Advanced Topics in Economic Theory	1 SWS	Practice / 🗣	Pegorari, Corbo, Mitusch, Brumm
Exams					
ST 2025	00227	Advanced Topics in Economic Theory			Mitusch, Brumm
ST 2025	7900329	Advanced Topics in Economic Theory			Mitusch, Brumm

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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.

Below you will find excerpts from courses related to this module component:

V Advanced Topics in Economic Theory

2520527, SS 2025, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Literature
Die Veranstaltung wird in englischer Sprache angeboten:

The course is based on the excellent textbook "Microeconomic Theory" (Chapters 1-5, 10, 13-20) by A.Mas-Colell, M.D.Whinston, and J.R.Green.

T 6.24 Module component: Advanced Topics in Human Resource Management [T-WIWI-111913]

Coordinators: Prof. Dr. Petra Nieken
Organisation: KIT Department of Economics and Management
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	Advanced Topics in Human Resource Management	2 SWS	Colloquium (K / 🗣)	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** — **Colloquium (KOL) On-Site**
2573014, WS 25/26, 2 SWS, Language: German, Open in study portal

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 6.25 Module component: AI Innovation Ecosystems [T-WIWI-113849]

Coordinators: Dr. Daniela Beyer
Jennifer Scheydt

Organisation: KIT Department of Economics and Management

Part of: M-WIWI-101488 - Entrepreneurship (EnTechnon)
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) Discussion of literature on innovation ecosystems (15%)
  - Read articles / book chapters
  - Summarize core results in an excerpt
  - present
- (B) active participation in all 4 events
- (C) Presentation on an area of Cyber Valley or IPAI Heilbronn [in the group] (30%)
- (D) Preparation of a guided interview that can be conducted with a representative of IPAI / Cyber Valley [in the group] (15%)
- (E) Elaboration of the findings in the form of a seminar paper* from C and D on an evaluation of a partial aspect of the IPAI / Cyber Valley [term paper in the semester-free period based on the findings presented and the interview] (40%)

* Scope according to the current requirements for crediting in the seminar module

Prerequisites
None

Recommendations
It is recommended that the lecture: Innovation Management: Concepts, Strategies and Methods has already been attended.

Workload
90 hours

T 6.26 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 2025	2400022	Algorithm Engineering	3 SWS	Lecture / 🗣	Sanders, Hermann
Exams					
ST 2025	75514	Algorithm Engineering			Sanders

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 6.27 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

Exams			
ST 2025	7500339	Algorithm Engineering Pass	Sanders

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 6.28 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

Courses					
ST 2025	2400028	Algorithmic Graph Theory	3 SWS	Lecture / Practice (/	Ueckerdt
Exams					
ST 2025	7500238	Algorithmic Graph Theory			Ueckerdt
WT 25/26	7500281	Algorithmic Graph Theory			Ueckerdt

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 **Algorithmic Graph Theory** — **Lecture / Practice (VÜ) On-Site**
2400028, SS 2025, 3 SWS, Language: English, Open in study portal

Content
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.

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.

Recommendation
Knowledge of the basics of graph theory and algorithm technology is helpful.

Workload
Lecture with 3SWS, 5LP
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

Competence Certificate
The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting 20 minutes.

T 6.29 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

T 6.30 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

T 6.31 Module component: Algorithms for Routing [T-INFO-100002]

Coordinators: TT-Prof. Dr. Thomas Bläsius
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

Exams			
ST 2025	7500019	Algorithms for Routing	Ueckerdt, Bläsius

T 6.32 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	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 20 minutes.

Prerequisites
None.

Recommendations
Knowledge of the basics of graph theory and algorithm technology is helpful.

T 6.33 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	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each winter term	1

Courses					
WT 25/26	2424079	Algorithms II	4 SWS	Lecture / 🗣	Sanders, Künnemann, Redzic, Stieß
Exams					
WT 25/26	7500245	Algorithms II			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 6.34 Module component: Analysis of Multivariate Data [T-WIWI-103063]

Coordinators: Prof. Dr. Oliver Grothe
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-105414 - Statistics and Econometrics II

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Irregular	1

Courses					
ST 2025	2550550		2 SWS	Lecture / 🗣	Grothe
ST 2025	2550551		2 SWS	Practice / 🗣	Grothe, Liu
Exams					
ST 2025	7900033	Analysis of Multivariate Data			Grothe
WT 25/26	7900297	Analysis of Multivariate Data			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

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

Below you will find excerpts from courses related to this module component:

V 2550550, SS 2025, 2 SWS, Open in study portal — **Lecture (V) On-Site**

Literature
Skript zur Vorlesung

T 6.35 Module component: Applied Econometrics [T-WIWI-111388]

Coordinators: Prof. Dr. Fabian Krüger
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101638 - Econometrics and Statistics I
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	Applied Econometrics	2 SWS	Lecture / 🗣	Krüger, N.N.
WT 25/26	2520021	Tutorial in Applied Econometrics	2 SWS	Practice / 🗣	Krüger, N.N.
Exams					
ST 2025	7900007	Applied Econometrics			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 6.36 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	Applied material flow simulation	3 SWS	Lecture / Practice (/	Baumann

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** — **Lecture / Practice (VÜ) On-Site**
2117054, WS 25/26, 3 SWS, Language: German, Open in study portal

Content
Learning Content:

- Methods of modeling a simulation such as:
  - Discrete-event simulation
  - Agent based simulation
- Design of a simulation model of a material flow system
- Data exchange in simulation models
- Verification and validation of simulation models
- Execution of simulation studies
- Statistical evaluation and parameter study

This is an application-oriented course in which the course contents are applied and deepened using the Anylogic software.

Learning Goals:
Students are able to:

- select the appropriate simulation modeling method depending on a modeling objective and build a suitable simulation model for material flow systems,
- extend a simulation model in a meaningful way with data import and export,
- verify and validate a simulation model,
- conduct a simulation study efficiently and with meaningful results, and
- design and conduct a parameter study and statistically analyze and evaluate the results.

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 Anmeldungsformulars (erforderliche Felder beim Beitritt zum ILIAS-Kurs) möglich.**
- **Die Anmeldung ist vom 01.09.2025 bis zum 30.09.2025 möglich.**

Literature
Borshev, 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 6.37 Module component: Artificial Intelligence in Service Systems [T-WIWI-108715]

Coordinators: Prof. Dr. Gerhard Satzger
Organisation: KIT Department of Economics and Management
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	Artificial Intelligence in Service Systems	1.5 SWS	Lecture /	Spitzer, Holstein, Satzger
WT 25/26	2595651	Übung zu Artificial Intelligence in Service Systems	1.5 SWS	Practice /	Spitzer, Holstein, Hendriks, Satzger
Exams					
ST 2025	7900204	Artificial Intelligence in Service Systems			Satzger
WT 25/26	7900032	Artificial Intelligence in Service Systems			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.

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.
- Gama, J., Žliobaitė, I., Bifet, A., Pechenizkiy, M., & Bouchachia, A. (2014). A survey on concept drift adaptation. ACM computing surveys (CSUR), 46(4), 1-37.
- 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 MarquisSan 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.
- Schöffer, 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 6.38 Module component: Artificial Intelligence in Service Systems II: Generative AI Applications & Adoption [T-WIWI-114209]

Coordinators: Prof. Dr. Gerhard Satzger
Organisation: KIT Department of Economics and Management
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	graded	Each summer term	1

Courses					
ST 2025	2595501	Artificial Intelligence in Service Systems - Generative AI Applications and Adoption	3 SWS	Lecture / 🗣	Holstein, Spitzer, Satzger
Exams					
ST 2025	7900373	Artificial Intelligence in Service Systems II: Generative AI Applications & Adoption			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** — **Lecture (V) On-Site**
2595501, SS 2025, 3 SWS, Language: English, Open in study portal

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 full-day block sessions for in-depth discussions and optional hands-on coding exercises

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 6.39 Module component: Asset Pricing [T-WIWI-102647]

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

Organisation: KIT Department of Economics and Management

Part of: M-WIWI-101480 - Finance 3
M-WIWI-101482 - Finance 1
M-WIWI-101483 - Finance 2
M-WIWI-101502 - Economic Theory and its Application in Finance

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each summer term	2

Courses					
ST 2025	2530555	Asset Pricing	2 SWS	Lecture / 🗣	Uhrig-Homburg, Thimme
ST 2025	2530556	Asset Pricing Exercices	1 SWS	Practice / 🗣	Böll, Uhrig-Homburg, Thimme
Exams					
ST 2025	7900110	Asset Pricing			Uhrig-Homburg, Thimme
WT 25/26	7900056	Asset Pricing			Uhrig-Homburg

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Depending on further pandemic developments, the examination will be offered either as a 60-minute written examination or as an open-book examination (alternative exam assessment).

A bonus can be earned by correctly solving at least 50% of the posed bonus exercises. If the grade of the written examination is between 4.0 and 1.3, the bonus improves the grade by up to one grade level (0.3 or 0.4). Details will be announced in the lecture.

Prerequisites
None

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 Exercices

2530556, SS 2025, 1 SWS, Language: German, Open in study portal

Practice (Ü)
On-Site

T 6.40 Module component: Auction Theory [T-WIWI-102613]

Coordinators: Prof. Dr. Karl-Martin Ehrhart
Organisation: KIT Department of Economics and Management
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	Auction Theory	2 SWS	Lecture	Ehrhart
Exams					
ST 2025	7900255	Auction Theory			Ehrhart
WT 25/26	7900033	Auction Theory			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)**

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 6.41 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	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each winter term	2

Courses					
WT 25/26	2424169	Automated Visual Inspection and Image Processing	4 SWS	Lecture / 🗣	Beyerer
Exams					
ST 2025	7500003	Automated Visual Inspection and Image Processing			Beyerer
WT 25/26	7500008	Automated Visual Inspection and Image Processing			Beyerer

Legend: 📱 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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: Automotive Software Engineering (ASE) [T-INFO-112203]

Coordinators: Prof. Dr.-Ing. Ina Schaefer
Organisation: KIT Department of Informatics
Part of: M-INFO-106019 - Automotive Software Engineering (ASE)

Type	Credits	Grading	Term offered	Version
Examination of another type	4 CP	graded	Each winter term	1

T 6.44 Module component: Automotive Software Engineering (ASE) - Pass [T-INFO-112204]

Coordinators: Prof. Dr.-Ing. Ina Schaefer
Organisation: KIT Department of Informatics
Part of: M-INFO-106019 - Automotive Software Engineering (ASE)

Type	Credits	Grading	Term offered	Version
Coursework	0 CP	pass/fail	Each winter term	1

T 6.45 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 Economics and Management

Part of: M-WIWI-101511 - Advanced Topics in Public Finance

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each winter term	2

Courses					
WT 25/26	2560134	Basics of German Company Tax Law and Tax Planning	3 SWS	Lecture / 🗣	Wigger, Gutekunst
Exams					
ST 2025	790unbe	Basics of German Company Tax Law and Tax Planning			Wigger
WT 25/26	790unbe	Basics of German Company Tax Law and Tax Planning			Wigger

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

Assessment
Depending on the further pandemic development the assessment will consist either of an open book exam (following Art. 4, para. 2, clause 3 of the examination regulation), or of an 1.5 h written exam (following Art. 4, para. 2, clause 1 of the examination regulation).

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 6.46 Module component: Bayesian Statistics for Analyzing Data [T-WIWI-113471]

Coordinators: Prof. Dr. Benjamin Scheibehenne
Organisation: KIT Department of Economics and Management
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	Bayesian Statistics for Analyzing Data	2 SWS	Seminar	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.

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 6.47 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	Beating the Worst-Case in Practice: Unexpectedly Efficient Algorithms	4 SWS	Practical course / 🗣	Bläsius, Wilhelm

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:

V Beating the Worst-Case in Practice: Unexpectedly Efficient Algorithms

2400253, WS 25/26, 4 SWS, Language: English, Open in study portal

Practical course (P)
On-Site

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 6.48 Module component: Behavioral Lab Exercise [T-WIWI-113095]

Coordinators: Prof. Dr. Petra Nieken
Prof. Dr. Benjamin Scheibehenne

Organisation: KIT Department of Economics and Management

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

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

T 6.49 Module component: Bond Markets [T-WIWI-110995]

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

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each winter term	1

Courses					
WT 25/26	2530560	Bond Markets	3 SWS	Lecture / Practice (/ 🗣	Uhrig-Homburg, Molnar
Exams					
ST 2025	7900280	Bond Markets			Uhrig-Homburg
WT 25/26	7900311	Bond Markets			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.

Depending on further pandemic developments, the examination will be offered as an open-book examination (alternative exam assessment).

Additional Information
This course will be held in English.

Workload
135 hours

Below you will find excerpts from courses related to this module component:

V Bond Markets

2530560, WS 25/26, 3 SWS, Language: English, Open in study portal

Lecture / Practice (VÜ)
On-Site

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 exercices. 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 6.50 Module component: Bond Markets - Models & Derivatives [T-WIWI-110997]

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

Type	Credits	Grading	Term offered	Version
Examination of another type	3 CP	graded	Each winter term	1

Courses					
WT 25/26	2530565	Bond Markets - Models & Derivatives	2 SWS	Block / 🗣	Grauer, 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 6.51 Module component: Bond Markets - Tools & Applications [T-WIWI-110996]

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

Type	Credits	Grading	Term offered	Version
Examination of another type	1,5 CP	graded	Each winter term	1

Courses					
WT 25/26	2530562	Bond Markets - Tools & Applications	1 SWS	Block / 🗣	Uhrig-Homburg, Grauer
Exams					
ST 2025	7900283	Bond Markets - Tools & Applications			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 6.52 Module component: Business Data Strategy [T-WIWI-106187]

Coordinators: Prof. Dr. Christof Weinhardt
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-103117 - Data Science: Data-Driven Information Systems
M-WIWI-107530 - Information Systems: AI & Data Science

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each winter term	1

Courses					
WT 25/26	2540484	Business Data Strategy	2 SWS	Lecture / 🗣	Weinhardt, van Dinther
WT 25/26	2540485	Übung zu Business Data Strategy	1 SWS	Practice / 🗣	Weinhardt, Schulz
Exams					
ST 2025	7900267	Business data strategy			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 regulationand an alternative exam assessment according to § 4 paragraph 2 Nr. 3 of the examination regulation. The grade isdetermined 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 6.53 Module component: Business Dynamics [T-WIWI-102762]

Coordinators: Prof. Dr. Andreas Geyer-Schulz
Dr Paul Glenn

Organisation: KIT Department of Economics and Management

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	Business Dynamics	2 SWS	Lecture / 🗣	Geyer-Schulz, Glenn
WT 25/26	2540532	Exercise Business Dynamics	1 SWS	Practice / 🗣	Geyer-Schulz, Glenn
Exams					
ST 2025	7900065	Business Dynamics (Nachklausur WS 2024/2025)			Geyer-Schulz
WT 25/26	7979777	Business Dynamics (WS 2025/2026)			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

14.02.2026 => Termin 4

Literature
John D. Sterman. Business Dynamics: Systems Thinking and Modeling for a Complex World. McGraw-Hill, 2000.

T 6.54 Module component: Business Intelligence Systems [T-WIWI-105777]

Coordinators: Prof. Dr. Alexander Mädche
Organisation: KIT Department of Economics and Management
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	Credits	Grading	Term offered	Version
Examination of another type	4,5 CP	graded	Each winter term	2

Courses					
WT 25/26	2540422	Business Intelligence Systems	3 SWS	Lecture /	Mädche
Exams					
ST 2025	7900149	Business Intelligence Systems			Mädche
WT 25/26	7900224	Business Intelligence Systems			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** — **Lecture (V)**
2540422, WS 25/26, 3 SWS, Language: English, Open in study portal — **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.

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 6.55 Module component: Business Planning [T-WIWI-102865]

Coordinators: Prof. Dr. Orestis Terzidis
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101488 - Entrepreneurship (EnTechnon)

Type	Credits	Grading	Term offered	Version
Examination of another type	3 CP	graded	Irregular	1

Courses					
ST 2025	2545109	Business Planning for Founders - Startup CFO	2 SWS	Seminar / 🗣	Rosales Bravo, Terzidis
WT 25/26	2545109	Business Planning for Founders - Startup CFO	2 SWS	Seminar / 🗣	Rosales Bravo, Wessendorf
Exams					
ST 2025	7900234	Business Planning for Founders			Terzidis
WT 25/26	7900023	Business Planning for Founders			Terzidis

Legend: 💻 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Alternative exam assessment.

Prerequisites
None

Recommendations
None

Below you will find excerpts from courses related to this module component:

V **Business Planning for Founders - Startup CFO** **Seminar (S) On-Site**
2545109, SS 2025, 2 SWS, Language: English, Open in study portal

Content
Content

Embark on a transformative journey into the dynamic realm of startup finance with our comprehensive course designed for Master's students interested in the task of aspiring to become future Chief Financial Officers (CFOs) or Chief Executive Officers (CEOs) in the startup. Particularly, students who previously attended classes on entrepreneurship or developed their business ideas in Design Thinking Seminars will work on the financial viability and, therefore, the potential for realizing their business ideas. The three-day seminar develops the financial literacy needed to start and operate an entrepreneurial venture, including analyzing and determining the cost and revenue structure of the firm and creating a financial strategy to execute the business plan successfully. Additionally, students will learn about the sources and conditions of different investment types and develop tailored fundraising strategies. The seminar is not restricted to the financial aspects but follows the Triple Bottom Line philosophy (3BL).

Throughout the course, real-world case studies and guest lectures, professional experts will provide valuable insights into the practical application of financial concepts.By the end of this course, you will be well-equipped to take on leadership roles in startups and startup ecosystems, armed with the managerial understanding required to drive success in dynamic and competitive markets.

Learning Objectives

Upon completion of this seminar, course participants will be able to

1. Analyze, forecast, and plan the cost structure and revenue streams of the venture project.
2. Reflect on the sustainability of a business based on the Triple Bottom Line theory.
3. Develop the essential financial statements for a startup.
4. Recall and reflect on investment strategies for startups.
5. Discover business stakeholders and prepare a tailored communication strategy.
6. Reflect on the role of information technology.
7. Apply negotiation techniques essential for securing favorable terms and agreements.
8. Have a brief overview of the related topic.

Credentials:

ONLY ONE of the two options - Business Planning for founders OR Business Planning for founders in the field of IT-Security - can be taken and credited under the in CAS mentioned partial credit, as they cover similar content. Registration must take place in the CAS for the respective examination.

Organizational issues
Wednesday, 07.05.2025, 09:00 -17:00
Wednesday, 28.05.2025, 09:00 - 17:00,
Final Session: tbd

ATTENTION: The last session with the team pitches will probably take place on Thursday, 03.07.2025, 09:00 – 13:00, as part of the Wissenswoche Innovation, open to the public

Registration is via the Wiwi-Portal.

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.

V **Business Planning for Founders - Startup CFO** **Seminar (S)**
2545109, WS 25/26, 2 SWS, Language: English, Open in study portal **On-Site**

Content
Content

Embark on a transformative journey into the dynamic realm of startup finance with our comprehensive course designed for Master's students interested in the task of aspiring to become future Chief Financial Officers (CFOs) or Chief Executive Officers (CEOs) in the startup. Particularly, students who previously attended classes on entrepreneurship or developed their business ideas in Design Thinking Seminars will work on the financial viability and, therefore, the potential for realizing their business ideas. The three-day seminar develops the financial literacy needed to start and operate an entrepreneurial venture, including analyzing and determining the cost and revenue structure of the firm and creating a financial strategy to execute the business plan successfully. Additionally, students will learn about the sources and conditions of different investment types and develop tailored fundraising strategies. The seminar is not restricted to the financial aspects but follows the Triple Bottom Line philosophy (3BL).

Throughout the course, real-world case studies and guest lectures, professional experts will provide valuable insights into the practical application of financial concepts.By the end of this course, you will be well-equipped to take on leadership roles in startups and startup ecosystems, armed with the managerial understanding required to drive success in dynamic and competitive markets.

Learning Objectives

Upon completion of this seminar, course participants will be able to

1. Analyze, forecast, and plan the cost structure and revenue streams of the venture project.
2. Reflect on the sustainability of a business based on the Triple Bottom Line theory.
3. Develop the essential financial statements for a startup.
4. Recall and reflect on investment strategies for startups.
5. Discover business stakeholders and prepare a tailored communication strategy.
6. Reflect on the role of information technology.
7. Apply negotiation techniques essential for securing favorable terms and agreements.
8. Have a brief overview of the related topic.

Credentials:

ONLY ONE of the two options - Business Planning for founders OR Business Planning for founders in the field of IT-Security - can be taken and credited under the in CAS mentioned partial credit, as they cover similar content. Registration must take place in the CAS for the respective examination.

Organizational issues
Registration is via the Wiwi-Portal.

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 6.56 Module component: Case Studies Seminar: Innovation Management [T-WIWI-102852]

Coordinators: Prof. Dr. Marion Weissenberger-Eibl
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101488 - Entrepreneurship (EnTechnon)
M-WIWI-101507 - Innovation Management
M-WIWI-101507 - Innovation Management

Type	Credits	Grading	Term offered	Version
Examination of another type	3 CP	graded	Each winter term	1

Courses					
WT 25/26	2545105	Case studies seminar: Innovation management	2 SWS	Seminar / 🗣	Weissenberger-Eibl
Exams					
WT 25/26	7900237	Case Studies Seminar: Innovation Management			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 6.57 Module component: Circular Economy – Challenges and Potentials [T-WIWI-114057]

Coordinators: Prof. Dr. Frank Schultmann
Organisation: KIT Department of Economics and Management
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 summer term	1

Courses					
ST 2025	2581965	Circular Economy - Challenges and Potentials	2 SWS	Lecture / 🗣	Schultmann
Exams					
ST 2025	7981965	Circular Economy – Challenges and Potentials			Schultmann
WT 25/26	7981965	Circular Economy – Challenges and Potentials			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 2025, 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 6.58 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	Credits	Grading	Version
Written examination	3 CP	graded	1

Courses					
WT 25/26	2400152	Coding Theory	2 SWS	Lecture	Müller-Quade, Benz, Hetzel
Exams					
ST 2025	7500382	Coding Theory			Müller-Quade
WT 25/26	7500090	Coding Theory			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 6.59 Module component: Collective Intelligence in Human Judgment and Decision Making [T-WIWI-114186]

Coordinators: Prof. Dr. Benjamin Scheibehenne
Organisation: KIT Department of Economics and Management
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 2025	2500026	Collective Intelligence in Human Judgment and Decision Making	2 SWS	Lecture / 🗣	Gradwohl
Exams					
ST 2025	7900118	Collective Intelligence in Human Judgment and Decision Making			Scheibehenne

Legend: 💻 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Alternative exam assessment. Details will be discussed at the beginning of the course.

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 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 Campus 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 2025, 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 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 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 20 participants. Registration via the campus portal is required for the course. If too many students register, students in higher semesters are selected first.

T 6.60 Module component: Collective Perception in Autonomous Driving [T-WIWI-113363]

Coordinators: Prof. Dr. Alexey Vinel
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-106631 - Cooperative Autonomous Vehicles

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each summer term	1

Courses					
ST 2025	2511456	Collective Perception in Autonomous Driving	2 SWS	Lecture /	Zhao, Bied, Vinel
ST 2025	2511457	Exercise Collective Perception in Autonomous Driving	1 SWS	Practice /	Zhao, Flores Comeca, Arockiasamy, Bied
Exams					
ST 2025	79AIFB_CPAD_C3	Collective Perception in Autonomous Driving (Registration extended until 21.07.2025)			Vinel
WT 25/26	79AIFB_CPAD_B3	Collective Perception in Autonomous Driving			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 6.61 Module component: Competition in Networks [T-WIWI-100005]

Coordinators: Prof. Dr. Kay Mitusch
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101406 - Network Economics

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each winter term	3

Courses					
WT 25/26	2561204	Competition in Networks	2 SWS	Lecture /	Mitusch
WT 25/26	2561205	Übung zu Wettbewerb in Netzen	1 SWS	Practice /	Mitusch, Corbo
Exams					
ST 2025	7900274	Competition in Networks			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 6.62 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

Courses					
ST 2025	2400055	Compiler Design	4 SWS	Lecture / 🗣	Platzer
Exams					
ST 2025	7500151	Compiler Design			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
Students are expected to have significant experience in a high-level programming language. Students are also expected to follow the lecture notes.

T 6.63 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	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Irregular	1

Courses					
ST 2025	2400124	Computational Complexity Theory, with a View Towards Cryptography	4 SWS	Lecture	Müller-Quade, Benz, Berger
Exams					
ST 2025	7500183	Computational Complexity Theory, with a View Towards Cryptography			Müller-Quade

Below you will find excerpts from courses related to this module component:

V Computational Complexity Theory, with a View Towards Cryptography

Lecture (V)

2400124, SS 2025, 4 SWS, Language: German, Open in study portal

T 6.64 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	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Irregular	1

Courses					
ST 2025	2400119	Computational Geometry	4 SWS	Lecture / Practice (/	Bläsius, Yi, Wilhelm, von der Heydt
Exams					
ST 2025	7500247	Computational Geometry			Bläsius
WT 25/26	7500210	Computational Geometry			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.

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.

Below you will find excerpts from courses related to this module component:

V **Computational Geometry** — **Lecture / Practice (VÜ) On-Site**
2400119, SS 2025, 4 SWS, Language: English, Open in study portal

Content
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.

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

Workload

Lecture with exercises, 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

Recommendation

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

Organizational issues
nur Masterstudiengang Informatik

T 6.65 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	Credits	Grading	Term offered	Version
Coursework	0 CP	pass/fail	Irregular	1

Courses					
ST 2025	2400119	Computational Geometry	4 SWS	Lecture / Practice (/	Bläsius, Yi, Wilhelm, von der Heydt
Exams					
ST 2025	7500034	Computational Geometry - Pass			Bläsius
WT 25/26	7500213	Computational Geometry - Pass			Bläsius

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 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.

Below you will find excerpts from courses related to this module component:

V Computational Geometry

2400119, SS 2025, 4 SWS, Language: English, Open in study portal

Lecture / Practice (VÜ)
On-Site

Content
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.

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

Workload

Lecture with exercises, 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

Recommendation

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

Organizational issues
nur Masterstudiengang Informatik

T 6.66 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	Computational Imaging	3 SWS	Lecture / Practice (/	Meyer, Beyerer
Exams					
ST 2025	7500351	Computational Imaging			Beyerer
WT 25/26	7500276	Computational Imaging			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:

V Computational Imaging

2400173, WS 25/26, 3 SWS, Language: English, Open in study portal

Lecture / Practice (VÜ)
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 6.67 Module component: Computational Modelling of Judgments, Decisions and Cognition [T-WIWI-114185]

Coordinators: Prof. Dr. Benjamin Scheibehenne
Organisation: KIT Department of Economics and Management
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 2025	2500119	Computational Modelling of Judgments, Decisions and Cognition	2 SWS	Others (sons / 🗣	Gradwohl
Exams					
ST 2025	7900119	Computational Modelling of Judgments, Decisions and Cognition			Scheibehenne

Legend: 📱 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Alternative exam assessment. There will be 4 assignments during the course of the semester. Each assignment will count 25% towards the final grade.

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 Campus 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 2025, 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.

All lectures, materials, and assignments are in English. The number of participants is limited. The registration will take place via the Campus portal.

Organizational issues
Participation is limited to 15 participants. Registration via the campus portal is required for the course. If too many students register, students in higher semesters are selected first.

T 6.68 Module component: Computational Risk and Asset Management [T-WIWI-102878]

Coordinators: Prof. Dr. Maxim Ulrich
Organisation: KIT Department of Economics and Management
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 6.69 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 2025	2424570	Computer structures	3 SWS	Lecture / 🗣	Karl
Exams					
ST 2025	7500190	Computer Architecture			Karl

Legend: 📱 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

T 6.70 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	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each winter term	2

Courses					
WT 25/26	2411604	Computer Contract Law	2 SWS	Lecture / 🗣	Menk
Exams					
ST 2025	7500066	Computer Contract Law			Sattler
WT 25/26	7500065	Computer Contract Law			Matz

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 6.71 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	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each winter term	1

Courses					
WT 25/26	2424081	Computergraphics	4 SWS	Lecture / 🗣	Grauer, Dachsbacher
Exams					
ST 2025	7500257	Computer Graphics			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 6.72 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	Credits	Grading	Version
Oral examination	5 CP	graded	2

Courses					
ST 2025	2400111	Computer Graphics 2	2 SWS	Lecture / 🗣	Schudeiske, Dachsbacher
Exams					
ST 2025	7500293	Computer Graphics 2			Dachsbacher
WT 25/26	7500237	Computer Graphics 2			Dachsbacher

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

T 6.73 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	Credits	Grading	Term offered	Version
Written examination	5 CP	graded	Each summer term	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 6.74 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	Credits	Grading	Term offered	Version
Oral examination	5 CP	graded	Each summer term	1

Courses					
ST 2025	2400099	Context Sensitive Systems	1 SWS	Practice / 💻	Riedel
ST 2025	24658	Context Sensitive Systems	2 SWS	Lecture / 🗣	Riedel
Exams					
ST 2025	7500013_29.07.2025	Context Sensitive Systems			Riedel
ST 2025	7500365_16.09.2025	Context Sensitive Systems			Riedel
ST 2025	7500365_27.08.2025	Context Sensitive Systems			Riedel
WT 25/26	7500229_18.11.2025	Context Sensitive Systems			Riedel
WT 25/26	7500365_21.10.2025	Context Sensitive Systems			Riedel

Legend: 💻 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

T 6.75 Module component: Convex Analysis [T-WIWI-102856]

Coordinators: Prof. Dr. Oliver Stein
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101473 - Mathematical Programming

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Irregular	1

Courses					
ST 2025	2550120	Convex Analysis	2 SWS	Lecture / 🗣	Stein
ST 2025	2550121	Exercises Convex Analysis	2 SWS	Practice / 🗣	Stein, Schwarze
Exams					
ST 2025	7900208_SS2025_HK	Convex Analysis			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.

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).

Below you will find excerpts from courses related to this module component:

V Convex Analysis

2550120, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

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

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

Remark:

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

Learning objectives:

The student

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

Literature

- J. Borwein, A. Lewis, Convex Analysis and Nonlinear Optimization: Theory and Examples (2 ed.), Springer, 2006
- S. Boyd, L. Vandenberghe, Convex Optimization, Cambridge University Press, 2004
- O. Güler, Foundations of Optimization, Springer, 2010
- J.-B. Hiriart-Urruty, C. Lemarechal, Fundamentals of Convex Analysis, Springer, 2001
- B. Mordukhovich, N.M. Nam, An Easy Path to Convex Analysis and Applications, Morgan & Claypool Publishers, 2014
- R.T. Rockafellar, Convex Analysis, Princeton University Press, 1970
- R.T. Rockafellar, R.J.B. Wets, Variational Analysis, Springer, Berlin, 1998

T 6.76 Module component: Cooperative Autonomous Vehicles [T-WIWI-112690]

Coordinators: Prof. Dr. Alexey Vinel
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-106631 - Cooperative Autonomous Vehicles

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each summer term	1

Courses					
ST 2025	2511450	Cooperative Autonomous Vehicles	2 SWS	Lecture /	Vinel
ST 2025	2511451	Exercise Cooperative Autonomous Vehicles	1 SWS	Practice /	Vinel
Exams					
ST 2025	79AIFB_CAV_B5	Cooperative Autonomous Vehicles (Registration extended until 28.07.2025)			Vinel
WT 25/26	79AIFB_CAV_A3	Cooperative Autonomous Vehicles			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 6.77 Module component: Copyright [T-INFO-101308]

Coordinators: N.N.
Organisation: KIT Department of Informatics
Part of: M-INFO-101215 - Intellectual Property Law

Type	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each winter term	1

Courses					
WT 25/26	24121	Copyright	2 SWS	Lecture / 🗣	Hartmann
Exams					
ST 2025	7500064	Copyright			Sattler
WT 25/26	7500064	Copyright			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.

Recommendations
None.

T 6.78 Module component: Corporate Compliance [T-INFO-101288]

Coordinators: Andreas Herzig
Organisation: KIT Department of Informatics
Part of: M-INFO-101216 - Private Business Law

Type	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each winter term	1

Courses					
WT 25/26	2400087	Corporate Compliance	2 SWS	Lecture /	Herzig, Siddiq
Exams					
ST 2025	7500063	Corporate Compliance			Sattler
WT 25/26	7500063	Corporate Compliance			Matz

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

T 6.79 Module component: Corporate Risk Management [T-WIWI-109050]

Coordinators: Prof. Dr. Martin Ruckes
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101480 - Finance 3
M-WIWI-101483 - Finance 2
M-WIWI-101502 - Economic Theory and its Application in Finance

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each summer term	2

Assessment
The assessment consists of a written exam (60 min.) according to § 4 paragraph 2 Nr. 1 of the examination regulation. If there are only a small number of participants registered for the exam, we reserve the right to hold an oral examination instead of a written one.
Please note that the exam is only offered in the semester of the lecture as well as in the following semester.

Prerequisites
None

Recommendations
None

Additional Information
The course will be held again in the summer term 2023 at the earliest. Please pay attention to the announcements on our website.

Workload
135 hours

T 6.80 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 6.81 Module component: Current Directions in Consumer Psychology [T-WIWI-111100]

Coordinators: Prof. Dr. Benjamin Scheibehenne
Organisation: KIT Department of Economics and Management
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					
ST 2025	2540441	Current Directions in Consumer Psychology	2 SWS	Others (sons / 🗣)	Scheibehenne
WT 25/26	2540441	Current Directions in Consumer Psychology	2 SWS	Others (sons / 🏵)	Scheibehenne
Exams					
ST 2025	7900384	Current Directions in Consumer Psychology			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
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

Others (sonst.)
Blended (On-Site/Online)

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 6.82 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	graded	Each summer term	1

Courses					
WT 25/26	2400079	Data Science and Artificial Intelligence for Energy Systems	2 SWS	Lecture / 🗣	Schäfer
WT 25/26	2400082	Data Science and Artificial Intelligence for Energy Systems	2 SWS	Practice / 🗣	Schäfer, Nikoltchovska, Sadric
Exams					
WT 25/26	7500398	Data Science and Artificial Intelligence for Energy Systems			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.

T 6.83 Module component: Data Science for Business [T-WIWI-114089]

Coordinators: Prof. Dr. Jella Pfeiffer
Organisation: KIT Department of Economics and Management
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					
ST 2025	2540466	Data Science for Business (formerly Business Data Analytics: Applications and Tools)	2 SWS	Lecture / 🗣	Pfeiffer
ST 2025	2540467	Exercise Data Science for Business (formerly Business Data Analytics: Applications and Tools)	1 SWS	Practice / 🗣	Gutschow, Heßler
WT 25/26	2540473	Business Data Analytics	2 SWS	Seminar / 🗣	Hariharan, Grote, Schulz, Motz
Exams					
ST 2025	7900183	Data Science for Business			Pfeiffer
WT 25/26	7900188	Data Science for Business (Nachklausur)			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 conscientious support for the case study. The selection of participants is based on a short letter of motivation (max. 2000 characters including spaces) in the faculty's portal.

Prerequisites
None

Recommendations
Knowledge of programming (particular python) and statistics is helpful.

Additional Information
Together with the lecture, there is an exercise which takes place every second week.

Workload
135 hours

Below you will find excerpts from courses related to this module component:

V Data Science for Business (formerly Business Data Analytics: Applications and Tools) Lecture (V) On-Site

2540466, SS 2025, 2 SWS, Language: English, Open in study portal

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
Application via the WiWi-Portal: https://portal.wiwi.kit.edu/ys/8602

V

Exercise Data Science for Business (formerly Business Data Analytics: Applications and Tools)

Practice (Ü)
On-Site

2540467, SS 2025, 1 SWS, Language: English, Open in study portal

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.

V

Business Data Analytics

Seminar (S)
On-Site

2540473, WS 25/26, 2 SWS, Language: German/English, Open in study portal

Content
wird auf deutsch und englisch gehalten

Organizational issues
Blockveranstaltung, siehe WWW

T 6.84 Module component: Database Systems and XML [T-WIWI-102661]

Coordinators: Prof. Dr. Andreas Oberweis
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101456 - Intelligent Systems and Services
M-WIWI-101477 - Development of Business Information Systems

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	see Annotations	2

Exams			
ST 2025	79AIFB_DBX_A3	Database Systems and XML (Registration extended until 28.07.2025)	Oberweis
WT 25/26	79AIFB_DBX_A4	Database Systems and XML	Oberweis

Assessment
The examination will be offered for the last time in the winter semester 2025/2026 for first-time students. The last examination opportunity (only for repeaters) is in the summer semester 2026. The assessment takes the form of a written examination (60 minutes) (in accordance with SPO § 4(2)).

Prerequisites
None

Additional Information
The lecture will be held for the last time in the winter semester 2024/25.

T 6.85 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	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each summer term	5

Courses					
ST 2025	2400089	Decentralized Systems: Fundamentals, Modeling, and Applications	4 SWS	Lecture / Practice (/ 🗣	Hartenstein, Jacob
Exams					
ST 2025	7500070	Decentralized Systems: Fundamentals, Modeling, and Applications			Hartenstein
WT 25/26	7500141	Decentralized Systems: Fundamentals, Modeling, and Applications			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

Lecture / Practice (VÜ)
On-Site

2400089, SS 2025, 4 SWS, Language: English, Open in study portal

Content

Content:

Decentralized Systems (like blockchain-based systems) represent distributed systems that are controlled by multiple parties who make their own independent 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, and Matrix. As a research-oriented lecture, we may cover additional current topics like verifiable computing and/or identity and access management in decentralized settings.

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 mutual exclusion in decentralized systems based on different models for node 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
  - The Matrix decentralized messaging platform
  - Distributed Ledgers and Blockchains at the examples of Bitcoin and Ethereum, in particular Proof-of-Work and Proof-of-Stake consensus
  - Payment Channel Networks and Rollups
  - Decentralized storage systems, at the example of IPFS

Compentency Goals:

1. Fundamentals & Modeling
   1. The student is able to recognize and distinguish distributed, federated, and decentralized systems.
   2. The student understands 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 for leader election and mutual exclusion 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, notably silent and noisy crash as well as byzantine 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 various models for and levels of consistency.
2. Applications
   1. The student understands conflict-free replicated data types and their use in decentralized systems like Matrix.
   2. The student has a fundamental understanding of blockchain-based systems (e.g. Bitcoin/Ethereum), Payment Channels, Rollups, and decentralized communication systems like Matrix.
   3. The student understands trust relations in distributed and decentralized systems and applications.
   4. The student is able to understand how theoretical foundations relate to networked and decentralized systems in practice.
   5. The student understands concepts of decentralized storage systems.

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)

   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: 45 h

Σ = 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 6.86 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	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each summer term	1

Courses					
ST 2025	2400024	Deep Learning and Neural Networks	4 SWS	Lecture / 🗣	Niehues
Exams					
ST 2025	7500044	Deep Learning and Neural Networks			Niehues, Waibel

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 6.87 Module component: Deep Learning for Computer Vision I: Basics [T-INFO-111491]

Coordinators: Prof. Dr.-Ing. Rainer Stiefelhagen
Organisation: KIT Department of Informatics
Part of: M-INFO-105753 - Deep Learning for Computer Vision I: Basics

Type	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each summer term	2

Courses					
ST 2025	2400007	Deep Learning for Computer Vision I: Basics	2 SWS	Lecture / 🗣	Stiefelhagen, Reiß, Peng
Exams					
ST 2025	7500122	Deep Learning for Computer Vision I: Basics			Stiefelhagen
WT 25/26	7500258	Deep Learning for Computer Vision I: Basics			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) lasting 120 minutes.

Prerequisites
None.

Recommendations
Basic knowledge of pattern recognition as taught in the module Cognitive Systems, is expected.

Additional Information
The course is partially given in German and English.

T 6.88 Module component: Deep Learning for Computer Vision II: Advanced Topics [T-INFO-111494]

Coordinators: Prof. Dr.-Ing. Rainer Stiefelhagen
Organisation: KIT Department of Informatics
Part of: M-INFO-105755 - Deep Learning for Computer Vision II: Advanced Topics

Type	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each winter term	2

Courses					
WT 25/26	2400258	Deep Learning for Computer Vision II: Advanced Topics	2 SWS	Lecture / 🗣	Stiefelhagen, Reiß, Peng
Exams					
ST 2025	7500150	Deep Learning for Computer Vision II: Advanced Topics			Stiefelhagen
WT 25/26	7500277	Deep Learning for Computer Vision II: Advanced Topics			Stiefelhagen

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
Knowledge of the basics of pattern recognition using deep learning, such as from the lecture "Deep Learning for Computer Vision", is assumed.

Recommendations
Knowledge of deep learning basics is assumed.

T 6.89 Module component: Derivatives [T-WIWI-102643]

Coordinators: Prof. Dr. Marliese Uhrig-Homburg
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101480 - Finance 3
M-WIWI-101482 - Finance 1
M-WIWI-101483 - Finance 2

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each summer term	1

Courses					
ST 2025	2530550	Derivatives	2 SWS	Lecture / 🗣	Uhrig-Homburg
ST 2025	2530551	Übung zu Derivate	1 SWS	Practice / 🗣	Dinger, Uhrig-Homburg
Exams					
ST 2025	7900111	Derivatives			Uhrig-Homburg
WT 25/26	7900051	Derivatives			Uhrig-Homburg

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Depending on further pandemic developments, the examination will be offered either as a 60-minute written examination or as an open-book examination (alternative exam assessment).

A bonus can be earned by correctly solving at least 50% of the posed bonus exercises. If the grade of the written examination is between 4.0 and 1.3, the bonus improves the grade by up to one grade level (0.3 or 0.4). Details will be announced in the lecture.

Prerequisites
None

Recommendations
None

Below you will find excerpts from courses related to this module component:

V Derivatives

2530550, SS 2025, 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	Credits	Grading	Term offered	Version
Oral examination	3 CP	graded	Each winter term	1

Courses					
WT 25/26	2424106	Design and architectures of embedded systems (ES2)	2 SWS	Lecture	Khdr, Henkel
Exams					
ST 2025	7500037	VL: Design and architectures of embedded systems (ES2)			Henkel
WT 25/26	7500124	VL: Design and architectures of embedded systems (ES2)			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

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 Economics and Management
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	Design and Operation of Industrial Plants and Processes	2 SWS	Lecture / 🗣	Schultmann, Rudi
Exams					
ST 2025	7981952	Planning and Management of Industrial Plants			Schultmann
WT 25/26	7981952	Design and Operation of Industrial Plants and Processes			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 Economics and Management
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					
ST 2025	2545008	Design Thinking (Track 1)	2 SWS	Seminar / 🗣	Osaro, Jochem, Terzidis
WT 25/26	2545008	Design Thinking (Track 1)	2 SWS	Seminar / 🧩	Haller, Terzidis
Exams					
ST 2025	7900053	Design Thinking (Track 1)			Terzidis
WT 25/26	7900084	Design Thinking (Track 1)			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, SS 2025, 2 SWS, Language: English, Open in study portal

Seminar (S)
On-Site

Content
Content

Design Thinking is a user-centric innovation management method. 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 are created, and tested by the user group. The result is a proven and validated product.

Learning Objectives

During the seminar, the students learn basic procedures for achieving user-centric innovations. These are concrete methods that start with the potential user of certain products and services. The method is problem-oriented and emphasizes the specific customer situation. After attending the seminar, the 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 seminar module! Crediting is only possible in the EXPERT MODULE ENTREPRENEURSHIP.

Organizational issues
ATTENTION: The seminar will take place outside in the city forest (about 10 minutes by bike from the city center). There will be an indoor option in case of bad weather. Detailed information about the location will be announced later.

Dates:

Mo, 26.05.2025; 09:30 - 17:00
Mo, 30.06.2025; 09:30 - 17:00
Mo, 21.07.2025; 09:00 - 13:00

Registration is via the Wiwi-Portal.

V **Design Thinking (Track 1)** **Seminar (S)**
2545008, WS 25/26, 2 SWS, Language: English, Open in study portal **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

T 6.93 Module component: Design Thinking in Practice [T-WIWI-113664]

Coordinators: Jennifer Scheydt
Organisation: KIT Department of Economics and Management
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

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 6.94 Module component: Designing Interactive Systems: Human-AI Interaction [T-WIWI-113465]

Coordinators: Prof. Dr. Alexander Mädche
Organisation: KIT Department of Economics and Management
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	graded	Each summer term	1

Courses					
ST 2025	2540558	Designing Interactive Systems: Human-AI Interaction	3 SWS	Lecture /	Mädche, Seitz
Exams					
ST 2025	7900299	Designing Interactive Systems: Human-AI Interaction			Mädche
WT 25/26	7900205	Designing Interactive Systems			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 2025, 3 SWS, Language: English, Open in study portal

Lecture (V)
Blended (On-Site/Online)

Content
Description

Computers have evolved from batch processors towards highly interactive systems. With the rapid progress in the field of artificial intelligence, computers can now learn and adapt to their environment, simulate human intelligence processes as well as support or even take over tasks from humans. This offers great possibilities, but at the same time raises new challenges for the successful design of interactive systems.

The aim of this course is to introduce advanced concepts and theories as well as current practice of designing interactive systems. A specific focus is set on designing AI-based interactive systems for individuals and groups at work ranging from personal productivity assistants to AI-augmented virtual collaboration.

The course is complemented with hands-on exercises and a design capstone project in cooperation with an industry partner. In the project, students in a team effort apply state-of-the-art design methods & techniques and create an interactive system design prototype with a specific focus on human-AI interaction.

Learning objectives

- Explain what interactive systems are and how they can be conceptualized
- Describe the unique characteristics of human-AI interaction and their impact on designing interactive systems
- Understand the human-centered design process and know how to apply corresponding methods and tools
- Understand the concepts and theoretical foundations that guide the design of interactive systems
- Know key concepts, design principles and design methods for contemporary interactive systems focusing on on human-AI interaction
- Get hands-on experience by applying lecture content in a design capstone project

Prerequisites

No specific prerequisites are required for the lecture

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 6.95 Module component: Development of Sustainable, Digital Business Models [T-WIWI-113663]

Coordinators: Prof. Dr. Marion Weissenberger-Eibl
Organisation: KIT Department of Economics and Management
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

Self Service Assignment of Supplementary Studies
This module component can be used for self service assignment of grades acquired from the following study providers:

- Personalentwicklung und Berufliche Ausbildung

Recommendations
Prior attendance of the course Innovation Management is recommended.

Workload
90 hours

T 6.96 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 2025	2400165	Digital Accessibility and Assistive Technologies	2 SWS	Lecture / 🗣	Stiefelhagen, Schwarz
Exams					
ST 2025	7500163	Digital Accessibility and Assistive Technologies			Stiefelhagen
WT 25/26	7500320	Digital Accessibility and Assistive Technologies			Stiefelhagen

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

T 6.97 Module component: Digital Democracy [T-WIWI-113160]

Coordinators: Jonas Fegert
Organisation: KIT Department of Economics and Management
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	Übung zur Digital Democracy	1 SWS	Practice /	Stein
WT 25/26	2500045	Digital Democracy - Challenges and Opportunities of the Digital Society	2 SWS	Seminar /	Fegert, Stein, Bezzaoui
WT 25/26	2600052	Digital Democracy	2 SWS	Lecture /	Fegert

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 6.98 Module component: Digital Marketing [T-WIWI-112693]

Coordinators: Prof. Dr. Ann-Kristin Kupfer
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-105312 - Marketing and Sales Management
M-WIWI-106258 - Digital Marketing

Type	Credits	Grading	Term offered	Version
Examination of another type	4,5 CP	graded	Each summer term	1

Courses					
ST 2025	2571185	Digital Marketing	2 SWS	Lecture / 🗣	Kupfer
ST 2025	2571186	Digital Marketing Exercise	1 SWS	Practice / 🗣	Schmitt
Exams					
ST 2025	7900064	Digital Marketing			Kupfer
WT 25/26	7900021	Digital Marketing			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 2025, 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 Economics and Management

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 2025	2571156	Digital Marketing and Sales in B2B	1 SWS	Others (sons / 🗣	Konhäuser
Exams					
ST 2025	7900297	Digital Marketing and Sales in B2B			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). Access to this course is restricted. Typically all students will be granted the attendance of one course with 1.5 ECTS. Nevertheless attendance can not be guaranteed.For further information please contact Marketing and Sales Research Group (marketing.iism.kit.edu).Please note that only one of the 1.5-ECTS courses can be attended in this module.

Workload
45 hours

Below you will find excerpts from courses related to this module component:

V **Digital Marketing and Sales in B2B** — **Others (sonst.) On-Site**
2571156, SS 2025, 1 SWS, Language: English, Open in study portal

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 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, Geb. 10.81, Termine werden noch bekannt gegeben

Literature
-

T 6.100 Module component: Digital Services: Innovation & Business Models [T-WIWI-112757]

Coordinators: Prof. Dr. Gerhard Satzger
Organisation: KIT Department of Economics and Management
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	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each summer term	2

Courses					
ST 2025	2595468	Digital Services: Innovation & Business Models	1.5 SWS	Lecture /	Satzger, Benz, Schüritz, Heinz
ST 2025	2595469	Übung zu Digital Services: Innovation & Business Models	1.5 SWS	Practice /	Satzger, Benz, Schüritz, Heinz
Exams					
ST 2025	7900163	Digital Services: Innovation & Business Models			Satzger
WT 25/26	7900036	Digital Services: Innovation & Business Models			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 2025, 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

- Böhmann, T./ Leimeister, J.M./ Möslein, 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., Böhmann, 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.

V Übung zu Digital Services: Innovation & Business Models

Practice (Ü)
On-Site

2595469, SS 2025, 1.5 SWS, Language: English, Open in study portal

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

- Böhmann, T./ Leimeister, J.M./ Möslein, 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., Böhmann, 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: Discrete-Event Simulation in Production and Logistics [T-WIWI-102718]

Coordinators: Hon.-Prof. Dr. Sven Spieckermann
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-102805 - Service Operations
M-WIWI-102832 - Operations Research in Supply Chain Management

Type	Credits	Grading	Term offered	Version
Examination of another type	4,5 CP	graded	Each summer term	2

Courses					
ST 2025	2550488	Ereignisdiskrete Simulation in Produktion und Logistik	3 SWS	Lecture / 🗣	Spieckermann
Exams					
ST 2025	7900244	Discrete-Event Simulation in Production and Logistics			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 2025, 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

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 6.102 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	graded	Each winter term	1

Courses					
WT 25/26	2400050	Distributed Computing	2 SWS	Lecture / 🗣	Streit, Krauß, Schnepf
Exams					
ST 2025	7500302	Distributed Computing			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 6.103 Module component: Dynamic Macroeconomics [T-WIWI-109194]

Coordinators: Prof. Dr. Johannes Brumm
Organisation: KIT Department of Economics and Management
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	4

Courses					
WT 25/26	2560402	Dynamic Macroeconomics	2 SWS	Lecture /	Brumm, Schang
WT 25/26	2560403	Übung zu Dynamic Macroeconomics	1 SWS	Practice /	Hußmann, Kissling
Exams					
ST 2025	7900286	Dynamic Macroeconomics			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 6.104 Module component: Economic Decision Making [T-WIWI-114174]

Coordinators: Prof. Dr. Benjamin Scheibehenne
Organisation: KIT Department of Economics and Management
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

Assessment
Alternative exam assessment. 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 CAMPUS 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

T 6.105 Module component: Economics of Innovation [T-WIWI-112822]

Coordinators: Prof. Dr. Ingrid Ott
Organisation: KIT Department of Economics and Management
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 summer term	1

Courses					
ST 2025	2560236	Economics of Innovation	2 SWS	Lecture / 🗣	Ott
ST 2025	2560237	Exercises of Economics of Innovation	1 SWS	Practice / 🗣	Ott, Mirzoyan
Exams					
ST 2025	7900107	Economics of Innovation			Ott
WT 25/26	7900077	Economics of Innovation			Ott

Legend: 💻 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Depending on further pandemic developments, the examination will be offered either as a 60-minute written examination (written examination according to SPO § 4 Abs. 2, Pkt. 1) or as an open-book examination (alternative exam assessment according to SPO § 4 Abs. 2, Pkt. 3).

Prerequisites
None

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.

Below you will find excerpts from courses related to this module component:

V **Economics of Innovation** — **Lecture (V) On-Site**
2560236, SS 2025, 2 SWS, Language: English, Open in study portal

Content
Learning objectives:

Students shall be given the ability to

- identify the importance of alternative incentive mechanisms for the emergence and dissemination of innovations
- understand the relationships between market structure and the development of innovation
- explain, in which situations market interventions by the state, for example taxes and subsidies, can be legitimized, and evaluate them in the light of economic welfare

Course content:

The course covers the following topics:

- Incentives for the emergence of innovations
- Patents
- Diffusion
- Impact of technological progress
- Innovation Policy

Recommendations:

Basic knowledge of micro- and macroeconomics is assumed, as taught in the courses Economics I [2600012], and Economics II [2600014]. In addition, an interest in quantitative-mathematical modeling is required.

Workload:

The total workload for this course is approximately 135.0 hours. For further information see German version.

Exam description:

The assessment consists of a written exam (60 min) according to Section 4(2), 1 of the examination regulation. The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Students will be given the opportunity of writing and presenting a short paper during the lecture time to achieve a bonus on the exam grade. If the mandatory credit point exam is passed, the awarded bonus points will be added to the regular exam points. A deterioration is not possible by definition, and a grade does not necessarily improve, but is very likely to (not every additional point improves the total number of points, since a grade can not become better than 1). The voluntary elaboration of such a paper can not countervail a fail in the exam.

Literature
Auszug:

- 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 6.106 Module component: Efficient Energy Systems and Electric Mobility [T-WIWI-102793]

Coordinators: Prof. Dr. Patrick Jochem
Organisation: KIT Department of Economics and Management
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 2025	2581006	Efficient Energy Systems and Electric Mobility	2 SWS	Lecture / 🗣	Jochem
Exams					
ST 2025	7981006	Efficient Energy Systems and Electric Mobility			Fichtner
WT 25/26	7981006	Efficient Energy Systems and Electric Mobility			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. Depending on the respective pandemic situation, the exam may be offered as an open book exam (alternative exam assessment, following §4(2), 3 of the examination regulation).

Prerequisites
None

Recommendations
None

Below you will find excerpts from courses related to this module component:

V Efficient Energy Systems and Electric Mobility

2581006, SS 2025, 2 SWS, Language: 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: 09.05., 23.05., 06.06., 27.06., 11.07., 25.07., 01.08.

Literature
Wird in der Vorlesung bekanntgegeben.

T 6.107 Module component: eFinance: Information Systems for Securities Trading [T-WIWI-110797]

Coordinators: Prof. Dr. Christof Weinhardt
Organisation: KIT Department of Economics and Management
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	graded	Each winter term	2

Courses					
WT 25/26	2540454	eFinance: Information Systems for Securities Trading	2 SWS	Lecture / 🗣	Weinhardt
WT 25/26	2540455	Übungen zu eFinance: Information Systems for Securities Trading	1 SWS	Practice / 🗣	Motz, Motz
Exams					
ST 2025	7900269	eFinance: Information Systems for Securities Trading			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

Lecture (V)
On-Site

2540454, WS 25/26, 2 SWS, Language: English, Open in study portal

Literature

- Picot, Arnold, Christine Bortenlänger, Heiner Röhrl (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 6.108 Module component: Emissions into the Environment [T-WIWI-102634]

Coordinators: Ute Karl
Organisation: KIT Department of Economics and Management
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	Emissions into the Environment	2 SWS	Lecture / 🗣	Karl
Exams					
ST 2025	7981962	Emissions into the Environment			Schultmann
WT 25/26	7981962	Emissions into the Environment			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 6.109 Module component: Empirical Software Engineering [T-INFO-101335]

Coordinators: Dr. Christopher Gerking
Organisation: KIT Department of Informatics
Part of: M-INFO-100798 - Empirical Software Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2424156	Empirical Software Engineering	2 SWS	Lecture / 🗣	Koziolek, Dehghani
Exams					
ST 2025	7500053	Empirical Software Engineering			Gerking
WT 25/26	7500312	Empirical Software Engineering			Koziolek

Legend: 📱 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

T 6.110 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	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each summer term	2

Courses					
ST 2025	24668	Employment Law	2 SWS	Lecture / 🗣	Hoff
Exams					
ST 2025	7500082	Employment Law			Sattler
WT 25/26	7500001	Employment Law			Matz

Legend: 📱 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

T 6.111 Module component: Energy and Environment [T-WIWI-102650]

Coordinators: Ute Karl
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101452 - Energy Economics and Technology
M-WIWI-101468 - Environmental Economics

Type	Credits	Grading	Term offered	Version
Written examination	3,5 CP	graded	Each summer term	2

Courses					
ST 2025	2581003	Energy and Environment	2 SWS	Lecture / 🗣	Karl
Exams					
ST 2025	7900294	Energy and Environment NEW			Karl
WT 25/26	7900302	Energy and Environment NEW			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 2025, 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 6.112 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	Energy Informatics 1	4 SWS	Lecture / Practice (	Hagenmeyer, Rapp, Dorn, Schmurr, Langner
Exams					
ST 2025	7500079	Energy informatics 1			Hagenmeyer
WT 25/26	7500174	Energy informatics 1			Hagenmeyer

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 6.113 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	Credits	Grading	Term offered	Version
Coursework	0 CP	pass/fail	Each term	1

Exams			
ST 2025	7500065	Energy Informatics 1 - preliminary work	Hagenmeyer
WT 25/26	7500235	Energy Informatics 1 - preliminary work	Hagenmeyer

T 6.114 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	Credits	Grading	Term offered	Version
Oral examination	5 CP	graded	Each summer term	2

Courses					
ST 2025	2400017	Energy Informatics 2	4 SWS	Lecture / Practice (/ 🗣	Hagenmeyer, Förderer, Bao, Elbez, Suess, Kühnapfel, Cakmak, Mikut, Schmurr, Langner
Exams					
ST 2025	7500156	Energy Informatics 2			Hagenmeyer
ST 2025	7500176	Energy Informatics 2			Hagenmeyer
WT 25/26	7500156	Energy Informatics 2			Hagenmeyer

Legend: 📱 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

T 6.115 Module component: Energy Market Engineering [T-WIWI-107501]

Coordinators: Prof. Dr. Christof Weinhardt
Organisation: KIT Department of Economics and Management
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	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each summer term	1

Courses					
ST 2025	2540464	Energy Market Engineering	2 SWS	Lecture /	Weinhardt, Miskiw
ST 2025	2540465	Übung zu Energy Market Engineering	1 SWS	Practice /	Semmelmann
Exams					
ST 2025	79852	Energy Market Engineering			Weinhardt
WT 25/26	7900127	Energy Market Engineering			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** — **Lecture (V)**
2540464, SS 2025, 2 SWS, Language: German/English, Open in study portal — **Blended (On-Site/Online)**

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 findet hybrid statt, mit Videos die während des Semester von den Studierenden eigenständig durchgearbeitet werden und einer Blockveranstaltung im Juli, welche die Vorlesungsinhalte anreichert und vertieft. Mehr Infos in der Auftaktverantsaltung in Präsenz in der ersten Vorlesungswoche.

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 6.116 Module component: Energy Networks and Regulation [T-WIWI-107503]

Coordinators: Prof. Dr. Christof Weinhardt
Organisation: KIT Department of Economics and Management
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	Energy Networks and Regulation	2 SWS	Lecture / 🗣	Rogat, Miskiw
WT 25/26	2540495	Übung zu Energy Networks and Regulation	1 SWS	Practice / 🗣	Rogat, Miskiw

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.

Bundesnetzagentur (2015): Evaluierungsbericht nach § 33 Anreizregulierungsverordnung, 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.

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 6.117 Module component: Energy Trading and Risk Management [T-WIWI-112151]

Coordinators: N.N.
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101451 - Energy Economics and Energy Markets

Type	Credits	Grading	Term offered	Version
Written examination	3,5 CP	graded	Each summer term	2

Courses					
ST 2025	2581020	Energy Trading and Risk Management	2 SWS	Lecture / 🗣	Kraft, Fichtner, Beranek
Exams					
ST 2025	7981020	Energy Trade and Risk Management			Fichtner
WT 25/26	7981020	Energy Trading and Risk Management			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. Depending on the respective pandemic situation, the exam may be offered as an open book exam (alternative exam assessment).

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 2025, 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

Organizational issues
Termine 14-täglich nach Vereinbarung

Literature
Weiterführende Literatur:

Burger, M., Graeber, B., Schindlmayr, G. (2007): *Managing energy risk: An integrated view on power and other energy markets*, Wiley&Sons, Chichester, England

EEX (2010): *Einführung in den Börsenhandel an der EEX auf Xetra und Eurex*, www.eex.de

Erdmann, G., Zweifel, P. (2008), Energieökonomik, Theorie und Anwendungen, Springer, ISBN: 978-3-540-71698-3

Hull, J.C. (2006): *Options, Futures and other Derivatives*, 6. Edition, Pearson Prentice Hall, New Jersey, USA

Borchert, J., Schlemm, R., Korth, S. (2006): *Stromhandel: Institutionen, Marktmodelle, Pricing und Risikomanagement (Gebundene Ausgabe)*, Schäffer-Poeschel Verlag

www.riskglossary.com

T 6.118 Module component: Engineering Interactive Systems: AI & Wearables [T-WIWI-113460]

Coordinators: Prof. Dr. Alexander Mädche
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-102806 - Service Innovation, Design & Engineering
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 winter term	1

Courses					
WT 25/26	2540420	Engineering Interactive Systems: AI & Wearables	3 SWS	Lecture /	Mädche, Feick, Kretzer
Exams					
WT 25/26	7900195	Engineering Interactive Systems: AI & Wearables			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 6.119 Module component: Engineering Self-Adaptive Systems [T-INFO-113349]

Coordinators: Prof. Dr. Raffaela Mirandola
Organisation: KIT Department of Informatics
Part of: M-INFO-106626 - Engineering Self-Adaptive Systems

Type	Credits	Grading	Version
Oral examination	3 CP	graded	1

Courses					
WT 25/26	2400186	Engineering Self-Adaptive Systems		Lecture	Mirandola
Exams					
WT 25/26	7500381	Engineering Self-Adaptive Systems			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 6.120 Module component: Entrepreneurship [T-WIWI-102864]

Coordinators: Prof. Dr. Orestis Terzidis
Organisation: KIT Department of Economics and Management
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					
ST 2025	2545001	Entrepreneurship	2 SWS	Lecture /	Terzidis, Dang
WT 25/26	2545001	Entrepreneurship	2 SWS	Lecture /	Malik, Terzidis, Dang
Exams					
ST 2025	7900002	Entrepreneurship			Terzidis
ST 2025	7900192	Entrepreneurship			Terzidis
WT 25/26	7900045	Entrepreneurship			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** — **Lecture (V)**
2545001, SS 2025, 2 SWS, Language: English, Open in study portal — **Blended (On-Site/Online)**

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:

22.04.2025
29.04.2025
06.05.2025
13.05.2025
20.05.2025
27.05.2025
03.06.2025 (inkl. Prep Session)

17.06.2025 (Klausur)

Literature
Füglistaller, 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.

V **Entrepreneurship** — **Lecture (V)**
2545001, WS 25/26, 2 SWS, Language: English, Open in study portal — **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 studentsare 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)

Füglistaller, 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.

T 6.121 Module component: Entrepreneurship Research [T-WIWI-102894]

Coordinators: Prof. Dr. Orestis Terzidis
Organisation: KIT Department of Economics and Management
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 2025	2545002	Entrepreneurship Research	2 SWS	Seminar / 🗣	Malik
Exams					
ST 2025	7900052	Entrepreneurship Research			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 2025, 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
Thursday, 08.05.2025, 10.00-16.00
Thursday, 05.06.2025, 10.00-16.00
Thursday, 10.07.2025, 09.00-12.00

Registration is via the Wiwi-Portal.

Literature
Will be announced in the seminar.

T 6.122 Module component: Entrepreneurship Seasonal School [T-WIWI-113151]

Coordinators: Prof. Dr. Orestis Terzidis
Organisation: KIT Department of Economics and Management
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 6.123 Module component: Environmental and Resource Policy [T-WIWI-102616]

Coordinators: Rainer Walz
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101468 - Environmental Economics

Type	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2560548	Environmental and Ressource Policy	2 SWS	Lecture / Practice (	Walz
Exams					
ST 2025	7900277	Environmental and Resource Policy			Mitusch, 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** **Lecture / Practice (VÜ)**
2560548, SS 2025, 2 SWS, Language: German, Open in study portal

Literature
Weiterführende Literatur:

Michaelis, P.: Ökonomische Instrumente in der Umweltpolitik. Eine anwendungsorientierte Einführung, Heidelberg
OECD: Environmental Performance Review Germany, Paris

T 6.124 Module component: Environmental Economics and Sustainability [T-WIWI-102615]

Coordinators: Prof. Dr. Rainer Walz
Organisation: KIT Department of Economics and Management
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	Umweltökonomik und Nachhaltigkeit (mit Übung)	2 SWS	Lecture / Practice (	Walz
Exams					
ST 2025	7900273	Environmental Economics and Sustainability			Mitusch

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 6.125 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	Environmental Law	2 SWS	Lecture / 🗣	Smeddinck
Exams					
WT 25/26	8262111102_1	Environmental Law			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 6.126 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	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each winter term	1

Courses					
WT 25/26	2424019	EU Data Protection Law	2 SWS	Lecture / 🗣	Gil Gasiola

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:

V **EU Data Protection Law** **Lecture (V)**
2424019, WS 25/26, 2 SWS, Language: English, Open in study portal **On-Site**

Content

Module:

EU Data Protection Law

Module Responsible:

Dr. iur. Gustavo Gil Gasiola

Program of Study:

Master **Business Informatic (Wirtschaftsinformatik)**

Area of Specialization

Wahlpflichtbereich

For Master modules only

Recurrence

Each winter term

Duration

One term

Academic Level 1 - 4:

Level 4: Master Program of Study

Credit points = ECTS

3 ECTS

We usually have a module for each course (lecture, seminar, practical course).

Language:

English

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

Annotation:

Prerequisites:

Competency certificate:

The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 60 minutes.

If the assessment is an examination of another type, the deadline for redraw must be set. These partial achievements can only be repeated once and are to be graded.

Course works are not graded and can be repeated indefinitely, if not otherwise specified.

Recommendations:

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=6kyXgfIG7H2SNwLX4qyerDasd56C5L.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=6kyXgfIG7H2SNwLX4qyerDasd56C5L.1

T 6.127 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	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each summer term	1

Courses					
ST 2025	24666	Europäisches und Internationales Recht	2 SWS	Lecture / 🗣	Brühann
Exams					
ST 2025	7500084	European and International Law			Zufall
WT 25/26	7500048	European and International Law			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 2025, 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 28.04.2025, 09:30 - 17:00 (Mittagspause wird flexibel gehalten)

Montag, den 02.06.2025, 09:30 - 17:00 (Mittagspause wird flexibel gehalten)

Montag, den 07.07.2025, 09:30 - 17:00 Uhr (Mittagspause wird flexibel gehalten).

Literature
Literatur wird in der Vorlesung angegeben.

Weiterführende Literatur

Erweiterte Literaturangaben werden in der Vorlesung bekannt gegeben.

T 6.128 Module component: Experimental Economics [T-WIWI-102614]

Coordinators: Prof. Dr. Christof Weinhardt
Organisation: KIT Department of Economics and Management
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
M-WIWI-107528 - Information Systems: Digital Markets & Services

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each winter term	1

Courses					
WT 25/26	2540489	Experimental Economics	2 SWS	Lecture / 🗣	Knierim
WT 25/26	2540493	Übung zu Experimental Economics	1 SWS	Practice / 🗣	del Puppo
Exams					
ST 2025	7900258	Experimental Economics			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 6.129 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 2025	2400128	Explainable Artificial Intelligence	2 SWS	Lecture / 🗣	Lioutikov
Exams					
ST 2025	7500359	Explainable Artificial Intelligence			Lioutikov
WT 25/26	7500370	Explainable Artificial Intelligence			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 2025, 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 04.-08. August 2025

T 6.130 Module component: Extraordinary Additional Course in the Module Cross-Functional Management Accounting [T-WIWI-108651]

Coordinators: Prof. Dr. Marcus Wouters
Organisation: KIT Department of Economics and Management
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 6.131 Module component: Financial Analysis [T-WIWI-102900]

Coordinators: Dr. Torsten Luedecke
Organisation: KIT Department of Economics and Management
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 summer term	2

Courses					
ST 2025	2530205	Financial Analysis	2 SWS	Lecture / 🗣	Luedecke
ST 2025	2530206	Übungen zu Financial Analysis	2 SWS	Practice / 🗣	Luedecke
Exams					
ST 2025	7900075	Financial Analysis			Luedecke
WT 25/26	7900059	Financial Analysis			Ruckes, 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 2025, 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 6.132 Module component: Financial Econometrics [T-WIWI-103064]

Coordinators: Prof. Dr. Melanie Schienle
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101638 - Econometrics and Statistics I
M-WIWI-101639 - Econometrics and Statistics II
M-WIWI-105414 - Statistics and Econometrics II

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each winter term	2

Courses					
WT 25/26	2520022	Financial Econometrics I	2 SWS	Lecture / 🗣	Schienle, Buse
WT 25/26	2520023	Übungen zu Financial Econometrics I	2 SWS	Practice / 🗣	Schienle, Buse
Exams					
ST 2025	7900223	Financial Econometrics			Schienle
WT 25/26	7900126	Financial Econometrics			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
Knowledge of the contents covered by the course "Economics III: Introduction in Econometrics"[2520016]

Additional Information
The next lecture will take place in the winter semester 2022/23.

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 fincancial 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 6.133 Module component: Financial Econometrics II [T-WIWI-110939]

Coordinators: Prof. Dr. Melanie Schienle
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101638 - Econometrics and Statistics I
M-WIWI-101639 - Econometrics and Statistics II
M-WIWI-105414 - Statistics and Econometrics II

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each summer term	3

Courses					
ST 2025	2521302	Financial Econometrics II	2 SWS	Lecture / 🗣	Schienle, Buse
ST 2025	2521303	Übung zu Financial Econometrics II	2 SWS	Practice / 🗣	Buse, Schienle
Exams					
ST 2025	7900081	Financial Econometrics II			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
Knowledge of the contents covered by the course "Financial Econometrics"

Additional Information
Course language is English
The next lecture will take place in the summer semester of 2023.

Workload
135 hours

T 6.134 Module component: Financial Intermediation [T-WIWI-102623]

Coordinators: Prof. Dr. Martin Ruckes
Organisation: KIT Department of Economics and Management
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	Financial Intermediation	2 SWS	Lecture / 🗣	Ruckes
WT 25/26	2530233	Übung zu Finanzintermediation	1 SWS	Practice	Ruckes, Benz
Exams					
ST 2025	7900078	Financial Intermediation			Ruckes
WT 25/26	7900063	Financial Intermediation			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 6.135 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	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each winter term	1

Courses					
WT 25/26	2424086	Formale Systeme	4 SWS	Lecture / Practice (	Beckert, Ulbrich, Weigl
Exams					
ST 2025	7500009	Formal Systems			Beckert
WT 25/26	7500036	Formal Systems			Beckert

T 6.136 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	Credits	Grading	Term offered	Version
Oral examination	5 CP	graded	Each summer term	1

Courses					
ST 2025	2400093	Formal Systems II: Application	3 SWS	Lecture / 🗣	Ulbrich, Beckert
Exams					
ST 2025	7500006	Formale Systeme II: Anwendung			Beckert, Ulbrich
WT 25/26	7500200	Formale Systeme II: Anwendung			Beckert, Ulbrich

Legend: 🖥 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

T 6.137 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

T 6.138 Module component: Fundamentals for Financial -Quant and -Machine Learning Research [T-WIWI-111846]

Coordinators: Prof. Dr. Maxim Ulrich
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-105894 - Foundations for Advanced Financial -Quant and -Machine Learning Research

Type	Credits	Grading	Term offered	Version
Examination of another type	9 CP	graded	see Annotations	1

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.

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.

Additional Information
Teaching and learning format: Lecture and exercise.

The course is offered every second year.

Workload
270 hours

T 6.139 Module component: Fundamentals of National and International Group Taxation [T-WIWI-111304]

Coordinators: Prof. Dr. Berthold Wigger
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101511 - Advanced Topics in Public Finance

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each summer term	1

Courses					
ST 2025	2560133	Fundamentals of National and International Group Taxation	3 SWS	Lecture / 🗣	Wigger, Gutekunst
Exams					
ST 2025	790kobe	Fundamentals of National and International Group Taxation			Wigger
WT 25/26	790kobe	Fundamentals of National and International Group Taxation			Wigger

Legend: 💻 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Depending on the further pandemic development the assessment will consist either of an open book exam (following Art. 4, para. 2, clause 3 of the examination regulation), or of an 1.5h written exam (following Art. 4, para. 2, clause 1 of the examination regulation).

Prerequisites
None

Recommendations
It is recommended to attend the course “Basics of German Company Tax Law and Tax Planning” beforehand.

Workload
135 hours

T 6.140 Module component: Global Manufacturing [T-WIWI-112103]

Coordinators: Dr. Henning Sasse
Organisation: KIT Department of Economics and Management
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	Global Manufacturing	2 SWS	Lecture /	Sasse
Exams					
ST 2025	7981956	Global Manufacturing			Schultmann
WT 25/26	7981956	Global Manufacturing			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 6.141 Module component: Global Optimization I [T-WIWI-102726]

Coordinators: Prof. Dr. Oliver Stein
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101473 - Mathematical Programming

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each summer term	1

Courses					
ST 2025	2550134	Global Optimization I	2 SWS	Lecture / 🗣	Stein
Exams					
ST 2025	7900205_SS2025_HK	Global Optimization I			Stein
WT 25/26	7900004_WS2526_NK	Global Optimization I			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 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
In many optimization problems from economics, engineering and natural sciences, solution algorithms are only able to efficiently identify *local* optimizers, while it is much harder to find *globally* optimal points. This corresponds to the fact that by local search it is easy to find the summit of the closest mountain, but that the search for the summit of Mount Everest is rather elaborate.

The lecture treats methods for global optimization of convex functions under convex constraints. It is structured as follows:

- Introduction, examples, and terminology
- Existence results for optimal points
- Optimality in convex optimization
- Duality, bounds, and constraint qualifications
- Algorithms (Kelley's cutting plane method, Frank-Wolfe method, primal-dual interior point methods)

The lecture is accompanied by exercises which, amongst others, offers the opportunity to implement and to test some of the methods on practically relevant examples.

Remark:

The treatment of *nonconvex* optimization problems forms the contents of the lecture "Global Optimization II". The lectures "Global Optimization I" and "Global Optimization II" are held consecutively *in the same semester*.

Learning objectives:

The student

- knows and understands the fundamentals of deterministic global optimization in the convex case,
- is able to choose, design and apply modern techniques of deterministic global optimization in the convex case in practice.

Literature
O. Stein, Grundzüge der Globalen Optimierung, SpringerSpektrum, 2018.

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 6.142 Module component: Global Optimization I and II [T-WIWI-103638]

Coordinators: Prof. Dr. Oliver Stein
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101473 - Mathematical Programming

Type	Credits	Grading	Term offered	Version
Written examination	9 CP	graded	Each summer term	1

Courses					
ST 2025	2550134	Global Optimization I	2 SWS	Lecture / 🗣	Stein
ST 2025	2550135	Exercise to Global Optimization I	1 SWS	Practice / 🗣	Stein, Beck
ST 2025	2550136	Global Optimization II	2 SWS	Lecture / 🗣	Stein
Exams					
ST 2025	7900207_SS2025_HK	Global Optimization I and II			Stein
WT 25/26	7900006_WS2526_NK	Global Optimization I and II			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** — **Lecture (V) On-Site**
2550134, SS 2025, 2 SWS, Language: German, Open in study portal

Content
In many optimization problems from economics, engineering and natural sciences, solution algorithms are only able to efficiently identify *local* optimizers, while it is much harder to find *globally* optimal points. This corresponds to the fact that by local search it is easy to find the summit of the closest mountain, but that the search for the summit of Mount Everest is rather elaborate.

The lecture treats methods for global optimization of convex functions under convex constraints. It is structured as follows:

- Introduction, examples, and terminology
- Existence results for optimal points
- Optimality in convex optimization
- Duality, bounds, and constraint qualifications
- Algorithms (Kelley's cutting plane method, Frank-Wolfe method, primal-dual interior point methods)

The lecture is accompanied by exercises which, amongst others, offers the opportunity to implement and to test some of the methods on practically relevant examples.

Remark:

The treatment of *nonconvex* optimization problems forms the contents of the lecture "Global Optimization II". The lectures "Global Optimization I" and "Global Optimization II" are held consecutively *in the same semester*.

Learning objectives:

The student

- knows and understands the fundamentals of deterministic global optimization in the convex case,
- is able to choose, design and apply modern techniques of deterministic global optimization in the convex case in practice.

Literature
O. Stein, Grundzüge der Globalen Optimierung, SpringerSpektrum, 2018.

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

V

Global Optimization II

2550136, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
In many optimization problems from economics, engineering and natural sciences, solution algorithms are only able to efficiently identify *local* optimizers, while it is much harder to find *globally* optimal points. This corresponds to the fact that by local search it is easy to find the summit of the closest mountain, but that the search for the summit of Mount Everest is rather elaborate.

The lecture treats methods for global optimization of nonconvex functions under nonconvex constraints. It is structured as follows:

- Introduction and examples
- Convex relaxation
- Interval arithmetic
- Convex relaxation via alphaBB method
- Branch-and-bound methods
- Lipschitz optimization

The lecture is accompanied by exercises which, amongst others, offers the opportunity to implement and to test some of the methods on practically relevant examples.

Remark:

The treatment of *convex* optimization problems forms the contents of the lecture "Global Optimization I". The lectures "Global Optimization I" and "Global Optimization II" are held consecutively *in the same semester*.

Learning objectives:

The student

- knows and understands the fundamentals of deterministic global optimization in the nonconvex case,
- is able to choose, design and apply modern techniques of deterministic global optimization in the nonconvex case in practice.

Literature
O. Stein, Grundzüge der Globalen Optimierung, SpringerSpektrum, 2018.

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 6.143 Module component: Global Optimization II [T-WIWI-102727]

Coordinators: Prof. Dr. Oliver Stein
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101473 - Mathematical Programming

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each summer term	2

Courses					
ST 2025	2550136	Global Optimization II	2 SWS	Lecture / 🗣	Stein
ST 2025	2550137	Exercise to Global Optimization II	1 SWS	Practice / 🗣	Stein, Beck
Exams					
ST 2025	7900206_SS2025_HK	Global Optimization II			Stein
WT 25/26	7900005_WS2526_NK	Global Optimization II			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** — **Lecture (V) On-Site**
2550136, SS 2025, 2 SWS, Language: German, Open in study portal

Content
In many optimization problems from economics, engineering and natural sciences, solution algorithms are only able to efficiently identify *local* optimizers, while it is much harder to find *globally* optimal points. This corresponds to the fact that by local search it is easy to find the summit of the closest mountain, but that the search for the summit of Mount Everest is rather elaborate.

The lecture treats methods for global optimization of nonconvex functions under nonconvex constraints. It is structured as follows:

- Introduction and examples
- Convex relaxation
- Interval arithmetic
- Convex relaxation via alphaBB method
- Branch-and-bound methods
- Lipschitz optimization

The lecture is accompanied by exercises which, amongst others, offers the opportunity to implement and to test some of the methods on practically relevant examples.

Remark:

The treatment of *convex* optimization problems forms the contents of the lecture "Global Optimization I". The lectures "Global Optimization I" and "Global Optimization II" are held consecutively *in the same semester*.

Learning objectives:

The student

- knows and understands the fundamentals of deterministic global optimization in the nonconvex case,
- is able to choose, design and apply modern techniques of deterministic global optimization in the nonconvex case in practice.

Literature
O. Stein, Grundzüge der Globalen Optimierung, SpringerSpektrum, 2018.

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: 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 6.145 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 6.146 Module component: Graph Theory and Advanced Location Models [T-WIWI-102723]

Coordinators: Prof. Dr. Stefan Nickel
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101473 - Mathematical Programming
M-WIWI-102832 - Operations Research in Supply Chain Management
M-WIWI-103289 - Stochastic Optimization

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Irregular	2

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" 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 6.147 Module component: Growth and Development [T-WIWI-112816]

Coordinators: Prof. Dr. Ingrid Ott
Organisation: KIT Department of Economics and Management
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	Growth and Development	2 SWS	Lecture / 🗣	Ott
WT 25/26	2561504	Exercise for Growth and Development	1 SWS	Practice / 🗣	Ott, Ghoniem
Exams					
ST 2025	7900105	Growth and Development			Ott
WT 25/26	7900078	Growth and Development			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 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
135 hours

Below you will find excerpts from courses related to this module component:

V **Growth and Development** — **Lecture (V) On-Site**
2561503, WS 25/26, 2 SWS, Language: English, Open in study portal

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 6.148 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 6.149 Module component: Heat Economy [T-WIWI-102695]

Coordinators: Prof. Dr. Wolf Fichtner
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101452 - Energy Economics and Technology

Type	Credits	Grading	Term offered	Version
Written examination	3,5 CP	graded	Each summer term	2

Courses					
ST 2025	2581001	Heat Economy	2 SWS	Lecture / 🗣	Fichtner
Exams					
ST 2025	7981001	Heat Economy			Fichtner
WT 25/26	7981001	Heat Economy			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** — **Lecture (V) On-Site**
2581001, SS 2025, 2 SWS, Language: German, Open in study portal

Organizational issues
Block, Seminarraum Standort West - siehe Institutsaushang

T 6.150 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	Heterogene parallele Rechensysteme	2 SWS	Lecture / 🗣	Karl
Exams					
ST 2025	7500216	Heterogeneous Parallel Computing Systems			Karl

Legend: 📱 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

T 6.151 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	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2400159	HRI and Social Robotics	4 SWS	Lecture / Practice (/	Bruno, Maure
Exams					
ST 2025	7500101	HRI and Social Robotics			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** — **Lecture / Practice (VÜ) On-Site**
2400159, SS 2025, 4 SWS, Language: English, Open in study portal

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 6.152 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	Credits	Grading	Term offered	Version
Examination of another type	2 CP	graded	Each summer term	1

Courses					
ST 2025	2400159	HRI and Social Robotics	4 SWS	Lecture / Practice (/	Bruno, Maure
Exams					
ST 2025	7500101	HRI and Social Robotics			Bruno
ST 2025	7500358	HRI and Social Robotics - Exercises			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** **Lecture / Practice (VÜ) On-Site**
2400159, SS 2025, 4 SWS, Language: English, Open in study portal

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 6.153 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	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each term	2

Courses					
ST 2025	24678	Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy	2 SWS	Lecture / 🗣	Spetzger
WT 25/26	2424139	Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy	2 SWS	Lecture / 🗣	Spetzger
Exams					
ST 2025	7500145	Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy			Spetzger
WT 25/26	7500118	Human Brain and Central Nervous System: Snatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy			Spetzger

Legend: 📱 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

T 6.154 Module component: Human Factors in Autonomous Driving [T-WIWI-113059]

Coordinators: Prof. Dr. Alexey Vinel
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-106631 - Cooperative Autonomous Vehicles

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each winter term	1

Courses					
WT 25/26	2511452	Human Factors in Autonomous Driving	2 SWS	Lecture /	Vinel, Bied, Schrapel
WT 25/26	2511453	Exercises Human Factors in Autonomous Driving	1 SWS	Practice /	Vinel, Bied, Schrapel
Exams					
ST 2025	79AIFB_HFAD_C6	Human Factors in Autonomous Driving (registration extended until 28.07.2025)			Vinel
WT 25/26	79AIFB_HFAD_C6	Human Factors in Autonomous Driving			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 (20 min).

The exam takes place every semester and can be repeated at every regular examination date.

Workload
135 hours

T 6.155 Module component: Human Factors in Security and Privacy [T-WIWI-109270]

Coordinators: Prof. Dr. Melanie Volkamer
Organisation: KIT Department of Economics and Management
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

Exams			
WT 25/26	79AIFB_HFSP_A1	Human Factors in Security and Privacy	Volkamer

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 (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 6.156 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

Type	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each summer term	1

Courses					
ST 2025	24659	Human-Computer-Interaction	2 SWS	Lecture /	Beigl, Lee
Exams					
ST 2025	7500048	Human-Computer-Interaction			Beigl
WT 25/26	7500076	Human-Computer-Interaction			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.

T 6.157 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

Type	Credits	Grading	Term offered	Version
Coursework	0 CP	pass/fail	Each summer term	1

Courses					
ST 2025	2400095	Human-Computer-Interaction	1 SWS	Practice /	Beigl, Lee
Exams					
ST 2025	7500121	Human-Computer-Interaction Pass			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 6.158 Module component: Human-Machine-Interaction [T-INFO-101266]

Coordinators: Prof. Dr.-Ing. Michael Beigl
Organisation: KIT Department of Informatics
Part of: M-WIWI-107531 - Information Systems: Interactive Systems

Type	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each summer term	3

Courses					
ST 2025	24659	Human-Computer-Interaction	2 SWS	Lecture /	Beigl, Lee
Exams					
ST 2025	7500048	Human-Computer-Interaction			Beigl
WT 25/26	7500076	Human-Computer-Interaction			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.

Prerequisites
Participation in the exercise is compulsory and the contents of the exercise are relevant for the examination.

T 6.159 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	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each winter term	4

Courses					
WT 25/26	2424100	Human-Machine-Interaction in Anthropomatics: Basics	2 SWS	Lecture /	van de Camp
Exams					
WT 25/26	7500017	Human-Machine-Interaction in Anthropomatics: Basics			Beyerer, van de Camp

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

T 6.160 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	Humanoid Robotics Laboratory	4 SWS	Practical course / 🗣	Asfour
Exams					
WT 25/26	7500149	Humanoid Robotics Laboratory			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:

V Humanoid Robotics Laboratory

2424890, WS 25/26, 4 SWS, Language: German/English, Open in study portal

Practical course (P)
On-Site

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.

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 6.161 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	Humanoid Robots - Seminar	2 SWS	Seminar / 🗣	Asfour
Exams					
WT 25/26	7500119	Humanoid Robots - Seminar			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

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 6.162 Module component: Incentives in Organizations [T-WIWI-105781]

Coordinators: Prof. Dr. Petra Nieken
Organisation: KIT Department of Economics and Management
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	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each summer term	1

Courses					
ST 2025	2573003	Incentives in Organizations	2 SWS	Lecture / 🗣	Nieken
ST 2025	2573004	Übung zu Incentives in Organizations	2 SWS	Practice / 🗣	Nieken, Mitarbeiter, Walther, Gorny
Exams					
ST 2025	7900132	Incentives in Organizations			Nieken
WT 25/26	7900201	Incentives in Organizations			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
Knowledge of microeconomics, game theory, and statistics is assumed.

Below you will find excerpts from courses related to this module component:

V Incentives in Organizations

2573003, SS 2025, 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 Organizantional Architecture, Brickley / Smith / Zimmerman, McGraw-Hill Education, 2015

Behavioral Game Theory, Camerer, Russel 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 6.163 Module component: Information Service Engineering [T-WIWI-106423]

Coordinators: Prof. Dr. Harald Sack
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101456 - Intelligent Systems and Services

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each summer term	2

Courses					
ST 2025	2511606	Information Service Engineering	2 SWS	Lecture / 🗣	Sack
ST 2025	2511607	Exercises to Information Service Engineering	1 SWS	Practice / 🗣	Sack, Norouzi, Tietz, Singh, Malekzadeh Mahani, Ondraszek
Exams					
ST 2025	79AIFB_ISE_B3	Information Service Engineering (Registration extended until 28.07.2025)			Sack
WT 25/26	79AIFB_ISE_B2	Information Service Engineering			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 **Information Service Engineering** — Lecture (V), On-Site
2511606, SS 2025, 2 SWS, Language: English, Open in study portal

Content
- The Art of Understanding

- From Numbers to Insights
- Data, Information, and Knowledge
- Natural Language
- What is Successful Communication?
- The Art of Understanding

- Natural Language Processing

- NLP and Basic Linguistic Knowledge
- NLP Applications, Techniques and Challenges
- How to evaluate an NLP Experiment?
- Tokenization and Word Normalisation
- Statistical Language Models (N-Gram Model)
- Naive Bayes Text Classification
- Distributional Semantics and Word Vectors

- 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
- From Linked Data to Knowledge Graphs

- Basic Machine Learning

- Machine Learning Fundamentals
- Evaluation and Generalization Problems
- Linear Regression
- Decision Trees
- Unsupervised Learning
- Neural Networks and Deep Learning
- Word Embeddings
- Knowledge Graph Embeddings

- ISE Applications

- Knowledge Graph Completion
- Knowledge Graphs and Large Language Models
- Semantic and Exploratory Search
- Semantic Recommender Systems

Learning objectives:

- The students know the fundamentals and measures of information theory and are able to apply those in the context of Information Service Engineering.
- The students have basic skills of natural language processing and are enabled to apply natural language processing technology to solve and evaluate simple text analysis tasks.
- The students have fundamental skills of knowledge representation with ontologies as well as basic knowledge of Semantic Web and Linked Data technologies. The students are able to apply these skills for simple representation and analysis tasks.
- The students have fundamental skills of information retrieval and are enabled to conduct and to evaluate simple information retrieval tasks.
- The students apply their skills of natural language processing, Linked Data engineering, and Information Retrieval to conduct and evaluate simple knowledge mining tasks.
- The students know the fundamentals of recommender systems as well as of semantic and exploratory search.

Literature

- D. Jurafsky, J.H. Martin, Speech and Language Processing, 2nd ed. Pearson Int., 2009.
- A. Hogan, The Web of Data, Springer, 2020.
- G. Rebala, A. Ravi, S. Churiwala, An Introduction to Machine Learning, Springer, 2019.

T 6.164 Module component: Innovation Management: Concepts, Strategies and Methods [T-WIWI-102893]

Coordinators: Prof. Dr. Marion Weissenberger-Eibl
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101488 - Entrepreneurship (EnTechnon)
M-WIWI-101507 - Innovation Management

Type	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each summer term	1

Courses					
ST 2025	2545100	Innovation Management: Concepts, Strategies and Methods	2 SWS	Lecture / 🔀	Weissenberger-Eibl
Exams					
ST 2025	7900144	Innovation Management: Concepts, Strategies and Methods			Weissenberger-Eibl
WT 25/26	7900145	Innovation Management: Concepts, Strategies and Methods			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 2025, 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 6.165 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	Innovation2Business – Innovation Strategy in the Industrial Corporate Practice	2 SWS	Lecture / 🗣	Albers
Exams					
WT 25/26	76-T-MACH-112882	Innovation2Business – innovation strategy in the industrial corporate practice			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 & Herzogenaurach locations with plant tours & fireside evenings + exam-preparatory Q&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 & accommodations).

Organizational issues
Vorlesung findet an Schaeffler-Standorten (Herzogenaurach und Bühl) statt.

Sprache: Unterlagen Englisch, Vortragssprache Englisch

T 6.166 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 2025	24179	Innovative Concepts for Programming Industrial Robots	2 SWS	Lecture / 🗣	Hein
Exams					
ST 2025	750001	Innovative Concepts for programming Industrial Robots			Hein

Legend: 📱 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

T 6.167 Module component: Intelligent Agent Architectures [T-WIWI-111267]

Coordinators: Prof. Dr. Andreas Geyer-Schulz
Organisation: KIT Department of Economics and Management
Part of: 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	2540525	Intelligent Agent Architectures	2 SWS	Lecture / 🗣	Geyer-Schulz
WT 25/26	2540526	Übung zu Intelligent Agent Architectures	1 SWS	Practice / 🗣	Geyer-Schulz
Exams					
ST 2025	7900069	Intelligent Agent Architectures (Nachklausur WS 2024/2025)			Geyer-Schulz
WT 25/26	79011480	Intelligent Agent Architectures (WS 2025/2026)			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** — **Lecture (V) On-Site**
2540525, WS 25/26, 2 SWS, Language: English, Open in study portal

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 6.168 Module component: Intelligent Agents and Decision Theory [T-WIWI-110915]

Coordinators: Prof. Dr. Andreas Geyer-Schulz
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-105661 - Data Science: Intelligent, Adaptive, and Learning Information Services

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each summer term	1

Courses					
ST 2025	2540537	Intelligent Agents and Decision Theory	2 SWS	Lecture	Geyer-Schulz
ST 2025	2540538	Übung zu Intelligent Agents and Decision Theory	1 SWS	Practice	Bell
Exams					
ST 2025	7900306	Intelligent Agents and Decision Theory			Geyer-Schulz
WT 25/26	7900294	Intelligent Agents and Decision Theory (Nachklausur SoSe 2025)			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 exam will no 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.

Workload
135 hours

Below you will find excerpts from courses related to this module component:

V **Intelligent Agents and Decision Theory** **Lecture (V)**
2540537, SS 2025, 2 SWS, Language: English, Open in study portal

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 decions 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 6.169 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	Credits	Grading	Term offered	Version
Oral examination	5 CP	graded	Each summer term	1

Courses					
ST 2025	24679	Interaktive Computergrafik	2 SWS	Lecture / 🗣	Dachsbacher, Piochowiak
Exams					
ST 2025	7500123	Interactive Computer Graphics			Dachsbacher
WT 25/26	7500202	Interactive Computer Graphics			Dachsbacher

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

T 6.170 Module component: International Entrepreneurship and Brand Development [T-WIWI-114893]

Coordinators: Prof. Dr. Ann-Kristin Kupfer
Prof. Dr. Orestis Terzidis

Organisation: KIT Department of Economics and Management

Part of: M-WIWI-101488 - Entrepreneurship (EnTechnon)
M-WIWI-105312 - Marketing and Sales Management
M-WIWI-106258 - Digital Marketing

Type	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	see Annotations	1

Courses					
WT 25/26	2572189	International Entrepreneurship and Brand Development	4 SWS	Block / 🗣	Terzidis, Kupfer
Exams					
WT 25/26	7900156	International Entrepreneurship and Brand Development			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.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component T-WIWI-110985 - International Business Development and Sales must not have been started.

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 6.171 Module component: International Finance [T-WIWI-102646]

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

Type	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	see Annotations	1

Courses					
ST 2025	2530570	International Finance	2 SWS	Lecture / 🗣	Walter, Uhrig-Homburg
Exams					
ST 2025	7900097	International Finance			Uhrig-Homburg
WT 25/26	7900052	International Finance			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 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Organizational issues
Kickoff am Mittwoch, 30.04.25, 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 6.172 Module component: Internet Law [T-INFO-101307]

Coordinators: N.N.
Organisation: KIT Department of Informatics
Part of: M-INFO-101215 - Intellectual Property Law

Type	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each winter term	2

Courses					
WT 25/26	2424354	Internet Law	2 SWS	Lecture /	Idelberger
Exams					
ST 2025	7500057	Internet Law			Sattler
WT 25/26	7500060	Internet Law			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 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 6.173 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	Internet of Everything	2 SWS	Lecture / 🗣	Zitterbart, Hildenbrand, Mahrt, Neumeister
Exams					
ST 2025	7500071	Internet of Everything			Zitterbart
WT 25/26	7500009	Internet of Everything			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 6.174 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	Introduction to Bioinformatics for Computer Scientists	2 SWS	Lecture /	Stamatakis
Exams					
WT 25/26	7500057	Introduction to Bioinformatics for Computer Scientists			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 6.175 Module component: Introduction to Econometrics [T-WIWI-114622]

Coordinators: Prof. Dr. Melanie Schienle
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-105414 - Statistics and Econometrics II

Type	Credits	Grading	Term offered	Version
Written examination	5 CP	graded	Each summer term	1

Exams			
WT 25/26	7900002	Introduction in Econometrics	Schienle

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

T 6.176 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	Introduction to Quantum Computing	2 SWS	Lecture / 🗣	Schaefer
Exams					
WT 25/26	7500107	Introduction to Quantum Computing (IQC)			Schaefer

Legend: 📱 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

T 6.177 Module component: Introduction to Stochastic Optimization [T-WIWI-106546]

Coordinators: Prof. Dr. Steffen Rebennack
Organisation: KIT Department of Economics and Management
Part of: 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

Courses					
ST 2025	2550470	Introduction to Stochastic Optimization	2 SWS	Lecture /	Rebennack
ST 2025	2550471	Übung zur Einführung in die Stochastische Optimierung	1 SWS	Practice /	Rebennack, Kandora
ST 2025	2550474	Rechnerübung zur Einführung in die Stochastische Optimierung	2 SWS	Others (sons	Rebennack, Kandora
Exams					
ST 2025	7900311	Introduction to Stochastic Optimization			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 6.178 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 2025	24684	Introduction to Video Analysis	2 SWS	Lecture / 🗣	Arens
Exams					
ST 2025	7500031	Introduction to Video Analysis			Beyerer, Arens
WT 25/26	7500099	Introduction to Video Analysis			Beyerer, Arens

Legend: 📱 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

T 6.179 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	graded	Each winter term	3

Courses					
WT 25/26	2400010	IT Security	4 SWS	Lecture / Practice (/ 🗣	Müller-Quade, Wressnegger, Martin
Exams					
ST 2025	7500025	IT Security (Nachklausur)			Müller-Quade, Wressnegger, Strufe
ST 2025	7500381	IT Security			Müller-Quade, Wressnegger, Strufe

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 6.180 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

Exams			
ST 2025	7500599	IT-Security Management for Networked Systems	Hartenstein

T 6.181 Module component: Joint Entrepreneurship Summer School [T-WIWI-109064]

Coordinators: Prof. Dr. Orestis Terzidis
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101488 - Entrepreneurship (EnTechnon)

Type	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Irregular	1

Courses					
ST 2025	2545021	Joint Entrepreneurship School China	4 SWS	Seminar / 🗣	Kleinn, Terzidis, Eckerle
Exams					
ST 2025	7900346	Joint Entrepreneurship Summer School (China)			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 2025, 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: 04.-08. August 2025
- Shanghai: Presumably: 22.-26. September 2025
- Deliverables: November 2025

T 6.182 Module component: KD²Lab Hands-On Research Course: New Ways and Tools in Experimental Economics [T-WIWI-111109]

Coordinators: Prof. Dr. Christof Weinhardt
Organisation: KIT Department of Economics and Management
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
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 6.183 Module component: Knowledge Discovery [T-WIWI-102666]

Coordinators: Dr.-Ing. Tobias Käfer
Organisation: KIT Department of Economics and Management
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	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each winter term	4

Courses					
WT 25/26	2511303	Knowledge Discovery, Graph Neural Networks, and Language Models	3 SWS	Lecture / Practice (/	Käfer, Shao, Noullet, Kubelka
Exams					
ST 2025	79AIFB_KD_C4	Knowledge Discovery (Registration until 21.07.2025)			Käfer
WT 25/26	79AIFB_KD_D1	Knowledge Discovery			Käfer

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

Assessment
The assessment for the 'Knowledge Discovery' course is conducted in the form of a written examination (exam) with a duration of 60 minutes. Depending on the number of participants, the examiner may decide to conduct the examination orally.

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 obectives:

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 preperation and postprocessing: 60 hours
- Exam and exam preperation: 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 6.184 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	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Each winter term	1

Courses					
WT 25/26	2400150	Lab Project: Speech Translation	4 SWS	Practical course / 🗣	Niehues, Dinh

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 6.185 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 6.186 Module component: Laboratory in Cryptoanalysis [T-INFO-102990]

Coordinators: Prof. Dr. Jörn Müller-Quade
Organisation: KIT Department of Informatics
Part of: M-INFO-101559 - Laboratory in Cryptoanalysis

Type	Credits	Grading	Term offered	Version
Examination of another type	3 CP	graded	Each term	1

Courses					
ST 2025	24881	Laboratory: Cryptanalysis	4 SWS	Practical course / 🗣	Müller-Quade, Berger, Bayreuther, Ottenhues
Exams					
ST 2025	7500111	Laboratory in Cryptanalysis			Müller-Quade

Legend: 📱 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

T 6.187 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	Credits	Grading	Term offered	Version
Examination of another type	3 CP	graded	Each winter term	1

Courses					
WT 25/26	2424301	Laboratory Cryptography and Security	4 SWS	Practical course / 🗣	Bayreuther, Berger, Müller-Quade
Exams					
WT 25/26	7500164	Laboratory in Cryptography			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 6.188 Module component: Large-scale Optimization [T-WIWI-106549]

Coordinators: Prof. Dr. Steffen Rebennack
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101473 - Mathematical Programming
M-WIWI-102832 - Operations Research in Supply Chain Management
M-WIWI-103289 - Stochastic Optimization

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each summer term	3

Courses					
ST 2025	2550475	Large-Scale Optimization	2 SWS	Lecture / 🖳	Rebennack
ST 2025	2550476	Übung zu Large-Scale Optimization	1 SWS	Practice / 🗣	Bijiga, Rebennack, Kandora
ST 2025	2550477	Rechnerübung zu Large-scale Optimization	2 SWS	Others (sons	Rebennack, Bijiga
Exams					
ST 2025	7900291	Large-scale Optimization			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 6.189 Module component: Liberalised Power Markets [T-WIWI-107043]

Coordinators: Prof. Dr. Wolf Fichtner
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101451 - Energy Economics and Energy Markets
M-WIWI-102808 - Digital Service Systems in Industry

Type	Credits	Grading	Term offered	Version
Written examination	5,5 CP	graded	Each winter term	3

Courses					
WT 25/26	2581998	Liberalised Power Markets	2 SWS	Lecture / 🗣	Fichtner
WT 25/26	2581999	Übungen zu Liberalised Power Markets	2 SWS	Practice / 🗣	Signer, Fichtner, Beranek
Exams					
ST 2025	7900205	Liberalised Power Markets NEW			Fichtner
WT 25/26	7900160	Liberalised Power Markets NEW			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. Depending on the respective pandemic situation, the exam may be offered as an open book exam (alternative exam assessment, following §4(2), 3 of the examination regulation).

Recommendations
None

Workload
165 hours

Below you will find excerpts from courses related to this module component:

V **Liberalised Power Markets** — **Lecture (V) On-Site**
2581998, WS 25/26, 2 SWS, Language: English, Open in study portal

Content

1. Power markets in the past, now and in future

2. Designing liberalised power markets

2.1. Unbundling Dimensions of liberalised power markets
2.2. Central dispatch versus markets without central dispatch
2.3. The short-term market model
2.4. The long-term market model
2.5. Market flaws and market failure
2.6. Regulation in liberalised markets

3. The power (sub)markets

3.1 Day-ahead market
3.2 Intraday market
3.3 (Long-term) Forwards and futures markets
3.4 Emission rights market
3.5 Market for ancillary services
3.6 The “market” for renewable energies
3.7 Future market segments

4. Grid operation and congestion management

4.1. Grid operation
4.2. Congestion management

5. Market power

5.1. Defining market power
5.2. Indicators of market power
5.3. Reducing market power

6. Future market structures in the electricity value chain

1. Power markets in the past, now and in future

2. Designing liberalised power markets

2.2. Unbundling Dimensions of liberalised power markets
2.3. Central dispatch versus markets without central dispatch
2.4. The short-term market model
2.5. The long-term market model
2.6. Market flaws and market failure
2.7. Regulation in liberalised markets

3. The power (sub)markets

3.1 Day-ahead market
3.2 Intraday market
3.3 (Long-term) Forwards and futures markets
3.4 Emission rights market
3.5 Market for ancillary services
3.6 The “market” for renewable energies
3.7 Future market segments

4. Grid operation and congestion management

4.1. Grid operation
4.2. Congestion management

5. Market power

5.1. Defining market power
5.2. Indicators of market power
5.3. Reducing market power

6. Future market structures in the electricity value chain

Literature
Weiterführende Literatur:

Power System Economics; Steven Stoft, IEEE Press/Wiley-Interscience Press, 0-471-15040-1

T 6.190 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 Economics and Management
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	Life Cycle Assessment - Basics and Application Possibilities in an Industrial Context	2 SWS	Lecture / 🗣	Treml, Schultmann, Schneider
Exams					
ST 2025	7981995	Life Cycle Assessment - Basics and Application Possibilities in an Industrial Context			Schultmann
WT 25/26	7981995	Life Cycle Assessment - Basics and Application Possibilities in an Industrial Context			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

Lecture (V) On-Site

2581995, WS 25/26, 2 SWS, Language: German, Open in study portal

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 6.191 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	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each summer term	2

Courses					
ST 2025	2400158	Introduction to Quantum Machine Learning	2 SWS	Lecture /	Kühn
Exams					
ST 2025	7500378	Introduction to Quantum Machine Learning			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 2025, 2 SWS, Language: German/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 6.192 Module component: Localization of Mobile Agents [T-INFO-101377]

Coordinators: Prof. Dr.-Ing. Uwe Hanebeck
Organisation: KIT Department of Informatics
Part of: M-INFO-100840 - Localization of Mobile Agents

Type	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Each summer term	2

Courses					
ST 2025	24613	Localization of Mobile Agents	3 SWS	Lecture / 🗣	Hanebeck, Frisch
Exams					
ST 2025	7500482	Localization of Mobile Agents			Hanebeck
WT 25/26	7500583	Localization of Mobile Agents			Hanebeck

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
The assessment takes the form of an oral examination, usually lasting 15 minutes in accordance with Section 4 (2) No. 2 of the SPO.

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
None.

Recommendations
Basic knowledge of linear algebra and stochastics is helpful.

Below you will find excerpts from courses related to this module component:

V Localization of Mobile Agents

24613, SS 2025, 3 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
This module provides a systematic introduction to the topic of localization methods. To facilitate entry into the subject, the module is divided into four main topics. Dead reckoning treats the instantaneous determination of a vehicle's position from dynamic parameters such as speed or steering angle. Localization with the aid of measurements of known landmarks is part of static localization. In addition to closed solutions for specific measurements (distances and angles), the method of least squares is introduced for the fusion of arbitrary measurements. This also includes nonlinear optimization methods and certifiable global optimization. Dynamic localization deals with the combination of dead reckoning and static localization using the Kalman filter, which has been successfully used in numerous practical applications. General estimator properties are also discussed. The course concludes with simultaneous localization and mapping (SLAM), which allows localization even when the location of landmarks is (partially) unknown. Thereby the association problem is also addressed.

The lecture is accompanied by a purely digital exercise. Here, numerical tasks are presented that can be solved, for example, with a small program, whereby the solution is automatically checked for correctness. The exercise certificate is a prerequisite for the oral exam. Both are offered throughout the year.

Organizational issues
Präsenz-Vorlesung und digitale/online Übung mit ILIAS Tests.

Terminvereinbarung für mündliche Prüfung unter: pruefung-isas@iar.kit.edu

Literature
Grundlegende Kenntnisse der linearen Algebra und Stochastik sind hilfreich.

T 6.193 Module component: Localization of Mobile Agents Pass [T-INFO-114169]

Coordinators: Prof. Dr.-Ing. Uwe Hanebeck
Organisation: KIT Department of Informatics
Part of: M-INFO-100840 - Localization of Mobile Agents

Type	Credits	Grading	Term offered	Version
Coursework	0 CP	pass/fail	Each summer term	1

Exams			
ST 2025	7500483	Localization of Mobile Agents - Pass	Hanebeck
WT 25/26	7500584	Localization of Mobile Agents Pass	Hanebeck

Assessment
The assessment is carried out in form of course work (German Studienleistung, § 4 Abs. 3 SPO).

The assessment is carried out in digital form. There are ILIAS tests with individual, randomized tasks that can be solved by hand or with a small numerical program. User input is automatically assessed and there is instant feedback. There is no limit on retakes. All tests must be passed; learning progress is displayed in ILIAS.

Prerequisites
None.

Recommendations
Basic knowledge of linear algebra and stochastics is helpful.

T 6.194 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	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each winter term	3

Courses					
WT 25/26	2400161	Logical Foundations of Cyber-Physical Systems	4 SWS	Lecture / 🗣	Platzer
Exams					
WT 25/26	7500252	Logical Foundations of Cyber-Physical Systems			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 6.195 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	Credits	Grading	Term offered	Version
Oral examination	3 CP	graded	Each summer term	1

Courses					
ST 2025	2424672	Low Power Design	2 SWS	Lecture / 🗣	Henkel, Nassar, Khdr
Exams					
ST 2025	7500200	VL: Low Power Design			Henkel

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 2025, 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 6.196 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	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each summer term	1

Courses					
ST 2025	2400018	Machine Learning – Foundations and Algorithms	4 SWS	Lecture / Practice (/ 🗣	Neumann
Exams					
ST 2025	7500215	Machine Learning - Foundations and Algorithms			Neumann
WT 25/26	7500292	Machine Learning - Foundations and Algorithms			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 6.197 Module component: Machine Learning 1 - Basic Methods [T-WIWI-106340]

Coordinators: Prof. Dr.-Ing. Johann Marius Zöllner
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-103356 - Machine Learning

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each winter term	4

Courses					
WT 25/26	2511500	Machine Learning 1 - Fundamental Methods	2 SWS	Lecture / 🗣	Zöllner
WT 25/26	2511501	Exercises to Machine Learning 1 - Fundamental Methods	1 SWS	Practice / 🗣	Zöllner, Polley, Fechner
Exams					
ST 2025	79AIFB_ML1_C4	Machine Learning 1 - Basic Methods (Registration extended until 28.07.2025)			Zöllner
WT 25/26	79AIFB_ML1_Deutsch	Machine Learning 1 - Basic Methods			Zöllner
WT 25/26	79AIFB_ML1_English	Machine Learning 1 - Basic Methods (written exam in English, registration until 09.02.2026)			Zöllner

Legend: 💻 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Depending on further pandemic developments, the exam will be offered either as an open-book exam, or as a written exam (60 min):

The exam takes place every semester and can be repeated at every regular examination date.

A grade bonus can be earned by successfully completing practice exercises. If the grade of the written exam is between 4.0 and 1.3, the bonus improves the grade by up to one grade level (0.3 or 0.4). Details will be announced in the lecture.

Prerequisites
None.

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 obectives:

- Students acquire knowledge of the fundamental methods in the field of machine learning.
- Students can classify, formally describe and evaluate methods of machine learning.
- Students can use their knowledge to select suitable models and methods for selected problems in the field of of machine learning.

Literature
Die Foliensätze sind als PDF verfügbar

Weiterführende Literatur

- 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 6.198 Module component: Machine Learning 2 - Advanced Methods [T-WIWI-106341]

Coordinators: Prof. Dr.-Ing. Johann Marius Zöllner
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101637 - Analytics and Statistics
M-WIWI-103356 - Machine Learning

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each summer term	4

Courses					
ST 2025	2511502	Machine Learning 2 - Advanced Methods	2 SWS	Lecture / 🗣	Zöllner, Fechner, Polley, Stegmaier
ST 2025	2511503	Exercises for Machine Learning 2 - Advanced Methods	1 SWS	Practice / 🗣	Zöllner, Fechner, Polley, Stegmaier
Exams					
ST 2025	79AIFB_ML2_Deutsch	Machine Learning 2 – Advanced Methods (written exam in German, registration extended until 28.07.2025)			Zöllner
ST 2025	79AIFB_ML2_English	Machine Learning 2 – Advanced Methods (written exam in English, registration extended until 28.07.2025)			Zöllner
WT 25/26	79AIFB_ML2_Deutsch	Machine Learning 2 – Advanced Methods (exam in German, registration until 09.02.2026)			Zöllner
WT 25/26	79AIFB_ML2E_B1	Machine Learning 2 – Advanced Methods (exam in English, registration until 09.02.2026)			Zöllner

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Depending on further pandemic developments, the exam will be offered either as an open-book exam, or as a written exam (60 min).

The exam takes place every semester and can be repeated at every regular examination date.

Prerequisites
None.

Workload
150 hours

Below you will find excerpts from courses related to this module component:

V Machine Learning 2 - Advanced Methods

2511502, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
The subject area of machine intelligence and, in particular, machine learning, taking into account real challenges of complex application domains, is a rapidly expanding field of knowledge and the subject of numerous research and development projects.

The lecture "Machine Learning 2" deals with modern advanced methods of machine learning such as semi-supervised, self-supervised and active learning, deep neural networks (deep learning, CNNs, GANs, diffusion models, transformer, adversarial attacks) and hierarchical approaches, e.g. reinforcement learning. Another focus is the embedding and application of machine learning methods in real systems.

The lecture introduces the latest basic principles as well as extended basic structures and elucidates previously developed algorithms. The structure and the mode of operation of the methods and methods are presented and explained by means of some application scenarios, especially in the field of technical (sub) autonomous systems (vehicles, robotics, neurorobotics, image processing, etc.).

Learning objectives:

- Students understand extended concepts of machine learning and their possible applications.
- Students can classify, formally describe and evaluate methods of machine learning.
- In detail, methods of machine learning can be embedded and applied in complex decision and inference systems.
- Students can use their knowledge to select suitable models and methods of machine learning for existing problems in the field of machine intelligence.

Recommendations:

Attending the lecture ***Machine Learning 1*** or a comparable lecture is very helpful in understanding this lecture.

Literature
Die Foliensätze sind als PDF verfügbar

Weiterführende Literatur

- Deep Learning - Ian Goodfellow
- Artificial Intelligence: A Modern Approach - Peter Norvig and Stuart J. Russell
- Machine Learning - Tom Mitchell
- Pattern Recognition and Machine Learning - Christopher M. Bishop
- Reinforcement Learning: An Introduction - Richard S. Sutton and Andrew G. Barto
- Deep Learning - Ian Goodfellow, Yoshua Bengio, Aaron Courville

Weitere (spezifische) Literatur zu einzelnen Themen wird in der Vorlesung angegeben.

T 6.199 Module component: Machine Learning and Optimization in Energy Systems [T-WIWI-113073]

Coordinators: Prof. Dr. Wolf Fichtner
Organisation: KIT Department of Economics and Management
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	Machine Learning and Optimization in Energy Systems	3 SWS	Lecture / Practice (/ 🗣	Dengiz, Yilmaz, Kleinebrahm
Exams					
ST 2025	7900207	Machine Learning and Optimization in Energy Systems			Fichtner
WT 25/26	7900179	Machine Learning and Optimization in Energy Systems			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 6.200 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	Credits	Grading	Term offered	Version
Oral examination	3 CP	graded	Each summer term	1

Courses					
ST 2025	2400008	Machine Learning for the Natural Sciences	2 SWS	Lecture /	Friederich
Exams					
ST 2025	7500211	Machine Learning for Natural Sciences			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 an 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 6.201 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 2025	2400034	Exercise for Machine Learning for the Natural Sciences	2 SWS	Lecture / Practice (/	Friederich, Reiser, Zhou, Torresi, Neubert, Eberhard, Schlöder
Exams					
ST 2025	7500149	Exercise for Machine Learning for the Natural Sciences			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 an 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 6.202 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	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each winter term	2

Exams			
ST 2025	7500004	Machine Learning in Climate and Environmental Sciences	Nowack

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.

T 6.203 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 winter term	2

Exams			
ST 2025	7500380	Machine Learning in Climate and Environmental Sciences - Pass	Nowack

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 an 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.

T 6.204 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

Exams			
ST 2025	7500043	Machine Translation	Niehues

T 6.205 Module component: Management Accounting 1 [T-WIWI-102800]

Coordinators: Prof. Dr. Marcus Wouters
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101498 - Management Accounting

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each summer term	2

Courses					
ST 2025	2579900	Management Accounting 1	2 SWS	Lecture / 🖥	Wouters
ST 2025	2579901	Tutorial Management Accounting 1 (Bachelor)	2 SWS	Practice / 🗣	Dickemann
ST 2025	2579902	Tutorial Management Accounting 1 (Master)	2 SWS	Practice / 🗣	Dickemann
Exams					
ST 2025	79-2579900-B	Management Accounting 1 (Bachelor)			Wouters
ST 2025	79-2579900-M	Management Accounting 1 (Mastervorzug und Master)			Wouters
WT 25/26	79-2579900-B	Management Accounting 1 (Bachelor)			Wouters
WT 25/26	79-2579900-M	Management Accounting 1 (Mastervorzug und Master)			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 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 2025, 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.

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.

V **Tutorial Management Accounting 1 (Bachelor)** **Practice (Ü) On-Site**
2579901, SS 2025, 2 SWS, Language: English, Open in study portal

Content
see Module Handbook

V **Tutorial Management Accounting 1 (Master)** **Practice (Ü) On-Site**
2579902, SS 2025, 2 SWS, Language: English, Open in study portal

Content
see Module Handbook

T 6.206 Module component: Management Accounting 2 [T-WIWI-102801]

Coordinators: Prof. Dr. Marcus Wouters
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101498 - Management Accounting

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each winter term	2

Courses					
WT 25/26	2579903	Management Accounting 2	2 SWS	Lecture / 🖥	Wouters
WT 25/26	2579904	Tutorial Management Accounting 2 (Bachelor)	2 SWS	Practice / 🗣	Letmathe
WT 25/26	2579905	Tutorial Management Accounting 2 (Master)	2 SWS	Practice / 🗣	Letmathe
Exams					
ST 2025	79-2579903-B	Management Accounting 2 (Bachelor)			Wouters
ST 2025	79-2579903-M	Management Accounting 2 (Mastervorzug und Master)			Wouters
WT 25/26	79-2579903-B	Management Accounting 2 (Bachelor)			Wouters
WT 25/26	79-2579903-M	Management Accounting 2 (Mastervorzug und Master)			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 Accounting1" before this course
- participation in the exercise for the lecture "Management Accounting 2"

Additional Information
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** — **Lecture (V) Online**
2579903, WS 25/26, 2 SWS, Language: English, Open in study portal

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 Vergügung gestellt.

V **Tutorial Management Accounting 2 (Bachelor)** — **Practice (Ü) On-Site**
2579904, WS 25/26, 2 SWS, Language: English, Open in study portal

Content
see ILIAS

V **Tutorial Management Accounting 2 (Master)** — **Practice (Ü) On-Site**
2579905, WS 25/26, 2 SWS, Language: English, Open in study portal

Content
see ILIAS

T 6.207 Module component: Management of IT-Projects [T-WIWI-113968]

Coordinators: Dr. Sascha Alpers
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101477 - Development of Business Information Systems

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each summer term	1

Courses					
ST 2025	2511214	IT Project Management	2 SWS	Lecture / 🗣	Alpers
ST 2025	2511215	Exercise IT Project Management	1 SWS	Practice / 🗣	Rybinski
Exams					
ST 2025	7900302	IT Project Management (Registration extended until 21.07.2025)			Oberweis
WT 25/26	79AIFB_ITP_C3	IT Project Management			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 2025, 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 infrastructur
- 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 appropiate 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.

V

Exercise IT Project Management

2511215, SS 2025, 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 6.208 Module component: Managing New Technologies [T-WIWI-102612]

Coordinators: Dr. Thomas Reiß
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101488 - Entrepreneurship (EnTechnon)

Type	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	see Annotations	2

Courses					
ST 2025	2545003	Managing New Technologies	2 SWS	Lecture / 🗣	Reiß
Exams					
ST 2025	7900169	Managing New Technologies			Reiß

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Success is assessed in the form of a written examination (60 minutes).

Prerequisites
None

Recommendations
None

Additional Information
The course is expected to be offered for the last time in the summer semester 2024.

Workload
90 hours

Below you will find excerpts from courses related to this module component:

V Managing New Technologies

2545003, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
This lecture provides an overview of new technologies in the research areas of biotechnology, nanotechnology and neuroscience as well as basic concepts of technology management. Students should be able to present problems of technology assessment and early recognition of new technologies in a structured way and apply formal approaches to technology management issues in an appropriate manner.

Organizational issues
Bitte melden Sie sich für die Prüfung Nr. 7900169 an, das ist die Prüfungs-Nr. für die schriftliche Prüfung.

(Die Prüfungs-Nr. 7900235 ist eine mündliche Prüfung, zu der sich Studierende nur nach Aufforderung durch das EnTechnon Sekretariat anmelden sollen, wenn Studierende eine mündliche Prüfung haben.)

Literature

- Hausschildt/Salomo: Innovationsmanagement;
- Borchert et al.: Innovations- und Technologiemanagement;
- Specht/Möhrle: Gabler Lexikon Technologiemanagement

Die relevanten Auszüge und zusätzlichen Quellen werden in der Veranstaltung bekannt gegeben.

T 6.209 Module component: Market Research [T-WIWI-107720]

Coordinators: Prof. Dr. Martin Klarmann
Organisation: KIT Department of Economics and Management
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 2025	2571150	Market Research	2 SWS	Lecture / 🗣	Klarmann
ST 2025	2571151	Market Research Tutorial	1 SWS	Practice / 🗣	Klarmann
Exams					
ST 2025	7900015	Market Research			Klarmann
WT 25/26	7900053	Market Research			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** — **Lecture (V) On-Site**
2571150, SS 2025, 2 SWS, Language: English, Open in study portal

Content
Within the lecture, essential statistical methods for measuring customer attitudes (e.g. satisfaction measurement), understanding customer behavior and making strategic decisions will be discussed. The practical use as well as the correct handling of different survey methods will be taught, such as experiments and surveys. To analyze the collected data, various analysis methods are presented, including hypothesis tests, factor analyses, cluster analyses, variance and regression analyses. Building on this, the interpretation of the results will be discussed.

Topics addressed in this course are for example:

- Theoretical foundations of market research
- Statistical foundations of market research
- Measuring customer attitudes
- Understanding customer reactions
- Strategical decision making

The aim of this lecture is to give an overview of essential statistical methods. In the lecture students learn the practical use as well as the correct handling of different statistical survey methods and analysis procedures. In addition, emphasis is put on the interpretation of the results after the application of an empirical survey. The derivation of strategic options is an important competence that is required in many companies in order to react optimally to customer needs.

The assessment is carried out (according to §4(2), 3 SPO) in the form of a written open book exam.

The total workload for this course is approximately 135.0 hours.

Presence time: 30 hours

Preparation and wrap-up of the course: 45.0 hours

Exam and exam preparation: 60.0 hours

Please note that this course has to be completed successfully by students interested in master thesis positions at the chair of marketing.

Literature
Homburg, Christian (2016), Marketingmanagement, 6. Aufl., Wiesbaden.

T 6.210 Module component: Marketing Analytics [T-WIWI-103139]

Coordinators: Prof. Dr. Martin Klarmann
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101647 - Data Science: Evidence-based Marketing

Type	Credits	Grading	Term offered	Version
Examination of another type	4,5 CP	graded	Each winter term	6

Courses					
WT 25/26	2572170	Marketing Analytics	2 SWS	Lecture / 🗣	Klarmann
WT 25/26	2572171		1 SWS	Practice / 🗣	Jacob

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
The prerequisite for taking the course is the successful completion of the course "Market Research".

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). 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).

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.

V 2572171, 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 6.211 Module component: Master's Thesis [T-WIWI-103142]

Coordinators: Studiendekan der KIT-Fakultät für Informatik
Studiendekan des KIT-Studienganges
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-104833 - Module Master's Thesis

Type	Credits	Grading	Version
Final Thesis	30 CP	graded	1

Assessment
see module description

Prerequisites
see module description

Final Thesis
This module component represents a final thesis. The following periods have been supplied:

Submission deadline	6 months
Maximum extension period	3 months
Correction period	8 weeks

T 6.212 Module component: Matching Theory [T-WIWI-113264]

Coordinators: Prof. Dr. Clemens Puppe
Organisation: KIT Department of Economics and Management
Part of: 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	2500042	Matching Theory	3 SWS	Lecture / Practice (/	Okulicz
Exams					
ST 2025	7900260	Matching Theory			Puppe
WT 25/26	7900347	Matching Theory			Puppe

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

Assessment
Written examination (90 minutes)

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

T 6.213 Module component: Mathematics for High Dimensional Statistics [T-WIWI-111247]

Coordinators: Prof. Dr. Oliver Grothe
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101473 - Mathematical Programming
M-WIWI-101637 - Analytics and Statistics
M-WIWI-103289 - Stochastic Optimization

Type	Credits	Grading	Term offered	Version
Oral examination	4,5 CP	graded	Irregular	1

Courses					
ST 2025	2550562	Mathematische Grundlagen hochdimensionaler Statistik	2 SWS	Lecture / 🗣	Grothe
ST 2025	2550563	Übung zu Mathematische Grundlagen hochdimensionaler Statistik	2 SWS	Practice / 🗣	Grothe
Exams					
ST 2025	7900362	Mathematics for High Dimensional Statistics			Grothe

Legend: 🖥 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
The assessment 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.

Additional Information
Teaching and learning format: Lecture and exercise

Below you will find excerpts from courses related to this module component:

V Mathematische Grundlagen hochdimensionaler Statistik

2550562, SS 2025, 2 SWS, Open in study portal

Lecture (V)
On-Site

Content
Content:

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

Learning objectives:

Students are able to

- name and justify statistical properties of high-dimensional objects (vectors, matrices, functions).
- describe and explain differences in the behaviour between low- and high-dimensional random objects.
- name procedures for assess uncertainties in statistical models and apply them in simple examples.
- decide well-founded which modeling of high-dimensional structures is best suited in a specific situation.
- transform data into lower dimensions and quantify approximation errors.
- understand basic proofs in high-dimensional statistics using examples.
- develop, implement and evaluate smaller simulations in a programming language of their choice.

T 6.214 Module component: Media Management [T-WIWI-112711]

Coordinators: Prof. Dr. Ann-Kristin Kupfer
Organisation: KIT Department of Economics and Management
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	Media Management	2 SWS	Lecture / 🗣	Kupfer
WT 25/26	2572193	Media Management Exercise	1 SWS	Practice / 🗣	Kupfer, Mitarbeiter, Schmitt
Exams					
ST 2025	7900004	Media Management			Kupfer
WT 25/26	7900135	Media Management			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 6.215 Module component: Methods in Economics [T-WIWI-114054]

Coordinators: Prof. Dr. Ingrid Ott
Organisation: KIT Department of Economics and Management
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

Exams			
ST 2025	7900108	Methods in Economics	Ott

Assessment
Alternative exam assessment.

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 quantiative-mathematical methods.

T 6.216 Module component: Methods in Innovation Management [T-WIWI-110263]

Coordinators: Prof. Dr. Marion Weissenberger-Eibl
Organisation: KIT Department of Economics and Management
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 6.217 Module component: Microeconometrics [T-WIWI-112153]

Coordinators: Prof. Dr. Fabian Krüger
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-105414 - Statistics and Econometrics II

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	see Annotations	1

Assessment
The assessment consists of a written examination (60 minutes). 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').

Additional Information
The course will be offered in the summer semester 2024.

Workload
135 hours

T 6.218 Module component: Mixed Integer Programming I [T-WIWI-102719]

Coordinators: Prof. Dr. Oliver Stein
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101473 - Mathematical Programming
M-WIWI-102832 - Operations Research in Supply Chain Management
M-WIWI-103289 - Stochastic Optimization

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Irregular	1

Courses					
WT 25/26	2550138	Mixed-integer Programming I	2 SWS	Lecture / 🗣	Stein
WT 25/26	2550139	Exercises Mixed Integer Programming I	2 SWS	Practice / 🗣	Stein, Beck, Neussel
Exams					
WT 25/26	7900180_WS2526_HK	Mixed Integer Programming I			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).

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.

T 6.219 Module component: Mixed Integer Programming II [T-WIWI-102720]

Coordinators: Prof. Dr. Oliver Stein
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101473 - Mathematical Programming
M-WIWI-102832 - Operations Research in Supply Chain Management
M-WIWI-103289 - Stochastic Optimization

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Irregular	1

Exams			
WT 25/26	7900007_WS2526_HK	Mixed Integer Programming II	Stein

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).

T 6.220 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	Mobile Communication	2 SWS	Lecture	Waldhorst, Mahrt
Exams					
ST 2025	7500073	Mobile Communication			Waldhorst, Zitterbart
WT 25/26	7500015	Mobile Communication			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 6.221 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	Model-Driven Software Development	2 SWS	Lecture / 🗣	Burger
Exams					
ST 2025	7500016	Model Driven Software Development			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 6.222 Module component: Modeling and OR-Software: Advanced Topics [T-WIWI-106200]

Coordinators: Prof. Dr. Stefan Nickel
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-102808 - Digital Service Systems in Industry
M-WIWI-102832 - Operations Research in Supply Chain Management

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each winter term	4

Courses					
WT 25/26	2550490	Modellieren und OR-Software: Fortgeschrittene Themen	3 SWS	Practical course / 🖧	Pomes, Linner, Nickel
Exams					
ST 2025	7900188	Modeling and OR-Software: Advanced Topics			Nickel
WT 25/26	7900071	Modeling and OR-Software: Advanced Topics			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.ior.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 6.223 Module component: Modeling and Simulation [T-WIWI-112685]

Coordinators: Prof. Dr. Sanja Lazarova-Molnar
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101456 - Intelligent Systems and Services

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each summer term	1

Courses					
ST 2025	2511100	Modeling and Simulation	2 SWS	Lecture	Lazarova-Molnar
ST 2025	2511101	Exercises Modeling and Simulation	1 SWS	Practice	Lazarova-Molnar, Mostafa
Exams					
ST 2025	79AIFB_MaS_C6	Modeling and Simulation (Registration extended until 28.07.2025)			Lazarova-Molnar
WT 25/26	79AIFB_MaS_A6	Modeling and Simulation			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 2025, 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 6.224 Module component: Modeling the Dynamics of Financial Markets [T-WIWI-113414]

Coordinators: Prof. Dr. Maxim Ulrich
Organisation: KIT Department of Economics and Management
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 Marke Theory", "Essentials for Dynamic Financial Machine Learning" and "Exercises, Python, Resesearch 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 6.225 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 2025	2400063	Motion in Human and Machine	3 SWS	Seminar / 🗣	Asfour
Exams					
ST 2025	7500289	Motion in Man and Machine - Seminar			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 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.

Additional Information
The block internship is an interdisciplinary event in co-operation with the University of Stuttgart and the University of Heidelberg.

Below you will find excerpts from courses related to this module component:

V Motion in Human and Machine

2400063, SS 2025, 3 SWS, Language: German/English, Open in study portal

Seminar (S)
On-Site

Content
This interdisciplinary block seminar deals with methods of modeling, generating and controlling movements in humans and robot systems. Students gain an insight into this interdisciplinary field and learn the basics of capturing biological motion, biomechanical simulation, robotics, and machine learning. In the introduction, the generation of human movement as effect of muscle contraction is discussed. It is shown how observed movement patterns can be identified and categorized and how these patterns can be reproduced on a humanoid robot. Finally, methods for learning movement primitives from human demonstration are presented and their application to motion generation in humanoid robots are explained.

Competency Goals:

The student knows methods for modeling, processing and analyzing human motions. He/she knows methods for learning motion primitives and mapping human motion to robots with different kinematics and dynamics and can apply these in new contexts.

Organizational issues
Institutions: KIT IAR-H²T Prof. T. Asfour, University of Stuttgart, University of Tübingen

This interdisciplinary block seminar is offered in cooperation with the University of Stuttgart and the University of Tübingen.

Competency certificate: Success is assessed by preparing documentation and a final presentation as a different type of success assessment in accordance with Section 4 (2) No. 3 of the SPO.

Module for Masters in Information Management, Mechanical Engineering, Mechatronics and Information Technology, Electrical Engineering and Information Technology, Sports Science

Workload: 90 h

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.

T 6.226 Module component: Multicriteria Optimization [T-WIWI-111587]

Coordinators: Prof. Dr. Oliver Stein
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101473 - Mathematical Programming
M-WIWI-102832 - Operations Research in Supply Chain Management
M-WIWI-103289 - Stochastic Optimization

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	see Annotations	1

Exams			
ST 2025	7900209_SS2025_NK	Multicriteria Optimization	Stein

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).

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 6.227 Module component: Multivariate Statistical Methods [T-WIWI-103124]

Coordinators: Prof. Dr. Oliver Grothe
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101473 - Mathematical Programming
M-WIWI-101637 - Analytics and Statistics
M-WIWI-101639 - Econometrics and Statistics II
M-WIWI-103289 - Stochastic Optimization

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Irregular	1

Exams			
ST 2025	7900351	Multivariate Statistical Methods	Grothe

Assessment
Witten 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
The course covers highly advanced statistical methods with a quantitative focus. Hence, participants are necessarily expected to have advanced statistical knowledge, e.g. acquired in the course ''Advanced Statistics''. Without this, participation in the course is not advised.

Previous attendance of the course Analysis of Multivariate Data is recommended. Alternatively, the script can be provided to interested students.

Additional Information
The course (lecture and exercise) is offered irregularly. Detailed information can be found on the chair's website.

Workload
135 hours

T 6.228 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	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each winter term	1

Courses					
WT 25/26	2400147	Natural Language Processing	4 SWS	Lecture / 🗣	Niehues, Liu, Züfle
Exams					
ST 2025	7500223	Natural Language Processing			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 6.229 Module component: Natural Language Processing and Software Engineering [T-INFO-114257]

Coordinators: Prof. Dr.-Ing. Anne Koziolek
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	Natural Language Processing and Software Engineering	2 SWS	Lecture / 🗣	Hey, Koziolek
Exams					
ST 2025	7500185	Natural Language Processing and Software Engineering			Koziolek, Hey

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 6.230 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	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2400221	Network Security: Architectures and Protocols	2 SWS	Lecture / 🗣	Baumgart, Bless, Zitterbart
ST 2025	24601	Network Security: Architectures and Protocols	2 SWS	Lecture / 🗣	Baumgart, Bless, Zitterbart
Exams					
ST 2025	7500040	Network Security: Architectures and Protocols			Zitterbart, Bless, Baumgart
ST 2025	7500072	Network Security: Architectures and Protocols			Zitterbart, Bless, Baumgart
ST 2025	7500375	Network Security: Architectures and Protocols - for retakers			Zitterbart, Bless, Baumgart
WT 25/26	7500014	Network Security: Architectures and Protocols			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.

T 6.231 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 2025	24674	Next Generation Internet	2 SWS	Lecture / 🗣	Bless
Exams					
ST 2025	7500074	Next Generation Internet			Bless, Zitterbart
WT 25/26	7500016	Next Generation Internet			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 2025, 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 6.232 Module component: Non- and Semiparametrics [T-WIWI-103126]

Coordinators: Prof. Dr. Melanie Schienle
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101638 - Econometrics and Statistics I
M-WIWI-101639 - Econometrics and Statistics II

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Irregular	1

Courses					
WT 25/26	2521300	Non- and Semiparametrics	2 SWS	Lecture	Schienle
WT 25/26	2521301		2 SWS	Practice	Schienle, Rüter, Wolffram
Exams					
WT 25/26	7900009	Non- and Semiparametrics			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 6.233 Module component: Nonlinear Optimization I [T-WIWI-102724]

Coordinators: Prof. Dr. Oliver Stein
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101473 - Mathematical Programming

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each winter term	4

Courses					
WT 25/26	2550111	Nonlinear Optimization I	2 SWS	Lecture / 🗣	Stein
WT 25/26	2550112	Exercises Nonlinear Optimization I	1 SWS	Practice / 🗣	Stein, Schwarze, Neussel
Exams					
ST 2025	7900202_SS2025_NK	Nonlinear Optimization I			Stein
WT 25/26	7900001_WS2526_HK	Nonlinear Optimization I			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 condtions
- 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 6.234 Module component: Nonlinear Optimization I and II [T-WIWI-103637]

Coordinators: Prof. Dr. Oliver Stein
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101473 - Mathematical Programming

Type	Credits	Grading	Term offered	Version
Written examination	9 CP	graded	Each winter term	6

Courses					
WT 25/26	2550111	Nonlinear Optimization I	2 SWS	Lecture / 🗣	Stein
WT 25/26	2550112	Exercises Nonlinear Optimization I	1 SWS	Practice / 🗣	Stein, Schwarze, Neussel
WT 25/26	2550113	Nonlinear Optimization II	2 SWS	Lecture / 🗣	Stein
Exams					
ST 2025	7900204_SS2025_NK	Nonlinear Optimization I and II			Stein
WT 25/26	7900003_WS2526_HK	Nonlinear Optimization I and II			Stein

Legend: 📱 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
The assessment consits 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 condtions
- 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

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 6.235 Module component: Nonlinear Optimization II [T-WIWI-102725]

Coordinators: Prof. Dr. Oliver Stein
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101473 - Mathematical Programming

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each winter term	3

Courses					
WT 25/26	2550112	Exercises Nonlinear Optimization I	1 SWS	Practice / 🗣	Stein, Schwarze, Neussel
WT 25/26	2550113	Nonlinear Optimization II	2 SWS	Lecture / 🗣	Stein
WT 25/26	2550114	Exercise to Nonlinear Optimization II	1 SWS	Practice / 🗣	Stein, Schwarze, Neussel
Exams					
ST 2025	7900203_SS2025_NK	Nonlinear Optimization II			Stein
WT 25/26	7900002_WS2526_HK	Nonlinear Optimization II			Stein

Legend: 💻 Online, 🎭 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
The assessment consits 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 6.236 Module component: Online Concepts for Karlsruhe City Retailers [T-WIWI-111848]

Coordinators: Prof. Dr. Martin Klarmann
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101510 - Cross-Functional Management Accounting
M-WIWI-105312 - Marketing and Sales Management
M-WIWI-106258 - Digital Marketing

Type	Credits	Grading	Term offered	Version
Examination of another type	3 CP	graded	Each summer term	2

Courses					
ST 2025	2571184	Online concepts for Karlsruhe city retailers	2 SWS	Others (sons / 🗣	Kupfer
Exams					
ST 2025	7900221	Online Concepts for Karlsruhe City Retailers			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) 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** — **Others (sonst.) On-Site**
2571184, SS 2025, 2 SWS, Language: German, Open in study portal

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

T 6.237 Module component: Operations Research in Health Care Management [T-WIWI-102884]

Coordinators: Prof. Dr. Stefan Nickel
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-102805 - Service Operations

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each term	4

Courses					
ST 2025	2550495	Operations Research in Health Care Management	2 SWS	Lecture /	Graß
ST 2025	2550496	Übungen zu OR im Health Care Management	1 SWS	Practice /	Graß
WT 25/26	2550495	Operations Research in Health Care Management	2 SWS	Lecture /	Graß
WT 25/26	2550496	Übungen zu OR im Health Care Management	1 SWS	Practice	Graß
Exams					
ST 2025	7900229	Operations Research in Health Care Management			Graß
WT 25/26	7900010	Operations Research in Health Care Management			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 co nveyed 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** — **Lecture (V) Online**
2550495, SS 2025, 2 SWS, Language: English, Open in study portal

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

V **Operations Research in Health Care Management** — **Lecture (V) On-Site**
2550495, WS 25/26, 2 SWS, Language: English, Open in study portal

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

T 6.238 Module component: Operations Research in Supply Chain Management [T-WIWI-102715]

Coordinators: Prof. Dr. Stefan Nickel
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101473 - Mathematical Programming
M-WIWI-102805 - Service Operations
M-WIWI-102832 - Operations Research in Supply Chain Management
M-WIWI-103289 - Stochastic Optimization

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Irregular	2

Courses					
ST 2025	2550480	Operations Research in Supply Chain Management	2 SWS	Lecture / 🗣	Nickel
ST 2025	2550481	Übungen zu OR in Supply Chain Management	1 SWS	Practice / 🗣	Hoffmann
Exams					
ST 2025	7900272	Operations Research in Supply Chain Management			Nickel
ST 2025	7900382	Operations Research in Supply Chain Management			Nickel
WT 25/26	7900028	Operations Research in Supply Chain Management			Nickel

Legend: 💻 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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 SCMis 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.

Below you will find excerpts from courses related to this module component:

V Operations Research in Supply Chain Management

2550480, SS 2025, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
Supply Chain Management constitutes a general tool for logistics process planning in supply networks. To an increasing degree quantitative decision support is provided by methods and models from Operations Research. The lecture "OR in Supply Chain Management" conveys concepts and approaches for solving practical problems and presents an insight to current research topics. The lecture's focus is set on modeling and solution methods for applications originating in different domains of a supply chain. The emphasis is put on mathematical methods like mixed integer programming, valid inequalities or column generation, and the derivation of optimal solution strategies.

In form and content, the lecture addresses multiple areas of Supply Chain Management: After a short introduction, inventory models, scheduling, assembly line balancing as well as cutting and packing will be discussed. Another main focus of the lecture is the application of methods from online optimization. This optimization discipline has gained more and more importance in the optimization of supply chains over the several past years due to an increasing amount of dynamic data flows.

Literature

- Simchi-Levi, D.; Chen, X.; Bramel, J.: The Logic of Logistics: Theory, Algorithms, and Applications for Logistics and Supply Chain Management, 2nd edition, Springer, 2005
- Simchi-Levi, D.; Kaminsky, P.; Simchi-Levi, E.: Designing and Managing the Supply Chain: Concepts, Strategies, and Case Studies, McGraw-Hill, 2000
- Silver, E. A.; Pyke, D. F.; Peterson, R.: Inventory Management and Production Planning and Scheduling, 3rd edition, Wiley, 1998
- Blazewicz, J.: Handbook on Scheduling - From Theory to Applications, Springer, 2007
- Pinedo, M. L.: Scheduling - Theory, Algorithms, and Systems (3rd edition), Springer, 2008
- Dyckhoff, H.; Finke, U.: Cutting and Packing in Production and Distribution - A Typology and Bibliography, Physica-Verlag, 1992
- Borodin, A.; El-Yaniv, R.: Online Computation and Competitive Analysis, Cambridge University Press, 2005
- Francis, R. L.; McGinnis, L. F.; White, A.: Facility Layout and Location: An Analytical Approach, 2nd edition, Prentice-Hall, 1992

T 6.239 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

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.

The prerequisites, if any, are explained in more detail in the module description.

T 6.240 Module component: Optimization under Uncertainty [T-WIWI-106545]

Coordinators: Prof. Dr. Steffen Rebennack
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-103289 - Stochastic Optimization

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each winter term	3

Courses					
WT 25/26	2550464	Optimization Under Uncertainty	2 SWS	Lecture /	Rebennack, Kandora
WT 25/26	2550465	Übungen zu Optimierungsansätze unter Unsicherheit	1 SWS	Practice /	Rebennack
WT 25/26	2550466		2 SWS	Others (sons	Rebennack
Exams					
ST 2025	7900309	Optimization under Uncertainty			Rebennack
WT 25/26	7900240	Optimization under Uncertainty			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 6.241 Module component: Panel Data [T-WIWI-103127]

Coordinators: apl. Prof. Dr. Wolf-Dieter Heller
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101638 - Econometrics and Statistics I
M-WIWI-101639 - Econometrics and Statistics II

Type	Credits	Grading	Term offered	Version
Examination of another type	4,5 CP	graded	Each summer term	2

Courses					
ST 2025	2520320	Panel Data	2 SWS	Lecture	Heller
ST 2025	2520321	Übungen zu Paneldaten	2 SWS	Practice	Heller
Exams					
ST 2025	7900115	Panel Data			Heller

Assessment
The performance assessment is an alternative exam assessment in the form of a one-hour examination comprising a written and an oral part. The examination takes place as an individual examination or in groups of two.

Prerequisites
None

Workload
135 hours

Below you will find excerpts from courses related to this module component:

V Panel Data

2520320, SS 2025, 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 6.242 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	Parallel Algorithms	3 SWS	Lecture / 🗣	Sanders, Uhl, Laupichler

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.

Final grade: 80% oral examination, 20% exercise

Prerequisites
None.

Recommendations
Knowledge from lectures such as Algorithms I/II is recommended.

T 6.243 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	Credits	Grading	Term offered	Version
Examination of another type	1 CP	graded	Each winter term	1

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.

Final grade: 80% oral examination, 20% exercise

Prerequisites
None.

Recommendations
Knowledge from lectures such as Algorithms I/II is recommended.

T 6.244 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	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each summer term	2

Courses					
ST 2025	24617	Parallel computer systems and parallel programming	2 SWS	Lecture	Streit, Barthel, Caspart
Exams					
ST 2025	7500365	Parallel Computer Systems and Parallel Programming			Streit
ST 2025	7500374	Parallel Computer Systems and Parallel Programming			Streit

T 6.245 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

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.

T 6.246 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	Credits	Grading	Version
Coursework	0 CP	pass/fail	1

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.

T 6.247 Module component: Parametric Optimization [T-WIWI-102855]

Coordinators: Prof. Dr. Oliver Stein
Organisation: KIT Department of Economics and Management
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).

T 6.248 Module component: Patent Law [T-INFO-101310]

Coordinators: Patric Werner
Organisation: KIT Department of Informatics
Part of: M-INFO-101215 - Intellectual Property Law

Type	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each summer term	3

Courses					
ST 2025	24656	Patent Law	2 SWS	Lecture / 🗣	Werner
Exams					
ST 2025	7500109	Patent Law			Sattler, Matz
WT 25/26	7500006	Patent Law			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.

Recommendations
None.

T 6.249 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 2025	24675	Pattern Recognition	4 SWS	Lecture / Practice (/ 🗣	Beyerer
Exams					
ST 2025	7500032	Pattern Recognition			Beyerer
WT 25/26	7500111	Pattern Recognition			Beyerer

Legend: 📱 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Below you will find excerpts from courses related to this module component:

V Pattern Recognition

24675, SS 2025, 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 6.250 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	Credits	Grading	Term offered	Version
Examination of another type	4 CP	graded	Each summer term	1

Courses					
ST 2025	2400058	Penetration Testing Lab	4 SWS	Practical course / 🗣	Baumgart, Müller, Dukek
WT 25/26	2400115	Penetration Testing Lab	4 SWS	Practical course / 🗣	Baumgart, Dukek, Müller
Exams					
ST 2025	7500275	Penetration Testing Lab			Baumgart
WT 25/26	7500330	Penetration Testing Lab			Baumgart, Müller-Quade

Legend: 📱 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

T 6.251 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 Economics and Management

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	Perceiving, Understanding and Communicating Risk and Uncertainty	2 SWS	Block / 🗣	Gradwohl

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** — **Block (B) On-Site**
2500007, WS 25/26, 2 SWS, Language: English, Open in study portal

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

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

T 6.252 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	Credits	Grading	Term offered	Version
Oral examination	5 CP	graded	Each summer term	1

Courses					
WT 25/26	2400180	Photorealistic Image Synthesis	2 SWS	Lecture / 🗣	Schudeiske, Dachsbacher
WT 25/26	2400185	Exercise Photorealistic Image Synthesis	2 SWS	Practice / 🗣	Werner, Schudeiske, Dachsbacher
Exams					
ST 2025	7500124	Photorealistic Rendering			Dachsbacher
WT 25/26	7500203	Fotorealistic Rendering			Dachsbacher

Legend: 💻 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

T 6.253 Module component: Pioneering Leadership in German SMEs [T-WIWI-114184]

Coordinators: Eva Schulz-Kamm
Organisation: KIT Department of Economics and Management
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 2025	2500033	Pioneering Leadership in the German Mittelstand	2 SWS	Seminar / 🗣	Weissenberger-Eibl
Exams					
ST 2025	7900226	Leadership and Innovation			Weissenberger-Eibl

Legend: 🖥 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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

Below you will find excerpts from courses related to this module component:

V Pioneering Leadership in the German Mittelstand

2500033, SS 2025, 2 SWS, Language: German, Open in study portal

Seminar (S)
On-Site

Content
Participants
- learn about the particular specifics of management and the cultural constitution of medium-sized and, in particular, family-run companies in Germany.
- understand the core elements of owner strategy and corporate strategy and why both strategies are linked in family businesses.
- gain an overview of the complex challenges facing German SMEs and the entrepreneurial barriers and success factors that significantly determine competitiveness and innovative ability.
- have understood what role leadership skills play in this, what key skills there are, how they are measured and how they are used in business practice.
- have internalized which competencies constitute so-called “pioneering leadership” and can assess these in themselves as well as medium-sized companies - as attractive future employers - with regard to innovative ability and competitiveness.
- consolidate what they have learned using current examples and case studies from business practice in German SMEs as well as management consulting and HR consulting practice.

T 6.254 Module component: Platform & Market Engineering: Commerce, Media, and Digital Democracy [T-WIWI-112823]

Coordinators: Prof. Dr. Christof Weinhardt
Organisation: KIT Department of Economics and Management
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 2025	2540460	Platform & Market Engineering: Commerce, Media, and Digital Democracy	2 SWS	Lecture / 🗣	Weinhardt, Fegert
ST 2025	2540461	Übungen zu Platform & Market Engineering: Commerce, Media, and Digital Democracy	1 SWS	Practice / 🗣	Fegert, Stano
Exams					
ST 2025	7979235	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** — **Lecture (V) On-Site**
2540460, SS 2025, 2 SWS, Language: English, Open in study portal

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 6.255 Module component: Portfolio and Asset Liability Management [T-WIWI-103128]

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

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each summer term	1

Courses					
ST 2025	2520357	Portfolio and Asset Liability Management	2 SWS	Lecture	Safarian
ST 2025	2520358	Übungen zu Portfolio and Asset Liability Management	2 SWS	Practice	Safarian
Exams					
ST 2025	7900366	Portfolio and Asset Liability Management			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 2025, 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 6.256 Module component: Practical Course Automatic Speech Recognition [T-INFO-104775]

Coordinators: Prof. Dr. Alexander Waibel
Organisation: KIT Department of Informatics
Part of: M-INFO-102411 - Practical Course Automatic Speech Recognition

Type	Credits	Grading	Term offered	Version
Examination of another type	3 CP	graded	Each winter term	1

Courses					
WT 25/26	2424298	Praktikum Automatische Spracherkennung	2 SWS	Practical course	Waibel, Ugan, Nguyen

Below you will find excerpts from courses related to this module component:

V Praktikum Automatische Spracherkennung

2424298, WS 25/26, 2 SWS, Language: German, Open in study portal

Practical course (P)

Content

- In a number of experiments different systems for automatic speech recognition will be built step-by-step
- The use of different tools and techniques from the area will be practiced

Literature
Weiterführende Literatur

- A. Waibel, K.F. Lee: Readings in Speech Recognition
- F. Jelinek: Statistical Methods of Speech Recognition
- Schukat-Talamazzini: Automatische Spracherkennung

T 6.257 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 2025	2400123	Practical Course Computer Vision for Human-Computer Interaction	2 SWS	Practical course / 🖳	Stiefelhagen
Exams					
ST 2025	7500279	Practical Course Computer Vision for Human-Computer Interaction			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 6.258 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

Exams			
ST 2025	7500157	Practical Course Decentralized Systems and Network Services	Hartenstein

T 6.259 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

Courses					
ST 2025	2400222	Practical Course on Network Security Research		Practical course / 🗣	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).

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 6.260 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	Credits	Grading	Term offered	Version
Examination of another type	3 CP	graded	Each winter term	1

Courses					
WT 25/26	2400016	Practical Course on Telematics	1 SWS	Practical course	Zitterbart, König, Mahrt

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 6.261 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

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 6.262 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	Credits	Grading	Term offered	Version
Examination of another type	4 CP	graded	Each winter term	1

Courses					
WT 25/26	2400086	Practical Course Protocol Engineering	4 SWS	Practical course	Zitterbart, König, Mahrt

T 6.263 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	Advanced Topics in High Performance Computing, Data Management and Analytics	3 SWS	Practical course	Farhadi, 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 6.264 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					
ST 2025	2400082	AI for climate and weather predictions	3 SWS	Practical course / 🗣	Nowack, Amiramjadi
WT 25/26	2400064	AI for climate and weather predictions	2 SWS	Practical course / 🗣	Nowack, Amiramjadi
Exams					
ST 2025	7500036	Practical Course: AI for Climate and Weather Predictions			Nowack
WT 25/26	7500010	Practical Course: AI for Climate and Weather Predictions			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

2400082, SS 2025, 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

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

T 6.265 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	Credits	Grading	Term offered	Version
Examination of another type	4 CP	graded	Each winter term	1

Courses					
ST 2025	2400117	Application Security Lab	4 SWS	Practical course / 🗣	Müller-Quade, Mechler, Dörre, Wressnegger
WT 25/26	2400114	Application Security Lab	4 SWS	Practical course / 🗣	Müller-Quade, Mechler, Dörre, Noppel, Wressnegger
Exams					
ST 2025	7500119	Application Security Lab			Müller-Quade, Wressnegger
WT 25/26	7500188	Application Security Lab			Müller-Quade, 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 6.266 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	Credits	Grading	Term offered	Version
Examination of another type	3 CP	graded	Each term	1

Courses					
ST 2025	2400104	Practical Course: Chip Design I	4 SWS	Practical course / 🗣	Tahoori
WT 25/26	2400216	Practical Course: Chip Design I	4 SWS	Practical course / 🗣	Tahoori
Exams					
ST 2025	7500234	Practical Course: Chip Design I			Tahoori
WT 25/26	7500192	Practical Course: Chip Design I			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 6.267 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	Credits	Grading	Term offered	Version
Examination of another type	3 CP	graded	Each term	1

Courses					
ST 2025	2400107	Practical Course: Chip Design II	4 SWS	Practical course / 🗣	Tahoori
WT 25/26	2400219	Practical Course: Chip Design II	4 SWS	Practical course / 🗣	Tahoori
Exams					
ST 2025	7500169	Practical Course: Chip Design II			Tahoori
WT 25/26	7500220	Practical Course: Chip Design II			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 6.268 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	graded	Each summer term	1

Courses					
ST 2025	2400203	Current Topics of Quantum Computing	3 SWS	Practical course	Kühn, Schaefer, Streit
Exams					
ST 2025	7500379	Practical Course: Current Topics of Quantum Computing			Kühn, 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 2025, 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.

Organizational issues
Die Themenvergabe findet in der Auftaktveranstaltung (**24.04. | 11:30-13:00 | CS, SCC (Gebäude 20.20), Raum 372.2**) statt

An der Auftaktveranstaltung kann auch via zoom teilgenommen werden: https://kit-lecture.zoom-x.de/j/68910470844?pwd=XUtfJYTJc81kakY2e3XERACKenozqF.1

Available topics are assigned during our kick off meeting (**24.04. | 11:30-13:00 | CS, SCC (Building 20.20), Room 372.2**)

The kick-off event can also be joined via zoom: https://kit-lecture.zoom-x.de/j/68910470844?pwd=XUtfJYTJc81kakY2e3XERACKenozqF.1

T 6.269 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
Coursework (written)	6 CP	pass/fail	Each summer term	1

Exams			
ST 2025	7500091	Data Science - Laboratory Course	Böhm, Nowack

T 6.270 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
Coursework	6 CP	pass/fail	Irregular	1

Courses					
ST 2025	242424	Data Science for Scientific Data	2 SWS	Practical course / 🗣	Böhm, Cribeiro Ramallo, Schäfer, Matteucci
Exams					
ST 2025	75751	Practical Course: Data Science for Scientific Data			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 2025, 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 (24874), 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 course is contingent on (1) being familiar with the Data Science 1 lecturesand (2) the submission of a solution to the Lab Qualification Task, which you can find on the ILIAS page of the Data Science 1 (WS 24/25) course.

The submission deadline is on 28.02.2025, we will contact the selected participants via ILIAS.

T 6.271 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	Credits	Grading	Term offered	Version
Coursework	4 CP	pass/fail	Each winter term	4

Courses					
WT 25/26	2424286	Datenbankpraktikum	2 SWS	Practical course / 🗣	Böhm, Richter
Exams					
WT 25/26	7500130	Practical Course Database Systems			Böhm

Legend: 📱 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

T 6.272 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 6.273 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	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Irregular	1

Courses					
WT 25/26	2400195	Lab: Efficient Parallel C++	4 SWS	Practical course /	Sanders, Schimek, Williams, Seemaier

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 6.274 Module component: Practical Course: Engineering Approaches to Software Development [T-INFO-108791]

Coordinators: Prof. Dr. Ralf Reussner
Organisation: KIT Department of Informatics
Part of: M-INFO-104254 - Practical Course: Engineering Approaches to Software Development

Type	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Each term	1

Courses					
WT 25/26	2400093	Practical Course Engineering Approaches to Software Development	4 SWS	Practical course	Reussner
Exams					
ST 2025	7500184	Practical Course Engineering Approaches to Software Development			Burger, Reussner

T 6.275 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	Credits	Grading	Term offered	Version
Examination of another type	3 CP	graded	Each term	1

Courses					
ST 2025	2400106	FPGA Programming	4 SWS	Practical course / 🗣	Tahoori
WT 25/26	2400106	FPGA Programming	4 SWS	Practical course / 🗣	Tahoori
Exams					
ST 2025	7500087	Practical Course FPGA Programming			Tahoori
WT 25/26	7500083	Practical Course FPGA Programming			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, SS 2025, 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 **23.04.2025**, alle 2 Wochen mittwochs 14:00-17:15, Geb. 07.21, **Gebäudeteil A, 3.OG, Praktikumsraum A.3.24, Anwesenheitspflicht**

Since the number of seats is limited, a registration for this laboratory in the campussystem is necessary.

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.

T 6.276 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					
ST 2025	24911	Practical course General-Purpose Computation on Graphics Processing Units	2 SWS	Practical course / 🗣	Lerzer, Dereviannykh, Klepikov, Dachsbacher
WT 25/26	2424297	Practical course General-Purpose Computation on Graphics Processing Units	2 SWS	Practical course / 🗣	Klepikov, Alber, Lerzer, Dachsbacher
Exams					
ST 2025	7500134	Practical-course General-Purpose Computation on Graphics Processing Units			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) On-Site

2424297, WS 25/26, 2 SWS, Language: English, Open in study portal

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 6.277 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 6.278 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 6.279 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	"Practical Course: Interactive Theorem Proving"	2 SWS	Practical course / 🗣	Beckert, Stübinger, Färber
Exams					
WT 25/26	7500297	Practical Course: Interactive Theorem Proving			Beckert

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 6.280 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	Credits	Grading	Term offered	Version
Examination of another type	4 CP	graded	Each term	1

Courses					
ST 2025	2424304	Internet of Things (IoT) Lab	4 SWS	Practical course / 🖳	Henkel, Mentzos, Tobar
WT 25/26	2424304	Internet of Things (IoT) Lab	4 SWS	Practical course / 🗣	Mentzos, Henkel, Tobar
Exams					
ST 2025	7500187	Lab: Internet of Things (IoT)			Henkel
WT 25/26	7500183	Lab: Internet of Things (IoT)			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, SS 2025, 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.

V **Internet of Things (IoT) Lab** **Practical course (P)**
2424304, WS 25/26, 4 SWS, Language: English, Open in study portal **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.

T 6.281 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 2025	2424811	Low Power Design and Embedded Systems	4 SWS	Practical course / 🔀	Henkel, Khdr, Sikal, Mentzos
Exams					
ST 2025	7500158	Lab: Low Power Design and Embedded Systems			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).
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 2025, 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 Programable 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 6.282 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	Credits	Grading	Term offered	Version
Examination of another type	8 CP	graded	Each term	1

Courses					
ST 2025	24871	Practical Course Machine Learning and Intelligent Systems	4 SWS	Practical course / 🗣	Hanebeck, Prossel
Exams					
ST 2025	7500050	Practical Course Machine Learning and Intelligent Systems			Hanebeck
WT 25/26	7500103	Practical Course Machine Learning and Intelligent Systems			Hanebeck

Legend: 💻 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

T 6.283 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	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Each winter term	2

Courses					
ST 2025	2400091	Practical Course: Model-Driven Software Development	4 SWS	Practical course / 🗣	Burger
Exams					
ST 2025	7500017	Practical Course: Model-Driven Software Development			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 6.284 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 2025	2400187	Praktikum Natural Language Dialog Systems	2 SWS	Practical course / 🗣	Niehues, Koneru
Exams					
ST 2025	7500371	Practical Course Natural Language Dialog Systems			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.

T 6.285 Module component: Practical Course: Neural Network Exercises [T-INFO-106259]

Coordinators: Prof. Dr. Alexander Waibel
Organisation: KIT Department of Informatics
Part of: M-INFO-103143 - Practical Course: Neural Network Exercises

Type	Credits	Grading	Term offered	Version
Examination of another type	3 CP	graded	Each winter term	1

T 6.286 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			
ST 2025	7500281	Practical Course: Programme Verification	Beckert
WT 25/26	7500260	Practical Course: Programme Verification	Beckert

T 6.287 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	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Each term	1

Courses					
ST 2025	2400026	Real Time Computer Graphics	4 SWS	Practical course / 🗣	Lerzer, Klepikov, Dereviannykh, Dachsbacher
WT 25/26	2424287	Practical course Realtime Computer Graphics	4 SWS	Practical course / 🗣	Klepikov, Alber, Lerzer, Dachsbacher
Exams					
ST 2025	7500307	Practical Course Realtime Computer Graphics			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 6.288 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	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Each term	1

Courses					
ST 2025	2400041	Rendering in CGI	4 SWS	Practical course / 🗣	Lerzer, Dereviannykh, Klepikov, Dachsbacher
WT 25/26	2400139	Practical course Rendering in CGI	4 SWS	Practical course / 🗣	Klepikov, Alber, Lerzer, Dachsbacher
Exams					
ST 2025	7500231	Practical Course Rendering in CGI			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 6.289 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	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Each summer term	1

Courses					
ST 2025	24870	Robotics - Practical Course	4 SWS	Practical course / 🗣	Asfour, Nutto
Exams					
ST 2025	7500261	Robotics - Practical Course			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 2025, 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, 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 statecharts, collision-free motion planning, grasp planning, robot vision and robot learning.

Learning Objectives:

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.

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.

Workload: 180 h

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 and Mechano-Informatics and Robotics is recommended.*

Target group: **Module for Master Mechanical Engineering, Mechatronics and Information Technology, Electrical Engineering and Information Technology**

T 6.290 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	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Irregular	1

Courses					
WT 25/26	2400252	Practical Course: Route Planning	4 SWS	Practical course / 🗣	Bläsius, Zündorf, Feilhauer, Wilhelm

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.

T 6.291 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

Exams			
ST 2025	7500039	Practical Course: Scientific Data Management	Böhm, Friederich

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 6.292 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	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Each term	1

Courses					
ST 2025	2400039	Scientific Visualization	4 SWS	Practical course / 🗣	Lerzer, Dereviannykh, Klepikov, Dachsbacher
WT 25/26	2400146	Practical course Scientific Visualisation	4 SWS	Practical course / 🗣	Klepikov, Lerzer, Alber, Dachsbacher
Exams					
ST 2025	7500292	Practical Course Scientific Visualization			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 6.293 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	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Each summer term	1

Courses					
ST 2025	24895	Practical Course: Smart Data Analytics	4 SWS	Practical course / 🗣	Riedel, Beigl
Exams					
ST 2025	7500088	Practical Course: Smart Data Analytics			Beigl, Riedel

Legend: 📱 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

T 6.294 Module component: Practical Course: Smart Energy System [T-INFO-112030]

Coordinators: Dr.-Ing. Simon Waczowicz
Organisation: KIT Department of Informatics
Part of: M-INFO-105955 - Practical Course: Smart Energy System

Type	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Each term	1

Courses					
ST 2025	2400170	Laboratory: Smart Energy System Lab	4 SWS	Practical course / 🗣	Hagenmeyer, Waczowicz, Jumar, Fernengel
WT 25/26	2400230	Lab Course: Smart Energy System Lab	4 SWS	Practical course / 🗣	Hagenmeyer, Jumar, Fernengel
Exams					
ST 2025	7500318	Practical Course: Smart Energy System Lab			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). A written paper must be prepared and a presentation given.

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 Laboratory: Smart Energy System Lab

2400170, SS 2025, 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: April 21, 2025 until May 02, 2025

- Interested students register via the Campus Plus portal (search for "Laboratory: Smart Energy System Lab")
- You can indicate your preferred topics 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 on May 05, 2025.

Compulsory work

- Completion of the assigned task
- Attendance during the attendance phase (min. 42 hours)
- Handover of results, documentation and presentation
- Relevant for the examination are: Preparation (literature research and discussion at the end of the preparation phase), practical work, presentation and a 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

- 21.04.2025 Upload of the project topics to the IAI page and the Campus-Plus portal
- 21.04.2025 Start of the application period
- 02.05.2025 End of the application period
- 08.05.2025 10 until 11:30 Kick-Off-Event (presence mandatory) Campus North B668.
- 09.05.2025 to 30.05.2025 Preparation phase (familiarization with the project topic), submission of literature review and in-depth talk with your project managers
- 02.06.2025 to 20.06.2025 Work phase on site at the Energy Lab (min. 42h required attendance)
- 10.07.2025, 11.07.2025 & 14.07.2025 Final presentations and grading
- 25.07.2025 Deadline for handing in the written 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

Lectures on IAI page
https://www.iai.kit.edu/english/RPE.php
Campus-Plus-Portal for registration

Organizational issues
Zweiwöchiges Praktikum

V **Lab Course: Smart Energy System Lab** — **Practical course (P)**
2400230, WS 25/26, 4 SWS, Open in study portal — **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)

T 6.295 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	graded	Each summer term	1

Courses					
ST 2025	2400223	Practical Course Software Defined Networking	4 SWS	Practical course /	König, Seehofer, Zitterbart
Exams					
ST 2025	7500354	Practical Course: Software Defined Networking			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 2025, 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 6.296 Module component: Practical Course: Tools for Agile Modelling [T-INFO-109925]

Coordinators: Prof. Dr.-Ing. Anne Koziolek
Organisation: KIT Department of Informatics
Part of: M-INFO-104893 - Practical Course: Tools for Agile Modelling

Type	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Each term	1

Courses					
ST 2025	2400043	Practical Course: Tools for Agile Modelling		Practical course / 🗣	Koziolek
WT 25/26	2400105	Practical Course: Tools for Agile Modelling		Practical course	Koziolek
Exams					
ST 2025	7500243	Practical Course: Tools for Agile Modelling			Koziolek

Legend: 📱 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

T 6.297 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	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Each term	4

Courses					
ST 2025	24909	Practical course GPU-Computing	4 SWS	Practical course / 🗣	Lerzer, Dereviannykh, Klepikov, Dachsbacher
WT 25/26	2424283	Practical course GPU-Computing	4 SWS	Practical course / 🗣	Klepikov, Alber, Lerzer, Dachsbacher
Exams					
ST 2025	7500125	Practical Course GPU-Computing			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 6.298 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	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Each term	1

Courses					
WT 25/26	2424895	Practical Course: Wearable Computing	4 SWS	Practical course / 🗣	Riedel, Beigl
Exams					
WT 25/26	7500027	Practical Course: Wearable Computing			Beigl, Riedel

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 6.299 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 2025	24873	Practical Course: Microservice2Go (II)	2 SWS	Practical course / 🗣	Abeck, Schneider, Throner
Exams					
ST 2025	7500139	Practical Course: Web Applications and Service-Oriented Architectures (II)			Abeck

Legend: 🖥 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

T 6.300 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					
ST 2025	2400009	Practical Introduction in Hardware Security	4 SWS	Lecture / Practice (/ 🗣	Tahoori, Gnad
WT 25/26	2400033	Practical Introduction to Hardware Security	4 SWS	Lecture / Practice (/ 🗣	Gnad, Tahoori
Exams					
ST 2025	7500224	Practical Introduction to Hardware Security			Tahoori
WT 25/26	7500226	Practical Introduction to Hardware Security			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 in Hardware Security

2400009, SS 2025, 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 emphasize 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
Starting 23.04.2025 - 1x Wednesdays: lecture 14:00-15:30 and lab 15:30-17:15. Location: building 07.21, wing B, 2.OG, room B316.4, mandatory attendance

There are limited slots and the registration is handled in a first-come, first-served manner. So make sure you sign-up as early as possible. We can only consider registrations with the correct documents or from the online system (https://campus.studium.kit.edu/exams/index.php)

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.

T 6.301 Module component: Practical SAT Solving [T-INFO-114262]

Coordinators: Dr. Tomas Balyo
Dr. Markus 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 2025	2400218	Practical SAT Solving	3 SWS	Lecture / Practice (	Sanders, Iser, Schreiber
Exams					
ST 2025	7500304	Practical SAT Solving			Sanders

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 6.302 Module component: Practical Seminar Digital Service Systems [T-WIWI-106563]

Coordinators: Prof. Dr. Gerhard Satzger
Organisation: KIT Department of Economics and Management
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			
ST 2025	7900262	Practical Seminar: Human-Centered Systems	Mädche
ST 2025	7900319	Service Design Thinking	Satzger
ST 2025	7900320	Practical Seminar Service Innovation	Satzger

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
None

Additional Information
New course title starting summer term 2017: "Practical Seminar Digital Service Systems".
The current range of seminar topics is announced on the KSRI website www.ksri.kit.edu.

T 6.303 Module component: Practical Seminar: Advanced Analytics [T-WIWI-108765]

Coordinators: Prof. Dr. Christof Weinhardt
Organisation: KIT Department of Economics and Management
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 6.304 Module component: Practical Seminar: AI & Data Science [T-WIWI-114892]

Coordinators: Prof. Dr. Alexander Mädche
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-107530 - Information Systems: AI & Data Science

Type	Credits	Grading	Term offered	Version
Examination of another type	4,5 CP	graded	Irregular	1

Courses					
WT 25/26	2500019	Practical Seminar: AI & Data Science	3 SWS	Lecture /	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

T 6.305 Module component: Practical Seminar: Artificial Intelligence in Service Systems [T-WIWI-112152]

Coordinators: Prof. Dr. Gerhard Satzger
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101506 - Service Analytics

Type	Credits	Grading	Term offered	Version
Examination of another type	4,5 CP	graded	Irregular	1

Exams			
ST 2025	7900320	Practical Seminar Service Innovation	Satzger

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 6.306 Module component: Practical Seminar: Data-Driven Information Systems [T-WIWI-106207]

Coordinators: Prof. Dr. Gerhard Satzger
Prof. Dr. Christof Weinhardt

Organisation: KIT Department of Economics and Management

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			
ST 2025	7900318	Practical Seminar: Data Science for Industrial Applications	Satzger

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 6.307 Module component: Practical Seminar: Health Care Management (with Case Studies) [T-WIWI-102716]

Coordinators: Prof. Dr. Stefan Nickel
Organisation: KIT Department of Economics and Management
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					
ST 2025	2550498	Practical seminar: Health Care Management	3 SWS	Seminar /	Nickel, Mitarbeiter
WT 25/26	2500008	Practical seminar: Health Care Management	3 SWS	Others (sons /	Nickel, Mitarbeiter
Exams					
ST 2025	7900380	Practical Seminar: Health Care Management (with Case Studies)			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 toOperations 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 6.308 Module component: Practical Seminar: Human-Centered Systems [T-WIWI-113459]

Coordinators: Prof. Dr. Alexander Mädche
Organisation: KIT Department of Economics and Management
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					
ST 2025	2540554	Practical Seminar: Human-Centered Systems	3 SWS	Lecture /	Mädche
WT 25/26	2540554	Practical Seminar: Human-Centered Systems	3 SWS	Lecture /	Mädche
Exams					
ST 2025	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:

V Practical Seminar: Human-Centered Systems

2540554, SS 2025, 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.

V Practical Seminar: Human-Centered Systems

2540554, WS 25/26, 3 SWS, Language: English, Open in study portal

Lecture (V)
Blended (On-Site/Online)

T 6.309 Module component: Practical Seminar: Service Innovation [T-WIWI-110887]

Coordinators: Prof. Dr. Gerhard Satzger
Organisation: KIT Department of Economics and Management
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

Exams			
ST 2025	7900319	Service Design Thinking	Satzger
ST 2025	7900320	Practical Seminar Service Innovation	Satzger
ST 2025	7900381	Practical Seminar: Service Innovation - LLM as a Judge for Business Ideas: Evaluate Business Ideas with LLMs	Satzger

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 6.310 Module component: Predictive Mechanism and Market Design [T-WIWI-102862]

Coordinators: Prof. Dr. Johannes Philipp Reiß
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101453 - Applied Strategic Decisions
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 (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 6.311 Module component: Predictive Modeling [T-WIWI-110868]

Coordinators: Prof. Dr. Fabian Krüger
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101638 - Econometrics and Statistics I
M-WIWI-101639 - Econometrics and Statistics II

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Irregular	2

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

T 6.312 Module component: Price Management [T-WIWI-105946]

Coordinators: Prof. Dr. Andreas Geyer-Schulz
Dr Paul Glenn
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101409 - Electronic Markets

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each summer term	1

Courses					
ST 2025	2540529	Price Management	2 SWS	Lecture / 🗣	Glenn
ST 2025	2540530	Exercise Price Management	1 SWS	Practice / 🗣	Glenn
Exams					
ST 2025	7900139	Price Management			Geyer-Schulz
WT 25/26	7900170	Price Management (Nachklausur SoSe 2025)			Geyer-Schulz

Legend: 💻 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Lecture and exam will not be offered in summer semester 2019. The next examination is in the summer semester 2020.

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
The lecture is offered for the first time in summer term 2016.

Below you will find excerpts from courses related to this module component:

V Price Management

2540529, SS 2025, 2 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Organizational issues
26.04.2025
10.05.2025 Termin wird verschoben auf den 05. Juli 2025
28.06.2025
05.07.2025
19.07.2025 Termin wird verschoben auf den 26. Juli 2025
26.07.2025

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 6.313 Module component: Pricing [T-WIWI-102883]

Coordinators: Prof. Dr. Martin Klarmann
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-105312 - Marketing and Sales Management

Type	Credits	Grading	Term offered	Version
Examination of another type	4,5 CP	graded	Each winter term	3

Courses					
WT 25/26	2572199	Pricing	3 SWS	Block / 🗣	Klarmann, Bill, Schröder

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) 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** **Block (B) On-Site**
2572199, WS 25/26, 3 SWS, Language: English, Open in study portal

Content
At the Pricing lecture, students learn about current research and best practices in price management. Delivered in workshop format, the lecture has three key elements:

1. "Behavioral Pricing" workshop
   In this part of the course, central concepts and findings from behavioral pricing research (e.g. price information processing, reference prices, price fairness and mental accounting) are presented and discussed on the basis of important behavioral theories (e.g. prospect theory and information economics). After a brief introduction to experimental research, participants will then conduct their own small experimental study in the form of group work on a hypothesis they have developed on pricing behavior, analyze the data, and present it.

2. "Pricing Excellence" workshop
   In a theory section at the beginning of the course, students are taught theoretical principles of pricing. This includes an introduction to (1) pricing of product prices as well as (2) pricing of net customer prices (development of discount systems). Furthermore, theoretical basics of price enforcement and price monitoring are discussed. This will be followed by a practical application of what has been learned by working on a case study in small groups with a concluding presentation.

3. "Price Negotiation" workshop
   After an introduction to key theories and concepts of negotiation, students prepare and then conduct a simulated price negotiation in small groups with guidance.

Learning Objectives:

Students...

- are familiar with central theories explaining behavioral phenomena regarding consumers dealing with prices
- are able to describe and explain central phenomena of behavioral science with regard to price behavior and derive implications from them
- can formulate their own hypotheses on price behavior and design, conduct and evaluate a suitable experimental study for this purpose
- learn theoretical basics of pricing behavior
- learn the theoretical basics of price enforcement and price monitoring
- apply the acquired knowledge in a practical case study
- know important conceptual basics on the subject of price negotiations
- can prepare and competently conduct price negotiations
- present the results of their group work in a concise and structured manner

All events will take place in presence with compulsory attendance at all dates.

Total time required for 4.5 credit points: approx. 135 hours

Attendance time: 30 hours

Self-study: 105 hours

Organizational issues
Dates will be announced.

T 6.314 Module component: Probabilistic Time Series Forecasting Challenge [T-WIWI-111387]

Coordinators: Prof. Dr. Fabian Krüger
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101638 - Econometrics and Statistics I
M-WIWI-101639 - Econometrics and Statistics II

Type	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 6.315 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	Probability and Computing	3 SWS	Lecture / Practice (/	Sanders, Walzer, Hermann

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 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 6.316 Module component: Production and Logistics Management [T-WIWI-102632]

Coordinators: Prof. Dr. Frank Schultmann
Organisation: KIT Department of Economics and Management
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 2025	2581954	Production and Logistics Management	2 SWS	Lecture / 🗣	Schultmann, Rudi
ST 2025	2581955	Production and Logistics Managment	2 SWS	Practice / 🗣	Alikhah
Exams					
ST 2025	7981954	Production and Logistics Management			Schultmann
WT 25/26	7981954	Production and Logistics Management			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 2025, 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 6.317 Module component: Project Lab Cognitive Automobiles and Robots [T-WIWI-109985]

Coordinators: Prof. Dr.-Ing. Johann Marius Zöllner
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-103356 - Machine Learning
M-WIWI-106491 - Project Lab Applied Machine Learning

Type	Credits	Grading	Term offered	Version
Examination of another type	5 CP	graded	Each winter term	3

Courses					
WT 25/26	2512501	Practical Course Cognitive automobiles and robots (Master)	3 SWS	Practical course /	Zöllner, Schneider
Exams					
WT 25/26	7900107	Advanced Lab Cognitive Automobile and Robots (Master)			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.

T 6.318 Module component: Project Lab Machine Learning [T-WIWI-109983]

Coordinators: Prof. Dr.-Ing. Johann Marius Zöllner
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-103356 - Machine Learning
M-WIWI-106491 - Project Lab Applied Machine Learning

Type	Credits	Grading	Term offered	Version
Examination of another type	5 CP	graded	Each summer term	3

Courses					
ST 2025	2512500	Project Lab Machine Learning	3 SWS	Practical course /	Daaboul, Zöllner, Schneider
Exams					
ST 2025	7900086	Project Lab Machine Learning			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 Project Lab Machine Learning

2512500, SS 2025, 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 6.319 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	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Each winter term	1

Courses					
WT 25/26	2424299	Project Lab: Image Analysis and Fusion	4 SWS	Practical course	Beyerer
Exams					
WT 25/26	7500101	Project Lab: Image Analysis and Fusion			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 6.320 Module component: Project Management [T-WIWI-103134]

Coordinators: Prof. Dr. Frank Schultmann
Organisation: KIT Department of Economics and Management
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	Project Management	2 SWS	Lecture / 🗣	Schultmann
Exams					
ST 2025	7981963	Project Management			Schultmann
WT 25/26	7981963	Project Management			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 6.321 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 2025	2400172	Public International Law with an Economic Law Focus	2 SWS	Lecture / 🗣	Kasper
Exams					
ST 2025	7500182	Public International Law with an Economic Law Focus			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 todays (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:

V **Public International Law with an Economic Law Focus** Lecture (V)
2400172, SS 2025, 2 SWS, Language: English, Open in study portal On-Site

Content
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 todays (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.

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.

Area of Specialization: For Master modules only.

Interest/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.

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
Lecture Dates:

- 26th of April 2025, 9 to 17 hours (in class)
- 24th of May, 9 to 17 hours (in class)
- 21th of June 9 to 17 hours (in class)

Name:

10.50 HS 102

Gebäude:

10.50 Kollegiengebäude Bauingenieure II

Lageplan:

https://www.kit.edu/campusplan/

T 6.322 Module component: Public Management [T-WIWI-102740]

Coordinators: Prof. Dr. Berthold Wigger
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101504 - Collective Decision Making
M-WIWI-101511 - Advanced Topics in Public Finance

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each winter term	1

Courses					
WT 25/26	2561127	Public Management	3 SWS	Lecture / Practice (/	Wigger
Exams					
ST 2025	790puma	Public Management			Wigger
WT 25/26	790puma	Public Management			Wigger

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

Assessment
Depending on the further pandemic development the assessment will consist either of an open book exam (following Art. 4, para. 2, clause 3 of the examination regulation), or of an 1.5h written exam (following Art. 4, para. 2, clause 1 of the examination regulation).

Prerequisites
None

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 6.323 Module component: Public Revenues [T-WIWI-102739]

Coordinators: Prof. Dr. Berthold Wigger
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101511 - Advanced Topics in Public Finance

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each summer term	1

Courses					
ST 2025	2560120	Public Revenues	2 SWS	Lecture / 🗣	Wigger
ST 2025	2560121	Übung zu Öffentliche Einnahmen	1 SWS	Practice / 🗣	Wigger, Schmelzer
Exams					
ST 2025	790oeff	Public Revenues			Wigger
WT 25/26	790oeff	Public Revenues			Wigger

Legend: 💻 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Depending on the further pandemic development the assessment will consist either of an open book exam (following Art. 4, para. 2, clause 3 of the examination regulation), or of an 1h written exam (following Art. 4, para. 2, clause 1 of the examination regulation).

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 2025, 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 6.324 Module component: Python for Computational Risk and Asset Management [T-WIWI-110213]

Coordinators: Prof. Dr. Maxim Ulrich
Organisation: KIT Department of Economics and Management
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 6.325 Module component: Quantitative Methods in Energy Economics [T-WIWI-107446]

Coordinators: Patrick Plötz
Organisation: KIT Department of Economics and Management
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	Quantitative Methods in Energy Economics	2 SWS	Lecture / 🗣	Plötz
WT 25/26	2581008	Übungen zu Quantitative Methods in Energy Economics	1 SWS	Practice / 🗣	Plötz, Britto
Exams					
ST 2025	7981007	Quantitative Methods in Energy Economics			Fichtner
WT 25/26	7981007	Quantitative Methods in Energy Economics			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 6.326 Module component: Recommender Systems [T-WIWI-102847]

Coordinators: Prof. Dr. Andreas Geyer-Schulz
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101410 - Business & Service Engineering
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	2540506	Recommender Systems	2 SWS	Lecture / 🗣	Geyer-Schulz
WT 25/26	2540507	Exercise Recommender Systems	1 SWS	Practice / 🗣	Geyer-Schulz, Nazemi
Exams					
ST 2025	7900138	Recommender Systems			Geyer-Schulz
WT 25/26	7900310	Recommender Systems (WS 2025/2026)			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 excersise 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

Literature

Rakesh Agrawal, Tomasz Imielinski, and Arun Swami. Mining association rules between sets of items in large databases. In Sushil Jajodia Peter Buneman, editor, Proceedings of the ACM SIGMOD International Conference on Management of Data, volume 22, Washington, D.C., USA, Jun 1993. ACM, ACM Press.

Rakesh Agrawal and Ramakrishnan Srikant. Fast algorithms for mining association rules. In Proceedings of the 20th Very Large Databases Conference, Santiago, Chile, pages 487 – 499, Sep 1994.

Asim Ansari, Skander Essegaier, and Rajeev Kohli. Internet recommendation systems. Journal of Marketing Research, 37:363 – 375, Aug 2000.

Christopher Avery, Paul Resnick, and Richard Zweckhauser. The market for evaluations. American Economic Review, 89(3):564 – 584, 1999.

Ibrahim Cingil, Asuman Dogac, and Ayca Azgin. A Broader Approach to Personalization. Communications of the ACM, 43(8):136 – 141, Aug 2000.

Richard O. Duda, Peter E. Hart, and David G. Stork. Pattern Classification. Wiley-Interscience, New York, 2 edition, 2001.

Andreas Geyer-Schulz, Michael Hahsler, and Maximilian Jahn. A customer purchase incidence model applied to recommender services. In R. Kohavi et al., editor, Proceedings of the WebKDD 2001 – Mining log data across all customer touchpoints, volume 2356 of Lecture Notes in Artificial Intelligence LNAI, pages 25–47, Berlin, 2002. ACM, Springer-Verlag.

Jon M. Kleinberg. Authoritative sources in a hyperlinked environment. JACM, 46(5):604–632, sep 1999.

Joseph Konstan, Bradley Miller, David Maltz, Jonathan Herlocker, Lee Gordon, and John Riedl. Grouplens: Applying Collaborative Filtering to Usernet News. Communications of the ACM, 40(3):77 – 87, Mar 1997.

Paul Resnick, Neophytos Iacovou, Peter Bergstrom, and John Riedl. Grouplens: An open architecture for collaborative filtering of netnews. In Proceedings of the conference on Computer supported cooperative work, pages 175 – 186. ACM Press, 1994.

Weiterführende Literatur:

Antoinette Alexander. The return of hardware: A necessary evil? Accounting Technology, 15(8):46 – 49, Sep 1999.

Christopher Avery and Richard Zeckhauser. Recommender systems for evaluating computer messages. Communications of the ACM, 40(3):88 – 89, Mar 1997.

Steven Bellman, Gerald Lohse, and Eric Johnson. Predictors of Online Buying Behavior. Communications of the ACM, 42(12):32 – 38, Dec 1999.

Thomas J. Blischok. Every transaction tells a story. Chain Store Age Executive with Shopping Center Age, 71(3):50–56, Mar 1995.

Hans Hermann Bock. Automatische Klassifikation. Vandenhoeck und Ruprecht, Göttingen, 1974.

Andrew S.C. Ehrenberg. Repeat-Buying: Facts, Theory and Applications. Charles Griffin & Company Ltd, London, 2 edition, 1988.

Wolfgang Gaul, Andreas Geyer-Schulz, Michael Hahsler, and Lars Schmidt-Thieme. eMarketing mittels Recommendersystemen. Marketing ZFP, 24:47 – 55, 2002.

Andreas Geyer-Schulz, Michael Hahsler, and Maximilian Jahn. myvu: a next generation recommender system based on observed consumer behavior and interactive evolutionary algorithms. In W. Gaul, O. Opitz, and M. Schader, editors, Data Analysis – Scientific Modeling and Practical Applications, volume 18 of Studies in Classification, Data Analysis and Knowledge Organization, pages 447 – 457, Heidelberg, Germany, 2000. Springer.

Andreas Geyer-Schulz, Michael Hahsler, and Maximillian Jahn. Educational and scientific recommender systems: Designing the information channels of the virtual university. International Journal of Engineering Education, 17(2):153 – 163, 2001.

Mark-Edward Grey. Recommendersysteme auf Basis linearer Regression, 2004.

John A. Hartigan. Clustering Algorithms. John Wiley and Sons, New York, 1975.

Kevin Kelly. New Rules for the New Economy: 10 Radical Strategies for a Connected World. Viking, 1998.

Taek-Hun Kim, Young-Suk Ryu, Seok-In Park, and Sung-Bong Yang. An improved recommendation algorithm in collaborative filtering. In K. Bauknecht, A. Min Tjoa, and G. Quirchmayr, editors, E-Commerce and Web Technologies, Third International Conference, Aix-en-Provence, France, volume 2455 of Lecture Notes in Computer Science, pages 254–261, Berlin, Sep 2002. Springer-Verlag.

Ron Kohavi, Brij Masand, Myra Spiliopoulou, and Jaideep Srivastava. Web mining. Data Mining and Knowledge Discovery, 6:5 – 8, 2002.

G. S. Maddala. Introduction to Econometrics. John Wiley, Chichester, 3 edition, 2001.

Andreas Mild and Martin Natter. Collaborative filtering or regression models for Internet recommendation systems? Journal of Targeting, Measurement and Analysis for Marketing, 10(4):304 – 313, Jan 2002.

Andreas Mild and Thomas Reutterer. An improved collaborative filtering approach for predicting cross-category purchases based on binary market basket data. Journal of Retailing & Consumer Services, 10(3):123–133, may 2003.

Paul Resnick and Hal R. Varian. Recommender Systems. Communications of the ACM, 40(3):56 – 58, Mar 1997.

Badrul M. Sarwar, Joseph A. Konstan, Al Borchers, Jon Herlocker, Brad Miller, and John Riedl. Using filtering agents to improve prediction quality in the grouplens research collaborative filtering system. In Proceedings of ACM Conference on Computer-Supported Cooperative Work, Social Filtering, Social Influences, pages 345 – 354, New York, 1998. ACM Press.

J. Ben Schafer, Joseph Konstan, and Jon Riedl. Recommender Systems in E-commerce. In Proceedings of the 1st ACM conference on Electronic commerce, pages 158 – 166, Denver, Colorado, USA, Nov 1999. ACM.

Upendra Shardanand and Patti Maes. Social information filtering: Algorithms for automating "word of mouth". In Proceedings of ACM SIGCHI, volume 1 of Papers: Using the Information of Others, pages 210 – 217. ACM, 1995.

T 6.327 Module component: Regulation Theory and Practice [T-WIWI-102712]

Coordinators: Prof. Dr. Kay Mitusch
Organisation: KIT Department of Economics and Management
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 6.328 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	Reinforcement Learning		Lecture / Practice (/	Neumann, Lioutikov, Zhou
Exams					
ST 2025	7500221	Reinforcement Learning			Neumann
WT 25/26	7500293	Reinforcement Learning			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** — **Lecture / Practice (VÜ) On-Site**
2400163, WS 25/26, SWS, Language: English, Open in study portal

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 6.329 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	Each winter term	1

Exams			
ST 2025	7500027	Reliable Computing I	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 6.330 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 2025	2400184	Research Focus Class: Blockchain & Cryptocurrencies Seminar	2 SWS	Seminar / 🗣	Hartenstein, Droll, Spiesberger
ST 2025	2400185	Research Focus Class: Blockchain & Cryptocurrencies	1 SWS	Lecture / 🗣	Hartenstein, Droll, Spiesberger
Exams					
ST 2025	7500341	Research Focus Class: Blockchain & Cryptocurrencies			Hartenstein

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** — **Lecture (V) On-Site**
2400185, SS 2025, 1 SWS, Language: English, Open in study portal

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 6.331 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 2025	2400184	Research Focus Class: Blockchain & Cryptocurrencies Seminar	2 SWS	Seminar / 🗣	Hartenstein, Droll, Spiesberger
ST 2025	2400185	Research Focus Class: Blockchain & Cryptocurrencies	1 SWS	Lecture / 🗣	Hartenstein, Droll, Spiesberger
Exams					
ST 2025	7500331	Research Focus Class: Blockchain & Cryptocurrencies - Seminar			Hartenstein

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** — **Lecture (V) On-Site**
2400185, SS 2025, 1 SWS, Language: English, Open in study portal

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 6.332 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	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Each winter term	1

Courses					
WT 25/26	2400142	Forschungspraktikum: Explainable Artificial Intelligence	4 SWS	Practical course / 🗣	Lioutikov, Li, Mattes

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 6.333 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 2025	2400139	ResearchPractical Course: Interactive Learning	4 SWS	Practical course / 🗣	Lioutikov
Exams					
ST 2025	7500266	Research Practical Course: Interactive Learning			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 6.334 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					
ST 2025	2400047	Research Project (Project, first semester)	6.5 SWS	/	Beckert, Kirsten
WT 25/26	2400068	Research Project (Project, first semester)	6.5 SWS	/	Beckert, Kirsten, Ulbrich
Exams					
ST 2025	7500114	Research Project (Project, 1st Semester) - Oral Exam			Beckert, Beigl, Reussner
WT 25/26	7500079	Research Project (Project, 1st Semester) - Oral Exam			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)

2400047, SS 2025, 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.

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.

T 6.335 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	Credits	Grading	Term offered	Version
Examination of another type	3 CP	graded	Each term	1

Courses					
ST 2025	2400047	Research Project (Project, first semester)	6.5 SWS	/	Beckert, Kirsten
WT 25/26	2400068	Research Project (Project, first semester)	6.5 SWS	/	Beckert, Kirsten, Ulbrich
Exams					
ST 2025	7500130	Research Project (Project, 1st Semester) - Presentation			Beckert, Beigl, Reussner
WT 25/26	7500080	Research Project (Project, 1st Semester) - Presentation			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)

2400047, SS 2025, 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.

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.

T 6.336 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	Credits	Grading	Term offered	Version
Examination of another type	4 CP	graded	Each term	1

Courses					
ST 2025	2400047	Research Project (Project, first semester)	6.5 SWS	/	Beckert, Kirsten
WT 25/26	2400068	Research Project (Project, first semester)	6.5 SWS	/	Beckert, Kirsten, Ulbrich
Exams					
ST 2025	7500131	Research Project (Project, 1st Semester) - Project Proposal			Beckert, Beigl, Reussner
WT 25/26	7500081	Research Project (Project, 1st Semester) - Written Exam			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)**
2400047, SS 2025, 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.

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.

T 6.337 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	Credits	Grading	Term offered	Version
Oral examination	3 CP	graded	Each term	2

Courses					
ST 2025	2400053	Research Project (Project, second semester)	6.5 SWS	/	Beckert, Kirsten
WT 25/26	2400070	Research Project (Project, second semester)	6.5 SWS	/	Beckert, Kirsten, Ulbrich
Exams					
ST 2025	7500126	Research Project (Project, 2nd Semester) - Oral Exam			Beckert, Beigl, Reussner
WT 25/26	7500171	Research Project (Project, 2nd Semester) - Oral Exam			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)

2400053, SS 2025, 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.

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.

T 6.338 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					
ST 2025	2400053	Research Project (Project, second semester)	6.5 SWS	/	Beckert, Kirsten
WT 25/26	2400070	Research Project (Project, second semester)	6.5 SWS	/	Beckert, Kirsten, Ulbrich
Exams					
ST 2025	7500132	Research Project (Project, 2nd Semester) - Presentation			Beckert, Beigl, Reussner
WT 25/26	7500077	Research Project (Project, 2nd Semester) - Presentation			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)

2400053, SS 2025, 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.

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.

T 6.339 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	Credits	Grading	Term offered	Version
Examination of another type	4 CP	graded	Each term	1

Courses					
ST 2025	2400053	Research Project (Project, second semester)	6.5 SWS	/	Beckert, Kirsten
WT 25/26	2400070	Research Project (Project, second semester)	6.5 SWS	/	Beckert, Kirsten, Ulbrich
Exams					
ST 2025	7500133	Research Project (Project, 2nd Semester) - Scientific Report			Beckert, Beigl, Reussner
WT 25/26	7500078	Research Project (Project, 2nd Semester) - Written Exam			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)

2400053, SS 2025, 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.

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.

T 6.340 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 2025	2400112	Research Laboratory Autonomous Learning Robots	4 SWS	Practical course / 🗣	Neumann
Exams					
ST 2025	7500274	Research Project Autonomous Learning Robots			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 2025, 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.

Arbeitsaufwand180h

T 6.341 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	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Each winter term	1

Courses					
WT 25/26	2400091	Deep Learning for Robotics	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).

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

Practical course (P)
On-Site

2400091, WS 25/26, 4 SWS, Language: English, Open in study portal

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 6.342 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	graded	Each summer term	1

Courses					
ST 2025	2400049	Research Project: Generative AI for Autonomous Agents	4 SWS	Practical course / 🗣	Neumann
Exams					
ST 2025	7500326	Research Project: Generative AI for Autonomous Agents			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 2025, 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 6.343 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	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Each winter term	1

Courses					
WT 25/26	2400240	Machine Learning for Autonomous Agents and Decision Making	4 SWS	Practical course	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 6.344 Module component: Responsible Artificial Intelligence [T-WIWI-111385]

Coordinators: Dr. Rainer Hoffmann
Prof. Dr. Jella Pfeiffer

Organisation: KIT Department of Economics and Management

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	Responsible Artificial Intelligence	3 SWS	Lecture / Practice (/ 🗣	Hoffmann, Gutschow, Bennardo
Exams					
WT 25/26	7900031	Responsible Artificial Intelligence (Hauptklausur)			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:

V

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 6.345 Module component: RIG 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 - RIG Lecture Series

Type	Credits	Grading	Expansion	Version
Oral examination	3 CP	graded	1 semesters	1

Courses					
WT 25/26	2400246	RIG Lecture Series	2 SWS	Lecture /	Bruno, Niehues, 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.

T 6.346 Module component: Risk Management in Industrial Supply Networks [T-WIWI-102826]

Coordinators: Prof. Dr. Frank Schultmann
Organisation: KIT Department of Economics and Management
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	Risk Management in Industrial Supply Networks	2 SWS	Lecture / 🗣	Schultmann, Rosenberg
Exams					
ST 2025	7981992	Risk Management in Industrial Supply Networks			Schultmann
WT 25/26	7981992	Risk Management in Industrial Supply Networks			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 6.347 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	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each winter term	1

Courses					
WT 25/26	2424152	Robotics I - Introduction to Robotics	4 SWS	Lecture / 🗣	Asfour, Mombaur
Exams					
ST 2025	7500218	Robotics I - Introduction to Robotics			Asfour
WT 25/26	7500106	Robotics I - Introduction to Robotics			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 6.348 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	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each summer term	1

Courses					
ST 2025	2400074	Robotics II: Humanoid Robotics	2 SWS	Lecture / 🗣	Asfour
Exams					
ST 2025	7500086	Robotics II: Humanoid Robotics			Asfour
WT 25/26	7500211	Robotics II: Humanoid Robotics			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 RoboticsPartial work must not have been started.

Recommendations
Having visited the lectures on Robotics I - Introduction to Robotics and Mechano-Informatics and Robotics is recommended.

Below you will find excerpts from courses related to this module component:

V Robotics II: Humanoid Robotics

2400074, SS 2025, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
The lecture presents current work in the field of humanoid robotics, which deals with the implementation of complex sensorimotor and cognitive abilities. Various methods and algorithm, their advantages and disadvantages, as well as the current state of research are discussed.

The following topics are covered: Applications and real world examples of humanoid robots; biomechanical models of the human body, biologically inspired and data-driven methods of grasping, imitation learning and programming by demonstration; semantic representations of sensorimotor experience as well as cognitive software architectures of humanoid robots

Learning Objectives:

The students have an overview of current research topics in the field of cognitive and learning robotics using the example of humanoid robotics and are able to categorize and assess current developments in the field of cognitive humanoid robotics.

Students are familiar with the main problem areas of cognitive humanoid robotics and are able to develop solutions on the basis of existing research work.

Organizational issues
The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) of, in general, 60 minutes.

Workload: 90 h

Recommendations: *Having visited the lectures on Robotics I – Introduction to Robotics and Mechano-Informatics and Robotics is recommended.*

Intended audience: **Module for Mechanical Engineering Master, Mechatronics and Information Technology Master, Electrical Engineering and Information Technology Master**

Literature
Additional literature

Scientific publications on the topic are made available on the lecture website.

T 6.349 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	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each summer term	1

Courses					
ST 2025	2400067	Robotics III - Sensors and Perception in Robotics	2 SWS	Lecture / 🗣	Asfour, Triebel
Exams					
ST 2025	7500242	Robotics III - Sensors and Perception in Robotics			Asfour
WT 25/26	7500207	Robotics III - Sensors and Perception in Robotics			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
Attending the lecture 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 2025, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
The lecture complements the lecture Robotics I and provides a broad overview of sensors and perception methods used in robotics. The focus is on visual perception, semantic scene interpretation, simultaneous localization and mapping (SLAM) as well as haptic exploration and active perception. The lecture is divided into two parts:

In the first part a comprehensive overview of current sensor technologies is given. A fundamental distinction is made between sensors for the perception of the environment (exteroceptive) and sensors for the perception of the internal state (proprioceptive). The second part of the lecture focuses on the use of exteroceptive sensors in robotics. The topics include tactile exploration and visual data processing, including the basics of feature extraction, segmentation, semantic scene interpretation, simultaneous localization and mapping (SLAM) as well as haptic exploration and active perception.

Learning Obejctives:

Students can name the main sensor principles used in robotics. They can explain the data flow from physical measurement through digitization to the use of the measured sensor data for feature extraction, state estimation and semantic scene understanding.

Students are able to propose and justify suitable sensor concepts for robotic tasks.

Organizational issues
The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) of, in general, 60 minutes.

Module for Mechanical Engineering Master, Mechatronics and Information Technology Master, Electrical Engineering and Information Technology Master, Mechatronics and Information Technology Bachelor

Recommendations: **Having visited the lectures on Robotics I – Introduction to Robotics is recommended.**

Workload: 90 h

Literature
Lecture slides will be provided during the course.

Accompanying literature references regarding the individual topics of the lecture will be provided.

T 6.350 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	Safe Human-Robot-Collaboration	2 SWS	Block / 🗣	Kurth

Legend: 📱 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

T 6.351 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	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Each summer term	1

Courses					
ST 2025	2400194	Sampling Methods for Machine Learning	3 SWS	Lecture / 🗣	Hanebeck, Frisch
Exams					
ST 2025	7500391	Sampling Methods for Machine Learning			Hanebeck
WT 25/26	7500533	Sampling Methods for Machine Learning			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 2025, 3 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

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.

Appointsments for oral exams: pruefung-isas@iar.kit.edu

T 6.352 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	Version
Coursework	0 CP	pass/fail	1

Courses					
ST 2025	2400194	Sampling Methods for Machine Learning	3 SWS	Lecture / 🗣	Hanebeck, Frisch
Exams					
ST 2025	7500392	Sampling Methods for Machine Learning - Pass			Hanebeck
WT 25/26	7500534	Sampling Methods for Machine Learning - Pass			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 2025, 3 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

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.

Appointsments for oral exams: pruefung-isas@iar.kit.edu

T 6.353 Module component: Science Communication in the Innovation Process [T-WIWI-114748]

Coordinators: Dr. Mara Schwind
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101507 - Innovation Management

Type	Credits	Grading	Term offered	Version
Examination of another type	3 CP	graded	Irregular	1

Courses					
WT 25/26	2500055	Science communication in the innovation process	2 SWS	Seminar / 🗣	Schwind, Weissenberger-Eibl, Schwind
Exams					
WT 25/26	7900106	Science Communication in the Innovation Process			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 6.354 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

Exams			
ST 2025	7500081	Scientific Methods to Design and Analyze Secure Decentralized Systems	Hartenstein

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 6.355 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	Credits	Grading	Expansion	Version
Oral examination	3 CP	graded	1 semesters	1

Courses					
WT 25/26	2400164	Selected aspects in Real-Time Systems	2 SWS	Lecture / 🗣	Längle

Legend: 💻 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

T 6.356 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	graded	Each summer term	1

Courses					
ST 2025	24821	Selected legal issues of Internet law	2 SWS	Colloquium (K / 🗣)	Sattler
Exams					
ST 2025	7500099	Selected Legal Issues of Internet Law			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 6.357 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 Economics and Management
Part of: M-WIWI-101637 - Analytics and Statistics

Type	Credits	Grading	Term offered	Version
Examination of another type	4,5 CP	graded	Irregular	1

Courses					
WT 25/26	2500005	Selected Topics in Statistics and Analytics: Seminal Papers in Theory and Methods	3 SWS	Lecture / Practice (/ 🗣	Grothe
Exams					
WT 25/26	7900044	Selected Topics in Statistics and Analytics: Seminal Papers in Theory and Methods			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

Lecture / Practice (VÜ)
On-Site

2500005, WS 25/26, 3 SWS, Language: German/English, Open in study portal

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 6.358 Module component: Semantic Web Technologies [T-WIWI-110848]

Coordinators: Dr.-Ing. Tobias Käfer
Organisation: KIT Department of Economics and Management
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	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each summer term	1

Courses					
ST 2025	2511310	Semantic Web Technologies	2 SWS	Lecture / 🗣	Käfer, Braun, Kinder, Kubelka
ST 2025	2511311	Exercises to Semantic Web Technologies	1 SWS	Practice / 🗣	Käfer, Braun, Kinder
Exams					
ST 2025	79AIFB_SWebT_A4	Semantic Web Technologies (Registration extended until 28.07.2025)			Käfer
WT 25/26	79AIFB_SWebT_A2	Semantic Web Technologies			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
Lectures on Informatics of the Bachelor on Information Systems (Semester 1-4) or equivalent are required.

Below you will find excerpts from courses related to this module component:

V Semantic Web Technologies

2511310, SS 2025, 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 preperation and postprocessing: 60 hours
- Exam and exam preperation: 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.

V **Exercises to Semantic Web Technologies** **Practice (Ü)**
2511311, SS 2025, 1 SWS, Language: English, Open in study portal **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.

Organizational issues
Die Übungen finden im Rahmen der Termine der Blockvorlesung statt.

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 6.359 Module component: Seminar in Business Administration A (Master) [T-WIWI-103474]

Coordinators: Professorenschaft des Fachbereichs Betriebswirtschaftslehre
Organisation: KIT Department of Economics and Management
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					
ST 2025	00063	Seminar Social Sentiment in Times of Crises	2 SWS	Seminar	Fegert
ST 2025	2500018	Successful transformation through innovation	2 SWS	Seminar / 🗣	Busch
ST 2025	2500020	Digital Democracy - Challenges and opportunities of the digital society	2 SWS	Seminar / 🧩	Fegert
ST 2025	2500024	Biosignals in Information Systems & Marketing	2 SWS	Seminar / 🧩	Knierim, del Puppo
ST 2025	2500056	ABBA Summer School Seminar: Biosignal-Adaptive GenAI Systems	2 SWS	Seminar / 🧩	Mädche
ST 2025	2500125	Human-Centered Systems Seminar: Engineering	3 SWS	Seminar / 🧩	Mädche
ST 2025	2530580	Seminar in Finance (Master)	2 SWS	Seminar / 🗣	Uhrig-Homburg, Müller, Thimme, Walter
ST 2025	2540469	Master Seminar: Trustworthy AI	2 SWS	Seminar / 🗣	Gutschow, Heßler
ST 2025	2540473	Business Data Analytics	2 SWS	Seminar	Hariharan
ST 2025	2540475	Positive Information Systems	2 SWS	Seminar	Knierim
ST 2025	2540478	Smart Grid Economics & Energy Markets	2 SWS	Seminar	Weinhardt
ST 2025	2540493	Data Science for Industrial Applications	2 SWS	Seminar / 🗣	Spitzer, Holstein, Hendriks
ST 2025	2540510	Master Seminar in Data Science and Machine Learning	2 SWS	Seminar	Geyer-Schulz
ST 2025	2540553	User-Adaptive Systems Seminar	2 SWS	Seminar / 🧩	Mädche, Beigl
ST 2025	2540557	Human-Centered Systems Seminar: Research	3 SWS	Seminar / 🧩	Mädche
ST 2025	2545002	Entrepreneurship Research	2 SWS	Seminar / 🗣	Malik
ST 2025	2550493	Hospital Management	2 SWS	Block / 🖥	Hansis
ST 2025	2571180	Seminar in Marketing and Sales (Master)	2 SWS	Seminar / 🗣	Klarmann, Mitarbeiter
ST 2025	2571182	Seminar “The Future of Marketing” (Master)	2 SWS	Seminar / 🗣	Kupfer
ST 2025	2573012	Seminar Human Resource Management (Master)	2 SWS	Seminar / 🗣	Nieken, Mitarbeiter, Gorny
ST 2025	2573013	Seminar Human Resources and Organizations (Master)	2 SWS	Seminar / 🗣	Nieken, Mitarbeiter, Walther
ST 2025	2579919	Seminar Management Accounting - Sustainability Topics	2 SWS	Seminar / 🗣	Letmathe
ST 2025	2581030	Seminar Energiewirtschaft IV	2 SWS	Seminar / 🗣	Fichtner, Sloot
ST 2025	2581031	Seminar Energiewirtschaft V	2 SWS	Seminar / 🗣	Plötz
ST 2025	2581032	Seminar Energiewirtschaft VI	2 SWS	Seminar / 🗣	Slednev, Fichtner
ST 2025	2581976	Seminar Produktionswirtschaft und Logistik I	2 SWS	Seminar / 🗣	Schultmann, Rudi

ST 2025	2581977	Seminar Produktionswirtschaft und Logistik II	2 SWS	Seminar / 🗣	Schultmann
ST 2025	2581979	Seminar Energiewirtschaft I	2 SWS	Seminar / 🗣	Fichtner, Kleinebrahm
ST 2025	2581981	Seminar Energiewirtschaft III	2 SWS	Seminar / 🗣	Ardone, Fichtner
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	2500067	Seminar in Electrogastrogram and Economic Decision Making	2 SWS	Seminar / 🗣	Dharmapalan
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)	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
Exams					
ST 2025	00064	Seminar Social Sentiment in Times of Crises			Weinhardt
ST 2025	7900008	Hospital Management			Hansis
ST 2025	7900019	Master Seminar in Data Science and Machine Learning			Geyer-Schulz
ST 2025	7900025	Successful Transformation Through Innovation			Busch

ST 2025	7900050	Language Models for Structured Literature Reviews	Satzger
ST 2025	7900052	Entrepreneurship Research	Terzidis
ST 2025	7900093	Seminar Smart Grid and Energy Markets	Weinhardt
ST 2025	7900101	Seminar Human Resource Management (Master)	Nieken
ST 2025	7900127	Seminar in Finance (Master)	Uhrig-Homburg
ST 2025	7900190	Human-Centered Systems Seminar: Engineering	Mädche
ST 2025	7900214	Seminar Business Data Analytics	Weinhardt
ST 2025	7900231	Seminar Human Resources and Organizations (Master)	Nieken
ST 2025	7900233	Seminar in Marketing and Sales (Master)	Klarmann
ST 2025	7900240	Seminar "The Future of Marketing" (Master)	Kupfer
ST 2025	7900256	Seminar Positive Information Systems	Weinhardt
ST 2025	7900261	Human-Centered Systems Seminar: Research	Mädche
ST 2025	7900265	User-Adaptive Systems Seminar	Mädche
ST 2025	7900318	Practical Seminar: Data Science for Industrial Applications	Satzger
ST 2025	7900319	Service Design Thinking	Satzger
ST 2025	7900320	Practical Seminar Service Innovation	Satzger
ST 2025	7900326	Seminar Energy Economics VI	Fichtner
ST 2025	7900364	Market Design (MA)	Puppe
ST 2025	7900370	ABBA Summer School Seminar: Biosignal-Adaptive GenAI Systems	Mädche
ST 2025	7900388	Seminar in Business Administration A (Master) - Exploration of Multi Agent System Concepts	Satzger
ST 2025	7900389	Seminar in Business Administration A (Master) - Strategical State of the Art Research on LLM-based Multi-Agent Systems: How Do They Interact and Reason?	Satzger
ST 2025	79-2579919-M	Seminar Management Accounting - Sustainability Topics (Master)	Wouters
ST 2025	792581030	Seminar Energy Economics IV	Fichtner
ST 2025	792581031	Seminar Energy Economics V	Plötz
ST 2025	7940469	Master Seminar: Trustworthy AI [SS252540469]	Pfeiffer
ST 2025	7981976	Seminar in Production and Operations Management I	Schultmann
ST 2025	7981977	Seminar in Production and Operations Management II	Schultmann
ST 2025	7981979	Seminar Energy Economics I	Fichtner
ST 2025	7981981	Seminar Energy Economics III	Fichtner
WT 25/26	7900106	Science Communication in the Innovation Process	Schwind
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	7900237	Case Studies Seminar: Innovation Management	Weissenberger-Eibl
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	7940469	Master Seminar: Information Systems / Wirtschaftsinformatik 3	Pfeiffer
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

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:

V **Successful transformation through innovation** — **Seminar (S) On-Site**
2500018, SS 2025, 2 SWS, Language: German, Open in study portal

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

V **ABBA Summer School Seminar: Biosignal-Adaptive GenAI Systems** — **Seminar (S) Blended (On-Site/Online)**
2500056, SS 2025, 2 SWS, Language: English, Open in study portal

Content

Background: In the ABBA Summer School Seminar hosted at the Karlsruhe Decision & Design Lab (KD²Lab) at KIT, we aim to enable students to explore biosignal sensors for designing user-adaptive systems, focusing on gaze-adaptive systems. This comprehensive block seminar is intended for both bachelor's and master's students who want to gain an understanding of biosignal and the development of user-adaptive systems. The learning objective is to design human-centered biosignal-adaptive systems to address user needs in learning scenarios.

Course Content: Throughout the summer school, students will learn the foundations of biosignal-adaptive systems through an introductory lecture and apply the knowledge in practical group work. For the group work, we offer students the concept of designing a gaze-adaptive tutor for immersive learning. Aiming to address user challenges in this context, we provide eye-tracking data and an existing gaze-adaptive VR learning application in the kick-off event. The students will have one week to work in groups to understand the task and existing resources, before returning one week later to attend the three-day group work sessions. During the three-day seminar, we encourage students to integrate GenAI technologies for their design and implementation. In the end, students should present their results to showcase the functionality, innovation, and prototype of their gaze-adaptive tutoring systems.

Learning Outcome: By successfully achieving the learning objective, students will receive a certificate from KIT and will have the opportunity to apply their acquired skills and knowledge for further research.

Organization: The seminar will be held **with a one-day kick-off event (with an introduction lecture, 16th July) and one week later a three-day block-seminar format (21st - 23rd July)** at KD²Lab (Etage 1, Fritz-Erler-Straße 1-3, 76131 Karlsruhe) with 3 ECTS. For any questions, please ask Luke Shi Liu (shi.liu@kit.edu) for more information!

V **Human-Centered Systems Seminar: Engineering**
2500125, SS 2025, 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.

V **Master Seminar: Trustworthy AI**
2540469, SS 2025, 2 SWS, Language: English, Open in study portal
Seminar (S)
On-Site

Content

Artificial Intelligence is shaping critical areas of society, but ensuring fairness, transparency, and trust remains a challenge. Our master seminar, "Trustworthy AI," explores key issues such as bias detection, intersectional fairness, and explainability in AI systems. We address bias in AI-driven decision-making, particularly in critical areas like credit scoring, which is classified as a high-risk application context by the AI Act, and examine methods to enhance fairness. A crucial focus is on developing transparent AI models and understanding how explanations influence trust in automated systems. Additionally, we analyze large language models, their limitations, and innovative retrieval methods such as GraphRAG, which enhance knowledge representation in AI.

This seminar is offered by the newly established Information Systems III research group headed by Prof. Dr. Jella Pfeiffer at the Institute for Information Systems (WIN). To learn more about us, please visit our website (WIN - Information Systems III).

V **Data Science for Industrial Applications**
2540493, SS 2025, 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

V **Master Seminar in Data Science and Machine Learning** **Seminar (S)**
2540510, SS 2025, 2 SWS, Language: German/English, Open in study portal

V **User-Adaptive Systems Seminar** **Seminar (S)**
2540553, SS 2025, 2 SWS, Language: English, Open in study portal **Blended (On-Site/Online)**

Content
User-adaptive systems collect and analyze biosignals from users to recognize user states as a basis for adaptation. Thermic, mechanical, electric, acoustic, and optical signals are collected using sensors which are integrated in wearables, e.g. glasses, earphones, belts, or bracelets. The collected data is processed with analytics and machine learning techniques in order to determine short-term, evolving over time, and long-term user states in the form of user characteristics, affective-cognitive states, or behavior. Finally, the recognized user states are leveraged for realizing user-centric adaptations.

In this seminar, interdisciplinary teams of students design, develop, and evaluate a user-adaptive system prototype leveraging state-of-the-art hard- and software. This seminar follows an interdisciplinary approach. Students from the fields of computer science, information systems and industrial engineering & management collaborate in the prototype design, development, and evaluation.

The seminar is carried out in cooperation between Teco/Chair of Pervasive Computing Systems (Prof. Beigl) and the Institute of Information Systems and Marketing (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 user-adaptive system is and how it can be conceptualized
- Suggest and evaluate different design solutions for addressing the identified problem
- Build a user-adaptive system prototype using state-of-the-art hard- and software
- Perform a user-centric evaluation of the user-adaptive system prototype

Prerequisites

Strong analytical abilities and profound software development skills are required.

Organizational issues
Termine werden bekannt gegeben

Literature
Required literature will be made available in the seminar.

V **Human-Centered Systems Seminar: Research** — **Seminar (S)**
2540557, SS 2025, 3 SWS, Language: English, Open in study portal — **Blended (On-Site/Online)**

Content
Formerly known as "Information Systems and Service Design Seminar"

With this seminar, we aim to provide students with the possibility to independently work on state-of-the-art research topics in addition to the knowledge gained in the lectures of the research group IS I (Prof. Mädche). The research group "Information Systems I" (IS I) headed by Prof. Mädche focuses in research, education, and innovation on designing interactive intelligent systems. It is positioned at the intersection of Information Systems and Human-Computer Interaction (HCI).

In the seminar, participants will get deeper insights in a contemporary research topic in the field of information systems, specifically interactive intelligent systems.

The actual seminar topics will be derived from current research activities of the research group. Our research assistants offer a rich set of topics from our research clusters (digital experience and participation, intelligent enterprise systems, or digital services design & innovation). Students can select among these topics individually depending on their personal interests. The seminar is carried out in the form of a literature-based thesis project. In the seminar, students will acquire the important methodological skills of running a systematic literature review.

Learning Objectives

- focus on a contemporary topic at the intersection of Information Systems and Human-Computer Interaction (HCI), specifically interactive intelligent systems
- carry out a structured literature search for a given topic
- aggregate the collected information in a suitable way to present and extract knowledge
- write a seminar thesis following academic writing standards
- deliver a presentation in a scientific context in front of an auditorium

Prerequisites

No specific prerequisites are required for the seminar.

Literature

Further literature will be made available in the seminar.

Organizational issues
Termine werden bekannt gegeben

V **Entrepreneurship Research** **Seminar (S)**
2545002, SS 2025, 2 SWS, Language: English, Open in study portal **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
Thursday, 08.05.2025, 10.00-16.00
Thursday, 05.06.2025, 10.00-16.00
Thursday, 10.07.2025, 09.00-12.00

Registration is via the Wiwi-Portal.

Literature
Will be announced in the seminar.

Hospital Management

V

2550493, SS 2025, 2 SWS, Language: German, Open in study portal

Block (B)
Online

Content
The "Hospital Management" seminar is intended to help students in higher semesters to simulate some of the organizational and management tasks that arise in a medium-sized service company using a specific example (here: management of a medium-sized hospital). The seminar thus represents a kind of "bracket" for a large number of individual skills that the students have acquired during their studies. The seminar takes place as a webinar.

Students will be asked about the typical interaction of a medium-sized hospital with its environment in 5 thematic blocks: Interaction with the customer (patients) / Interaction with employees* / Interaction with business partners / Interaction with stakeholders / Summarizing opportunities and risks.

Organizational issues
Das Seminar wird als Blockveranstaltung stattfinden. Die Termine werden bei der Bewerbung über das Wiwi-Portal bekanntgegeben.

Seminar Human Resource Management (Master)

V

2573012, SS 2025, 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)

V

2573013, SS 2025, 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

V **Seminar Management Accounting - Sustainability Topics** **Seminar (S) On-Site**
2579919, SS 2025, 2 SWS, Language: English, Open in study portal

Content
The course will be a mix of lectures, discussions, and student presentations. Students will write a paper in small groups, and present this in the final week. Topics are selectively prediscibed. The seminar course is concentrated in several meetings that are spread throughout the semester.

Learning objectives:

- Students are largely independently able to identify a distinct topic in Management Accounting,
- Students are capable to research the topic, analyze the information, to conceptualize and deduct fundamental principles and relationships from relatively unstructured information,
- Students can afterwards logically and systematically present the results in writing and as an oral presentation, following a scientific approach (structuring, terminology, sources.

Workload:

- The total workload for this course is approximately 90 hours. For further information see German version.

Examination:

- The performance review is carried out in the form of a “Prüfungsleistung anderer Art” (following § 4 (2) No. 3 of the examination regulation), which in this case is an essay the seminar participants prepare in group work.
- The final grade 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.

Note:

- Maximum of 8 students.

Organizational issues
Geb.05.20, 2A-12.1; Termine werden bekannt gegeben

Literature
Will be announced in the course.

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.

V

Seminar in Electrogastrogram and Economic Decision Making

2500067, WS 25/26, 2 SWS, Language: English, Open in study portal

Seminar (S)
On-Site

Content

The gut is often referred to as the "second brain" due to its substantial influence on cognition, emotion regulation, and mental health. This concept is grounded in the gut-brain axis (GBA), the bidirectional communication network between the central nervous system (CNS) and the enteric nervous system (ENS). These systems interact through the autonomic nervous system (ANS), and the hypothalamic-pituitary-adrenal (HPA) axis, along with a complex network of neuroimmune and neuroendocrine mediators (The Gut-Brain Axis: Influence of Microbiota on Mood and Mental Health, 2018).

While much of the existing literature emphasizes the role of gut microbiota, which provides retrospective insight into gut function and mental health, real-time physiological measures of gut activity remain relatively underexplored. In this context, electrogastrography (EGG) — a non-invasive method for recording gastric myoelectric activity — offers a novel tool to investigate the dynamic interplay between gut physiology and mental states, including economic decision-making.

The use of EGG in cognitive neuroscience and behavioral science is still emerging, providing space for critical inquiry and methodological development. This seminar is designed to explore the landscape of EGG research from technical, theoretical, and applied perspectives.

Seminar Structure

The seminar is organized around five core thematic areas. Each student will choose one topic and develop a focused literature review that generates both technical knowledge and real-world application.

Topics

1. Gut-Brain Axis and the Basics of EGG

Goal: Introduce the physiological, theoretical, and conceptual background for why we want to measure gut signals.

This topic offers a deep dive into the anatomy and physiology of the gut-brain axis — including the enteric and autonomic nervous systems, interoceptive processing, and affective-body theories such as the somatic marker hypothesis, embodied emotion, and homeostasis. Students will also learn the basics of gastric myoelectric activity (slow waves, frequency bands) and what exactly EGG measures, in contrast to pressure sensors, motility tracking, or microbiota analysis.

Key Readings:

Mayer et al. (2015) – Gut-brain axis
Herbert & Pollatos (2012) – Interoception
Damasio (1996) – Somatic marker hypothesis
Koch & Stern (2004) – Basics of EGG

2. EGG Sensors, Signal Acquisition, and Processing

Goal: Understand the technical underpinnings of how EGG data is captured and analyzed.

This topic covers the sensor and hardware ecosystem for EGG, including types of electrodes, placements, and configurations. It explores wearable vs. lab-based systems, amplifier design, signal acquisition standards, and detailed signal processing techniques (e.g., filtering, artifact rejection, power analysis, and normogastria). The emphasis is on methodological rigor and the challenges of working with noisy physiological data.

Key Readings:

Gopu et al. (2010) – Signal processing in EGG
Stern et al. (2007)

3. EGG in Behavioral, Affective, and Clinical Research

Goal: Explore how EGG is used in real-world studies across behavioral and medical domains.

This topic focuses on empirical applications of EGG in behavioral science, affective research, and clinical diagnostics. Topics include EGG studies on emotion regulation, interoception, and cognitive tasks, as well as clinical research in IBS, gastroparesis (Hasler et al., 2004), nausea, and psychiatry. Students will critically assess limitations in sample sizes, interpretability, and translational potential.

Key Readings:

Vianna & Tranel (2006)
Wolpert et al. (2020)

4. EGG in Multimodal Biosignal Contexts and Future Directions

Goal: Position EGG among other biosignals and critically reflect on the field's limitations and future.

This module explores how EGG signal acquisition and processing compares to other biosignals such as ECG (heart rate variability), EDA (skin conductance), EEG (brain activity), and respiration in behavioural studies. Students will examine challenges of multimodal integration, signal synchrony, and interpretation. The topics include the use of wearables, AI-based classification, biofeedback, and the potential of open physiological datasets.

Key Readings:

Critchley et al. (2004)
Kim et al. (2021)
Wearable gut sensor papers - Vujic et al. (2020)

5. Multimodal Biosignals, Decision-Making, and Future Directions
Goal: Understand how EGG could capture aspects of decision-making in various contexts.

This topic explores the behavioral and cognitive implications of gut signals in decision-making tasks. Students will investigate studies linking gastric activity to risk-taking, delay discounting, and intuition, and how EGG data may reflect the visceral foundations of judgment. It also touches on EGG's potential in affective computing, real-time monitoring, and neuroeconomic models.

Key Readings:

Dunn et al. (2010)

Learning Outcomes
Throughout the course, students will sharpen key academic skills, including literature review and synthesis, critical analysis of research methods and findings, scientific writing, and clear communication of complex concepts. These skills will be developed through an in-depth exploration of electrogastrography (EGG), with a focus on its physiological and technological foundations, its relationship to gut-brain interactions, and its role in research on emotion, cognition, and decision-making. The course encourages students to engage critically with how EGG has been used so far, how it compares to other biosignals like ECG, EDA, and EEG, and how it might be applied in behavioural science and affective research. By the end of the seminar, students will contribute to a shared understanding of the field's current state, and reflect on future directions, challenges, and possibilities for applying EGG in both basic and applied research contexts.

Organizational issues
Application for this Seminar takes place exclusively via the WiWi portal during the specified timeframe. Please refrain from requests until the end of the application pahse.

There will be a kick-off and a final presentation.

Central criteria for evaluating your performance are the identification of relevant scientific sources, a systematization of literature, the highlighting of central findings, a clear, concise and intelligible presentation of results, and the identification of interesting research gaps.

- Di 4.11.2025, 15:45-17:15 -- Kick-off
- Di 10.02.2026, 9:00-12:15 – Abschlusspräsentationen
  Seminarraum Geb. 01.87 5B 25-26

V

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

V

Master Seminar (Information Systems III)

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).

V **Business Data Analytics** — **Seminar (S) On-Site**
2540473, WS 25/26, 2 SWS, Language: German/English, Open in study portal

Content
wird auf deutsch und englisch gehalten

Organizational issues
Blockveranstaltung, siehe WWW

V **Master Seminar in Data Science and Machine Learning** — **Seminar (S) Blended (On-Site/Online)**
2540510, WS 25/26, 2 SWS, Language: German, Open in study portal

V **Case studies seminar: Innovation management** — **Seminar (S) On-Site**
2545105, WS 25/26, 2 SWS, Language: German, Open in study portal

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.

V **Seminar Human Resource Management (Master)** — **Seminar (S) On-Site**
2573012, WS 25/26, 2 SWS, Language: German, Open in study portal

Content
The topics are redefined each semester on basis of current research topics. The topics will be announced on the website of the Wiwi-Portal.

Aim

The student

- looks critically into current research topics in the fields of Human Resource Management and Personnel Economics.
- trains his / her presentation skills.
- learns to get his / her ideas and insights across in a focused and concise way, both in oral and written form, and to sum up the crucial facts.
- cultivates the discussion of research approaches.

Workload

The total workload for this course is: approximately 90 hours.

Lecture: 30h
Preparation of lecture: 45h
Exam preparation: 15h

Literature

Selected journal articles and books.

Organizational issues
Blockveranstaltung siehe Homepage

V **Seminar Human Resources and Organizations (Master)** **Seminar (S) On-Site**
2573013, WS 25/26, 2 SWS, Language: German, Open in study portal

Content
The topics are redefined each semester on basis of current research topics. The topics will be announced on the website of the Wiwi-Portal.

Aim

The student

- looks critically into current research topics in the fields of human resources and organizations.
- trains his / her presentation skills.
- learns to get his / her ideas and insights across in a focused and concise way, both in oral and written form, and to sum up the crucial facts.
- cultivates the discussion of research approaches.

Workload

The total workload for this course is: approximately 90 hours.

Lecture: 30h
Preparation of lecture: 45h
Exam preparation: 15h

Literature

Selected journal articles and books.

Organizational issues
Blockveranstaltung siehe Homepage

V **Seminar Management Accounting - Sustainability Topics** **Seminar (S) On-Site**
2579919, WS 25/26, 2 SWS, Language: English, Open in study portal

Content
The course will be a mix of lectures, discussions, and student presentations. Students will write a paper in small groups, and present this in the final week. Topics are selectively prediscibed. The seminar course is concentrated in several meetings that are spread throughout the semester.

Learning objectives:

- Students are largely independently able to identify a distinct topic in Management Accounting,
- Students are capable to research the topic, analyze the information, to conceptualize and deduct fundamental principles and relationships from relatively unstructured information,
- Students can afterwards logically and systematically present the results in writing and as an oral presentation, following a scientific approach (structuring, terminology, sources.

Examination:

- The performance review is carried out in the form of a “Prüfungsleistung anderer Art” (following § 4 (2) No. 3 of the examination regulation), which in this case is an essay the seminar participants prepare in group work.
- The final grade 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.

T 6.360 Module component: Seminar in Economic Policy [T-WIWI-102789]

Coordinators: Prof. Dr. Ingrid Ott
Organisation: KIT Department of Economics and Management
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			
ST 2025	7900051	Seminar in Economic Policy	Ott
WT 25/26	7900212	Seminar in Economic Policy	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 6.361 Module component: Seminar in Economics A (Master) [T-WIWI-103478]

Coordinators: Professorenschaft des Fachbereichs Volkswirtschaftslehre
Organisation: KIT Department of Economics and Management
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					
ST 2025	2500040	Seminar zur Bahnökonomie und -politik	2 SWS	Seminar / 🗣	Krenn, Mitusch
ST 2025	2520367	Strategische Entscheidungen	2 SWS	Seminar / 🧩	Ehrhart
ST 2025	2520536	Seminar in Economic Theory II	2 SWS	Seminar / 🗣	Ammann, Kretz, Okulicz
ST 2025	2520563	Wirtschaftstheoretisches Seminar III	2 SWS	Seminar / 🗣	Ammann, Kretz, Okulicz
ST 2025	2521310	Advanced Topics in Econometrics	2 SWS	Seminar	Schienle, Koster, Buse, Rüter, Bracher
ST 2025	2560130	Seminar Public Finance	2 SWS	Block / 🧩	Wigger, Schmelzer
ST 2025	2560282	Seminar in economic policy	2 SWS	Seminar / 🗣	Ott, Assistenten
ST 2025	2560400	Seminar in Macroeconomics I	2 SWS	Seminar / 🧩	Brumm, Kissling, Frank
ST 2025	2560401	Seminar in Macroeconomics II	2 SWS	Seminar / 🧩	Brumm, Pegorari
ST 2025	2560552	Seminar Co-opetition: A Practical Perspective on Game Theory in the Digital Economy (Master)	2 SWS	Seminar / 🗣	Rosar
ST 2025	2560554	Seminar Lying and Cheating in Economic Decision Situations (Master)	2 SWS	Seminar / 🗣	Rau
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, Rüter
WT 25/26	2560130	Seminar Public Finance	2 SWS	Seminar / 🧩	Wigger, 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
Exams					

ST 2025	7900051	Seminar in Economic Policy	Ott
ST 2025	7900059	Co-opetition: A practical perspective to game theory in the game of business (Master)	Puppe
ST 2025	7900131	Lying and Cheating in Economic Decision Situations (Master)	Puppe
ST 2025	7900164	Seminar in Economics (Bachelor)	Mitusch
ST 2025	7900331	Seminar in Economics A (Master)	Brumm
ST 2025	7900357	Game Theory in Practice: How Do People Really Play? (Master)	Puppe
ST 2025	7900364	Market Design (MA)	Puppe
ST 2025	7900367	Seminar of railway economics and politics	Mitusch
ST 2025	7900386	Seminar in Economics A (Master)	Ehrhart
ST 2025	7900390	Seminar in Macroeconomics II: The Macroeconomics of Geopolitical Conflict	Brumm
ST 2025	79sefi2	Seminar Public Finance A (Master)	Wigger
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	7900140	Seminar in Digital Economics (Master)	Puppe
WT 25/26	7900212	Seminar in Economic Policy	Ott
WT 25/26	7900296	Seminar Game Theory and Behavioral Economics (Master)	Mill

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:

V **Advanced Topics in Econometrics** — **Seminar (S)**
2521310, SS 2025, 2 SWS, Language: German/English, Open in study portal

Organizational issues
Blockveranstaltung, Termine werden bekannt gegeben

V **Seminar Public Finance** — **Block (B)** **Blended (On-Site/Online)**
2560130, SS 2025, 2 SWS, Language: German, Open in study portal

Content
See German version.

Organizational issues
Termine werden bekannt gegeben.

Literature
Literatur wird zu Beginn des jeweiligen Seminars vorgestellt.

V

Seminar Co-opetition: A Practical Perspective on Game Theory in the Digital Economy (Master)

Seminar (S)
On-Site

2560552, SS 2025, 2 SWS, Language: English, Open in study portal

Content
Seminar Co-opetition: A Practical Perspective on Game Theory in the Digital Economy

This seminar offers an alternative perspective on game theory that is more applied, complementing the more mathematical approach taught in standard university courses (e.g., "Einführung in die Spieltheorie").

Traditional game theory focuses on abstract mathematical models. The insights from these models are useful in real-life situations, particularly in business contexts. However, strategic interactions in such contexts are often complex, and it is not always obvious what the 'right game' looks like. Moreover, effectively communicating game-theoretical principles to colleagues, subordinates, and stakeholders is just as important as the analysis itself.

In their 1996 book "Co-opetition", Nalebuff and Brandenburger address these issues by explaining game-theoretic principles using real-world business examples rather than mathematical models. The authors argue rigorously but 'hide' the underlying mathematical models. While many of the book's stories now seem outdated, the lessons remain valuable for anyone interested in applying game theory.

Seminar Objectives
In this seminar, students will either work alone or in small groups. Each group will be assigned one chapter of the book and will address three key tasks:

1. Presentation of Ideas: Each group will demonstrate their understanding of the assigned chapter by clearly communicating its key insights in their own words.
2. Application to Modern Contexts: Each group will transfer the chapter's ideas to examples from today's digital economy, such as platform markets, AI-driven business models, digital advertising strategies, and data-driven competition.
3. Linking to Game Theory: Each group will demonstrate their ability to engage with academic literature by identifying literature related to their book chapter and discussing these connections.

Seminar Organization
Introductory Meeting: The seminar will start with a kick-off meeting on April 24, 2024, at 14:00. In this meeting, students will be assigned to groups and chapters of the book and receive further guidance on expectations. The meeting will last approximately one hour.

Presentations: Each group will give a 30-minute presentation, followed by a discussion, in a blocked event on June 27. Attendance at all presentations is mandatory for successful completion of the seminar.

Seminar paper: Each group must submit a 12-page seminar paper by August 3. The seminar paper is a polished version of the presentation, incorporating useful feedback from the discussion on the seminar presentation day.

For further questions, don't hesitate to get in touch with Dr. Frank Rosar (rosar@kit.edu).

References
Nalebuff, Barry J., Brandenburger, A. (1996). Co-opetition. Currency.

Organizational issues
Registration via WiWi-Portal

Kick-off Meeting: 24.04.2025

Seminar Presentations: 27.06.2025

V

Seminar Lying and Cheating in Economic Decision Situations (Master)

Seminar (S)
On-Site

2560554, SS 2025, 2 SWS, Language: English, Open in study portal

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

Presentations: 02.07.2025,
10.00 - 12.30 Seminar Room in 01.85, 5th floor
13.00 - 18.00 KD2Lab Teamraum

Seminar Topics in Political Economy

V **Statistics and Epidemics** **Seminar (S)**
25000111, WS 25/26, 2 SWS, Language: English, Open in study portal **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.

V **Economics of Crime** — **Seminar (S) On-Site**
2500064, WS 25/26, 2 SWS, Open in study portal

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

V **Topics in Econometrics** — **Seminar (S)**
2521310, WS 25/26, 2 SWS, Language: German, Open in study portal

Organizational issues
Blockveranstaltung, Termine werden auf Homepage und über Ilias bekannt gegeben

V **Seminar in Digital Economics (Master)** — **Seminar (S) On-Site**
2560142, WS 25/26, 2 SWS, Language: English, Open in study portal

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.

Organizational issues
Application is possible via https://portal.wiwi.kit.edu/Seminare

Kick-off: 28.10.25, 16.30 - 18.00 h, 01.85, KD2 Lab (1. floor über Außentreppe), Team Room

Presentations: 12.01.2026, Bdg. 01.85, KD2Lab (1. floor über Außentreppe), Team Room

V **Seminar Game Theory and Behavioral Economics (Master)** — **Seminar (S) On-Site**
2560143, WS 25/26, 2 SWS, Language: English, Open in study portal

Content
For Master students of the fields Industrial Engineering and Management, Information Engineering and Management, Economics Engineering or Economathematics.

The student develops an own idea for an economic experiment in this research direction. Students work in groups. Changing topics each semester. For current topics, see 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)

T 6.362 Module component: Seminar in Informatics B (Master) [T-WIWI-103480]

Coordinators: Professorenschaft des Instituts AIFB
Organisation: KIT Department of Economics and Management
Part of: M-INFO-102822 - Seminar Module Informatics

Type	Credits	Grading	Term offered	Version
Examination of another type	3 CP	graded	Each term	1

Courses					
ST 2025	2512101	Seminar: From Physical Models to Digital Twins: A Data-Driven Simulation Workshop (Seminar/ Master)	2 SWS	Seminar / 🗣	Lazarova-Molnar, Khodadadi, Mostafa
ST 2025	2513103	Seminar: Applications of Digital Twins (Master)	2 SWS	Seminar / 🗣	Lazarova-Molnar, Lee
ST 2025	2513108	Seminar: New Trends in Artificial Intelligence Techniques for Noise Prediction (Master)	2 SWS	Seminar / 🗣	Demetgül, Lazarova-Molnar
ST 2025	2513109	Seminar: Agent-based Modeling and Simulation (Master)	2 SWS	Seminar	Lazarova-Molnar, Ghasemi
ST 2025	2513211	Seminar Business Information Systems (Master)	2 SWS	Seminar / 🗣	Oberweis, Forell, Frister, Fritsch, Rybinski, Schreiber, Schüler, Ullrich
ST 2025	2513309	Seminar Knowledge Discovery and Data Mining (Master)	2 SWS	Seminar / 🗣	Käfer, Noullet, Shao, Kinder
ST 2025	2513311	Seminar Data Science & Real-time Big Data Analytics (Master)	2 SWS	Seminar / 🗣	Käfer, Thoma, Hoellig
ST 2025	2513455	Seminar Machine Learning in Autonomous Driving (Master)	2 SWS	Seminar / 🧩	Zhao, Vinel
ST 2025	2513459	Seminar Vulnerable Road User Technologies (Master)	2 SWS	Seminar / 🧩	Schrapel, Vinel
ST 2025	2513500	Cognitive Automobiles and Robots	2 SWS	Seminar / 🗣	Schneider, Zöllner, Daaboul
ST 2025	2513553	Seminar E-Voting (Master)	2 SWS	Seminar / 🗣	Beckert, Müller-Quade, Volkamer, Kirsten, Hilt, Dörre
ST 2025	2513607	Large Language Model-Enhanced Representation Learning for Knowledge Graphs (Master)	2 SWS	Seminar / 🧩	Sack, Gesese, Tan
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
Exams					
ST 2025	7500255	Seminar: E-Voting			Beckert, Müller-Quade
ST 2025	7900088	Seminar Business Information Systems (Master)			Oberweis
ST 2025	7900147	Cognitive Automobiles and Robots			Zöllner
ST 2025	7900162	Seminar: From Physical Models to Digital Twins: A Data-Driven Simulation Workshop (Master)			Lazarova-Molnar
ST 2025	7900191	Seminar Vulnerable Road User Technologies (Master)			Vinel
ST 2025	7900196	Seminar: Wearables and Machine Learning for Humancentric Digital Twins (Master)			Lazarova-Molnar
ST 2025	7900198	Seminar Data Science & Real-Time Big Data Analytics (Master)			Käfer
ST 2025	7900199	Seminar Large Language Model-Enhanced Representation Learning for Knowledge Graphs (Master)			Sack
ST 2025	7900202	Seminar Knowledge Discovery and Data Mining (Master)			Käfer
ST 2025	7900203	Seminar Machine Learning in Autonomous Driving (Master)			Vinel
ST 2025	7900206	Seminar New Trends in Artificial Intelligence Techniques for Noise Prediction (Master)			Lazarova-Molnar
ST 2025	7900222	Seminar: Agent-based Modeling and Simulation (Master)			Lazarova-Molnar
ST 2025	7900305	Seminar: Applications of Digital Twins (Master)			Lazarova-Molnar
WT 25/26	7500175	Seminar: Energy Informatics			Hagenmeyer, Bläsius
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 Prediction (Master)			Lazarova-Molnar
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 Simulation Workshop (Master)"			Lazarova-Molnar
WT 25/26	7900226	Seminar Modeling and Simulation for Energy Systems (Master)			Lazarova-Molnar
WT 25/26	7900245	Seminar Cooperative Autonomous Vehicles (Master)			Vinel
WT 25/26	7900274	Seminar Real-World Challenges in Data Science and Analytics (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 (Master)			Sure-Vetter, Färber
WT 25/26	79AIFB_AIAD_C4	Seminar Artificial Intelligence for Autonomous Driving (Master)			Vinel

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.

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:

V **Seminar: From Physical Models to Digital Twins: A Data-Driven Simulation Workshop (Seminar/Master)** **Seminar (S) On-Site**
2512101, SS 2025, 2 SWS, Language: English, Open in study portal

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%

V **Seminar: Applications of Digital Twins (Master)** **Seminar (S) On-Site**
2513103, SS 2025, 2 SWS, Language: English, Open in study portal

Content

Seminar Name: Applications of Digital Twins

Size: 10 students (with 10 different topics)

Workload:

- 2 Lectures:
  - Introduction to Digital Twins and topic distribution
  - "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)

V

Seminar: New Trends in Artificial Intelligence Techniques for Noise Prediction (Master)

Seminar (S)
On-Site

2513108, SS 2025, 2 SWS, Language: English, Open in study portal

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 24, 2025**: 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 **29 May 2025**: Presentation of the current situation and information sharing.
- Final presentation on **July 17, 2025**: 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

V

Seminar Knowledge Discovery and Data Mining (Master)

Seminar (S)
On-Site

2513309, SS 2025, 2 SWS, Language: English, Open in study portal

Content
In this seminar different machine learning and data mining methods are implemented.

The seminar includes different methods of machine learning and data mining. Participants of the seminar should have basic knowledge of machine learning and programming skills.

Domains of interest include, but are not limited to:

- Medicine
- Social Media
- Finance Market
- Scientific Publications

Further Information: https://aifb.kit.edu/web/Lehre/Praktikum_Knowledge_Discovery_and_Data_Science

The exact dates and information for registration will be announced at the event page.

Organizational issues
Die Anmeldung erfolgt über das WiWi-Portal https://portal.wiwi.kit.edu/ .

Literature
Detaillierte Referenzen werden zusammen mit den jeweiligenThemen 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.

V **Seminar Data Science & Real-time Big Data Analytics (Master)** **Seminar (S) On-Site**
2513311, SS 2025, 2 SWS, Language: English, Open in study portal

Content
In this seminar, students will design applications in teams that use meaningful and creative Event Processing methods. Thereby, students have access to an existing record.

Event processing and real-time data are everywhere: financial market data, sensors, business intelligence, social media analytics, logistics. Many applications collect large volumes of data in real time and are increasingly faced with the challenge of being able to process them quickly and react promptly. The challenges of this real-time processing are currently also receiving a great deal of attention under the term "Big Data". The complex processing of real-time data requires both knowledge of methods for data analysis (data science) and their processing (real-time analytics). Seminar papers are offered on both of these areas as well as on interface topics, the input of own ideas is explicitly desired.

Further information to the practical seminar is given under the following Link:
http://seminar-cep.fzi.de

Questions are answered via the e-mail address sem-ep@fzi.de.

Organizational issues
Die Anmeldung erfolgt über das WiWi-Portal https://portal.wiwi.kit.edu/ .

V **Cognitive Automobiles and Robots** **Seminar (S) On-Site**
2513500, SS 2025, 2 SWS, Language: German/English, Open in study portal

Content
The seminar is intended as a theoretical supplement to lectures such as "Machine Learning". The theoretical basics will be deepened in the seminar. The aim of the seminar is that the participants work individually to analyze a subsystem from the field of robotics and cognitive systems using one or more procedures from the field of AI/ML.

The individual projects require the analysis of the task at hand, selection of suitable procedures, specification and theoretical evaluation of the approach taken. Finally, the chosen solution has to be documented and presented in a short presentation.

Learning objectives:

- Students can apply knowledge from the Machine Learning lecture in a selected field of current research in robotics or cognitive automobiles for theoretical analysis.
- Students can evaluate, document and present their concepts and results.

Recommendations:

Attendance of the lecture machine learning

Workload:

The workload of 3 credit points consists of the time spent on literature research and planning/specifying the proposed solution. In addition, a short report and a presentation of the work carried out will be prepared.

Organizational issues
Anmeldung und weitere Informationen sind im Wiwi-Portal zu finden.

Registration and further information can be found in the WiWi-portal.

V

Seminar E-Voting (Master)

2513553, SS 2025, 2 SWS, Language: German/English, Open in study portal

Seminar (S)
On-Site

Content
What should a voting procedure fulfill? When is a voting procedure secure? Which components need to be examined? Which methods can be used to investigate this?

Cryptographic voting procedures and algorithmic voting (counting) procedures are examined from different perspectives (cryptographic methods, formal correctness, human factors).

This course can also be credited for the KASTEL certificate. Further information about obtaining the certificate can be found on the SECUSO website (https://secuso.aifb.kit.edu/Studium_und_Lehre.php).

Organizational issues
Die Anmeldung für das Seminar ist bis zum 20. April über https://portal.wiwi.kit.edu/ys/8668 möglich.

V

Large Language Model-Enhanced Representation Learning for Knowledge Graphs (Master)

2513607, SS 2025, 2 SWS, Language: English, Open in study portal

Seminar (S)
Blended (On-Site/Online)

Content
Effective feature representation is critical for optimizing the performances of machine learning algorithms. Recently, Representation Learning (RL) has advanced significantly, focusing on embedding words and Knowledge Graphs (KGs) into low-dimensional vector spaces. Word embeddings encode words as vectors, capturing context, semantic similarity, and relationships. Similarly, KG representation learning (KGRL) algorithms (a.k.a. KG embedding (KGE) models) are used to represent entities and relations as vectors in a low-dimensional vector space, preserving structure and semantic connections.

KGE models can be unimodal, using a single source of information, or multimodal, integrating multiple sources such as relations between entities, text literals, numeric literals, images, etc. Capturing information from these sources ensures semantically rich representations. Multimodal KGE models either create separate representations for each source in non-unified spaces or a unified representation for KG elements. These embeddings are commonly used for KG completion tasks such as link prediction and entity classification.

Emerging methodologies for KGRL leverage LLMs such as LLaMA, GPT 3.5, and PaLM2. The integration of LLMs with KG KGRL signifies a pivotal advancement in the field of artificial intelligence, enhancing the ability to capture and utilize complex knowledge structures.

In this seminar, we aim to explore state-of-the-art approaches that utilize LLMs for Knowledge Graph representation learning.

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.

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.

V **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:
  - Introduction to Digital Twins and topic distribution
  - "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
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Approximate Time Consumption for Students (Draft):

- Lectures: 3 hours
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- 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.

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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

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4. Digital Twins of City Infrastructures (in Smart Cities)

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- 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)

V

Seminar: New Trends in Artificial Intelligence Techniques for Noise Prediction (Master)

Seminar (S)
On-Site

2513105, WS 25/26, 2 SWS, Language: English, Open in study portal

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.

V

Seminar Linked Data and the Semantic Web (Master)

Seminar (S)
On-Site

2513313, WS 25/26, 3 SWS, Language: German/English, Open in study portal

Content
Linked Data is a way of publishing data on the web in a machine-understandable fashion. The aim of this practical seminar is to build applications and devise algorithms that consume, provide, or analyse Linked Data.

The Linked Data principles are a set of practices for data publishing on the web. Linked Data builds on the web architecture and uses HTTP for data access, and RDF for describing data, thus aiming towards web-scale data integration. There is a vast amount of data available published according to those principles: recently, 4.5 billion facts have been counted with information about various domains, including music, movies, geography, natural sciences. Linked Data is also used to make web-pages machine-understandable, corresponding annotations are considered by the big search engine providers. On a smaller scale, devices on the Internet of Things can also be accessed using Linked Data which makes the unified processing of device data and data from the web easy.

In this practical seminar, students will build prototypical applications and devise algorithms that consume, provide, or analyse Linked Data. Those applications and algorithms can also extend existing applications ranging from databases to mobile apps.

For the seminar, programming skills or knowledge about web development tools/technologies are highly recommended. Basic knowledge of RDF and SPARQL are also recommended, but may be acquired during the seminar. Students will work in groups. Seminar meetings will take place as 'Block-Seminar'.

Topics of interest include, but are not limited to:

- Travel Security
- Geo data
- Linked News
- Social Media

The exact dates and information for registration will be announced at the event page.

V **Seminar Real-World Challenges in Data Science and Analytics (Bachelor)** **On-Site**
2513314, WS 25/26, 3 SWS, Language: German/English, Open in study portal

Content
In the seminar, various Real-World Challenges in Data Science and Analytics will be worked on.

During this seminar, groups of students work on a case challenge with data provided. Here, the typical process of a data science project is depicted: integration of data, analysis of these, modeling of the decisions and visualization of the results.

During the seminar, solution concepts are worked out, implemented as a software solution and presented in an intermediate and final presentation. The seminar "Real-World Challenges in Data Science and Analytics" is aimed at students in master's programs.

The exact dates and information for registration will be announced at the course page.

V **Seminar Real-World Challenges in Data Science and Analytics (Master)** **On-Site**
2513315, WS 25/26, 3 SWS, Language: German/English, Open in study portal

Content
In the seminar, various Real-World Challenges in Data Science and Analytics will be worked on.

During this seminar, groups of students work on a case challenge with data provided. Here, the typical process of a data science project is depicted: integration of data, analysis of these, modeling of the decisions and visualization of the results.

During the seminar, solution concepts are worked out, implemented as a software solution and presented in an intermediate and final presentation. The seminar "Real-World Challenges in Data Science and Analytics" is aimed at students in master's programs.

The exact dates and information for registration will be announced at the course page.

V **Seminar Cognitive Automobiles and Robots (Master)** **Seminar (S)** **Blended (On-Site/Online)**
2513500, WS 25/26, 2 SWS, Language: German/English, Open in study portal

Content
The seminar is intended as a theoretical supplement to lectures such as "Machine Learning". The theoretical basics will be deepened in the seminar. The aim of the seminar is that the participants work individually to analyze a subsystem from the field of robotics and cognitive systems using one or more procedures from the field of AI/ML.

The individual projects require the analysis of the task at hand, selection of suitable procedures, specification and theoretical evaluation of the approach taken. Finally, the chosen solution has to be documented and presented in a short presentation.

Learning objectives:

- Students can apply knowledge from the Machine Learning lecture in a selected field of current research in robotics or cognitive automobiles for theoretical analysis.
- Students can evaluate, document and present their concepts and results.

Recommendations:

Attendance of the lecture machine learning

Workload:

The workload of 3 credit points consists of the time spent on literature research and planning/specifying the proposed solution. In addition, a short report and a presentation of the work carried out will be prepared.

Organizational issues
Anmeldung und weitere Informationen sind im Wiwi-Portal zu finden.

Registration and further information can be found in the WiWi-portal.

T 6.363 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 Economics and Management

Part of: M-WIWI-104815 - Seminar Information Systems

Type	Credits	Grading	Term offered	Version
Examination of another type	3 CP	graded	Each term	1

Courses					
ST 2025	00063	Seminar Social Sentiment in Times of Crises	2 SWS	Seminar	Fegert
ST 2025	2500020	Digital Democracy - Challenges and opportunities of the digital society	2 SWS	Seminar /	Fegert
ST 2025	2500024	Biosignals in Information Systems & Marketing	2 SWS	Seminar /	Knierim, del Puppo
ST 2025	2500056	ABBA Summer School Seminar: Biosignal-Adaptive GenAI Systems	2 SWS	Seminar /	Mädche
ST 2025	2500125	Human-Centered Systems Seminar: Engineering	3 SWS	Seminar /	Mädche
ST 2025	2540469	Master Seminar: Trustworthy AI	2 SWS	Seminar /	Gutschow, Heßler
ST 2025	2540473	Business Data Analytics	2 SWS	Seminar	Hariharan
ST 2025	2540475	Positive Information Systems	2 SWS	Seminar	Knierim
ST 2025	2540478	Smart Grid Economics & Energy Markets	2 SWS	Seminar	Weinhardt
ST 2025	2540493	Data Science for Industrial Applications	2 SWS	Seminar /	Spitzer, Holstein, Hendriks
ST 2025	2540510	Master Seminar in Data Science and Machine Learning	2 SWS	Seminar	Geyer-Schulz
ST 2025	2540553	User-Adaptive Systems Seminar	2 SWS	Seminar /	Mädche, Beigl
ST 2025	2540557	Human-Centered Systems Seminar: Research	3 SWS	Seminar /	Mädche
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)	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

Exams			
ST 2025	00064	Seminar Social Sentiment in Times of Crises	Weinhardt
ST 2025	7900019	Master Seminar in Data Science and Machine Learning	Geyer-Schulz
ST 2025	7900093	Seminar Smart Grid and Energy Markets	Weinhardt
ST 2025	7900190	Human-Centered Systems Seminar: Engineering	Mädche
ST 2025	7900214	Seminar Business Data Analytics	Weinhardt
ST 2025	7900256	Seminar Positive Information Systems	Weinhardt

ST 2025	7900261	Human-Centered Systems Seminar: Research	Mädche
ST 2025	7900265	User-Adaptive Systems Seminar	Mädche
ST 2025	7900318	Practical Seminar: Data Science for Industrial Applications	Satzger
ST 2025	7900370	ABBA Summer School Seminar: Biosignal-Adaptive GenAI Systems	Mädche
ST 2025	7940469	Master Seminar: Trustworthy AI [SS252540469]	Pfeiffer
WT 25/26	7940469	Master Seminar: Information Systems / Wirtschaftsinformatik 3	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:

V **ABBA Summer School Seminar: Biosignal-Adaptive GenAI Systems** — **Seminar (S)**
2500056, SS 2025, 2 SWS, Language: English, Open in study portal — **Blended (On-Site/Online)**

Content

Background: In the ABBA Summer School Seminar hosted at the Karlsruhe Decision & Design Lab (KD²Lab) at KIT, we aim to enable students to explore biosignal sensors for designing user-adaptive systems, focusing on gaze-adaptive systems. This comprehensive block seminar is intended for both bachelor's and master's students who want to gain an understanding of biosignal and the development of user-adaptive systems. The learning objective is to design human-centered biosignal-adaptive systems to address user needs in learning scenarios.

Course Content: Throughout the summer school, students will learn the foundations of biosignal-adaptive systems through an introductory lecture and apply the knowledge in practical group work. For the group work, we offer students the concept of designing a gaze-adaptive tutor for immersive learning. Aiming to address user challenges in this context, we provide eye-tracking data and an existing gaze-adaptive VR learning application in the kick-off event. The students will have one week to work in groups to understand the task and existing resources, before returning one week later to attend the three-day group work sessions. During the three-day seminar, we encourage students to integrate GenAI technologies for their design and implementation. In the end, students should present their results to showcase the functionality, innovation, and prototype of their gaze-adaptive tutoring systems.

Learning Outcome: By successfully achieving the learning objective, students will receive a certificate from KIT and will have the opportunity to apply their acquired skills and knowledge for further research.

Organization: The seminar will be held **with a one-day kick-off event (with an introduction lecture, 16th July) and one week later a three-day block-seminar format (21st - 23rd July)** at KD²Lab (Etage 1, Fritz-Erler-Straße 1-3, 76131 Karlsruhe) with 3 ECTS. For any questions, please ask Luke Shi Liu (shi.liu@kit.edu) for more information!

V **Human-Centered Systems Seminar: Engineering**
2500125, SS 2025, 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.

V **Master Seminar: Trustworthy AI**
2540469, SS 2025, 2 SWS, Language: English, Open in study portal
Seminar (S)
On-Site

Content

Artificial Intelligence is shaping critical areas of society, but ensuring fairness, transparency, and trust remains a challenge. Our master seminar, "Trustworthy AI," explores key issues such as bias detection, intersectional fairness, and explainability in AI systems. We address bias in AI-driven decision-making, particularly in critical areas like credit scoring, which is classified as a high-risk application context by the AI Act, and examine methods to enhance fairness. A crucial focus is on developing transparent AI models and understanding how explanations influence trust in automated systems. Additionally, we analyze large language models, their limitations, and innovative retrieval methods such as GraphRAG, which enhance knowledge representation in AI.

This seminar is offered by the newly established Information Systems III research group headed by Prof. Dr. Jella Pfeiffer at the Institute for Information Systems (WIN). To learn more about us, please visit our website (WIN - Information Systems III).

V **Data Science for Industrial Applications**
2540493, SS 2025, 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

V **Master Seminar in Data Science and Machine Learning** — **Seminar (S)**
2540510, SS 2025, 2 SWS, Language: German/English, Open in study portal

V **User-Adaptive Systems Seminar** — **Seminar (S)** **Blended (On-Site/Online)**
2540553, SS 2025, 2 SWS, Language: English, Open in study portal

Content
User-adaptive systems collect and analyze biosignals from users to recognize user states as a basis for adaptation. Thermic, mechanical, electric, acoustic, and optical signals are collected using sensors which are integrated in wearables, e.g. glasses, earphones, belts, or bracelets. The collected data is processed with analytics and machine learning techniques in order to determine short-term, evolving over time, and long-term user states in the form of user characteristics, affective-cognitive states, or behavior. Finally, the recognized user states are leveraged for realizing user-centric adaptations.

In this seminar, interdisciplinary teams of students design, develop, and evaluate a user-adaptive system prototype leveraging state-of-the-art hard- and software. This seminar follows an interdisciplinary approach. Students from the fields of computer science, information systems and industrial engineering & management collaborate in the prototype design, development, and evaluation.

The seminar is carried out in cooperation between Teco/Chair of Pervasive Computing Systems (Prof. Beigl) and the Institute of Information Systems and Marketing (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 user-adaptive system is and how it can be conceptualized
- Suggest and evaluate different design solutions for addressing the identified problem
- Build a user-adaptive system prototype using state-of-the-art hard- and software
- Perform a user-centric evaluation of the user-adaptive system prototype

Prerequisites

Strong analytical abilities and profound software development skills are required.

Organizational issues
Termine werden bekannt gegeben

Literature
Required literature will be made available in the seminar.

V **Human-Centered Systems Seminar: Research** — **Seminar (S)**
2540557, SS 2025, 3 SWS, Language: English, Open in study portal — **Blended (On-Site/Online)**

Content
Formerly known as "Information Systems and Service Design Seminar"

With this seminar, we aim to provide students with the possibility to independently work on state-of-the-art research topics in addition to the knowledge gained in the lectures of the research group IS I (Prof. Mädche). The research group "Information Systems I" (IS I) headed by Prof. Mädche focuses in research, education, and innovation on designing interactive intelligent systems. It is positioned at the intersection of Information Systems and Human-Computer Interaction (HCI).

In the seminar, participants will get deeper insights in a contemporary research topic in the field of information systems, specifically interactive intelligent systems.

The actual seminar topics will be derived from current research activities of the research group. Our research assistants offer a rich set of topics from our research clusters (digital experience and participation, intelligent enterprise systems, or digital services design & innovation). Students can select among these topics individually depending on their personal interests. The seminar is carried out in the form of a literature-based thesis project. In the seminar, students will acquire the important methodological skills of running a systematic literature review.

Learning Objectives

- focus on a contemporary topic at the intersection of Information Systems and Human-Computer Interaction (HCI), specifically interactive intelligent systems
- carry out a structured literature search for a given topic
- aggregate the collected information in a suitable way to present and extract knowledge
- write a seminar thesis following academic writing standards
- deliver a presentation in a scientific context in front of an auditorium

Prerequisites

No specific prerequisites are required for the seminar.

Literature

Further literature will be made available in the seminar.

Organizational issues
Termine werden bekannt gegeben

V **Master Seminar (Information Systems III)** — **Seminar (S)** **On-Site**
2540472, WS 25/26, 2 SWS, Language: English, Open in study portal

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).

V **Business Data Analytics** — **Seminar (S)** **On-Site**
2540473, WS 25/26, 2 SWS, Language: German/English, Open in study portal

Content
wird auf deutsch und englisch gehalten

Organizational issues
Blockveranstaltung, siehe WWW

V **Master Seminar in Data Science and Machine Learning** — **Seminar (S)** **Blended (On-Site/Online)**
2540510, WS 25/26, 2 SWS, Language: German, Open in study portal

T 6.364 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 Economics and Management

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					
ST 2025	2500028	Seminar: Modern OR and Innovative Logistics	2 SWS	Seminar / 🖧	Nickel, Mitarbeiter, Pomes
ST 2025	2550131	Seminar on Methodical Foundations of Operations Research (BA)	2 SWS	Seminar / 🗣	Stein, Beck, Schwarze, Neussel
ST 2025	2550132	Seminar on Mathematical Optimization (MA)	2 SWS	Seminar / 🗣	Stein, Beck, Schwarze, Neussel
ST 2025	2550462	Seminar: Trending Topics in Machine Learning and Optimization (Master)	2 SWS	Seminar / 🖧	Rebennack, Warwicker, Kandora
ST 2025	2550473	Seminar: Energy and Power Systems Optimization (Master)	2 SWS	Seminar / 🖧	Rebennack, Warwicker, Kandora
WT 25/26	2500056	Seminar: Modern OR and Innovative Logistics	2 SWS	Seminar / 🖧	Nickel, Mitarbeiter, Pomes
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
Exams					
ST 2025	7900026	Seminar Modern OR and Innovative Logistics			Nickel
ST 2025	7900200_SS2025	Seminar in Operations Research A (Master)			Stein
ST 2025	7900201_SS2025	Seminar in Operations Research (Bachelor)			Stein
ST 2025	7900295	Seminar Trending Topics in Machine Learning and Opt. - Operations Research A (Master)			Rebennack
ST 2025	7900349	Seminar on Power Systems Optimization (Master)			Rebennack
ST 2025	7900359	Digitalization in the Steel Industry			Nickel
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	7900314	Seminar on Power Systems Optimization (Master)			Rebennack

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:

V **Seminar: Modern OR and Innovative Logistics** — **Seminar (S)** **Blended (On-Site/Online)**
2500028, SS 2025, 2 SWS, Language: German, Open in study portal

Content
The seminar aims at the presentation, critical evaluation and exemplary discussion of recent questions in discrete optimization. The focus lies on optimization models and algorithms, also with regard to their applicability in practical cases (especially in Supply Chain and Health Care Management). The students get in touch with scientific working: The in-depth work with a special scientific topic makes the students familiar with scientific literature research and argumentation methods. As a further aspect of scientific work, especially for Master students the emphasis is put on a critical discussion of the seminar topic. Regarding the seminar presentations, the students will be familiarized with basic presentational and rhetoric skills.

Organizational issues
Anmeldung erfolgt über das Wiwi-Portal. Nähere Informationen hierzu finden Sie hier zu einem späteren Zeitpunkt.

Literature
Die Literatur und die relevanten Quellen werden zu Beginn des Seminars bekannt gegeben.

V **Seminar on Methodical Foundations of Operations Research (BA)** — **Seminar (S)** **On-Site**
2550131, SS 2025, 2 SWS, Language: German, Open in study portal

Content
The seminar aims at describing, evaluating, and discussing recent as well as classical topics in continuous optimization. The focus is on the treatment of optimization models and algorithms, also with respect to their practical application.

Bachelor studenst 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 scientifc 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 Literaur 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 prepatory meeting.

V

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 bzw. im WiWi-Portal sowie bei der Vorbesprechung.

Literature
Die Literatur und die relevanten Quellen werden zu Beginn des Seminars bekannt gegeben.

V

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 studenst 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 scientifc 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 Literaur 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 prepatory meeting.

T 6.365 Module component: Seminar in Statistics A (Master) [T-WIWI-103483]

Coordinators: Prof. Dr. Oliver Grothe
Prof. Dr. Melanie Schienle

Organisation: KIT Department of Economics and Management

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					
ST 2025	2500208	Statistics and Large Language Models	2 SWS	Seminar	Krüger, Eberl
ST 2025	2521310	Advanced Topics in Econometrics	2 SWS	Seminar	Schienle, Koster, Buse, Rüter, Bracher
ST 2025	2550561	Fortgeschrittene Themen zu Statistik, Datenanalyse und maschinellem Lernen (Master)	2 SWS	Seminar / 🗣	Grothe, Liu
WT 25/26	25000111	Statistics and Epidemics	2 SWS	Seminar / 🗣	Bracher, Nemcova
WT 25/26	2500012		2 SWS	Seminar / 🗣	Grothe, Liu
WT 25/26	2521310	Topics in Econometrics	2 SWS	Seminar	Schienle, Krüger, Rüter
Exams					
ST 2025	7900208	Statistics and Large Language Models			Krüger
ST 2025	7900343	Seminar in Statistics A (Master)			Grothe
WT 25/26	7900216	Seminar in Statistics A (Master)			Grothe

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:

V Advanced Topics in Econometrics

2521310, SS 2025, 2 SWS, Language: German/English, Open in study portal — **Seminar (S)**

Organizational issues
Blockveranstaltung, Termine werden bekannt gegeben

V **Statistics and Epidemics** — **Seminar (S) On-Site**
25000111, WS 25/26, 2 SWS, Language: English, Open in study portal

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.

V **Topics in Econometrics** — **Seminar (S)**
2521310, WS 25/26, 2 SWS, Language: German, Open in study portal

Organizational issues
Blockveranstaltung, Termine werden auf Homepage und über Ilias bekannt gegeben

T 6.366 Module component: Seminar Informatics Master [T-INFO-111205]

Organisation: KIT Department of Informatics
Part of: M-INFO-102822 - Seminar Module Informatics

Type	Credits	Grading	Version
Examination of another type	3 CP	graded	1

Courses					
ST 2025	2400002	Post-Quantum Cryptography	2 SWS	Seminar / 🗣	Klooß, Ottenhues, Tiepelt, Müller-Quade, Fruböse, Gröll, Beskorovajnov, Benz
ST 2025	2400011	Hot Topics in Bioinformatics	2 SWS	Seminar / 🗣	Stamatakis
ST 2025	2400029	Hot Topics in Decentralized Systems	2 SWS	Seminar / 🗣	Hartenstein, Grundmann
ST 2025	2400032	Seminar Speech-to-Speech Translation	2 SWS	Seminar / 🗣	Niehues
ST 2025	2400035	Seminar Image Analysis and Fusion	2 SWS	Seminar / 🗣	Beyerer
ST 2025	2400038	Advanced Topics in Machine Translation	2 SWS	Seminar / 🗣	Niehues
ST 2025	2400044	Seminar Cryptanalysis	2 SWS	Seminar / 🗣	Müller-Quade, Tiepelt, Ottenhues, Martin
ST 2025	2400063	Motion in Human and Machine	3 SWS	Seminar / 🗣	Asfour
ST 2025	2400072	Seminar: Service-oriented Architectures	2 SWS	Seminar / 🗣	Abeck, Schneider
ST 2025	2400084	Seminar: Robot Reinforcement Learning	2 SWS	Seminar / 🗣	Neumann, Hoang, Gyenes, Celik, Gospodinov
ST 2025	2400085	Quantum Information Theory	2 SWS	Seminar / 🧩	Müller-Quade, Tiepelt, Ottenhues, Fruböse, Hetzel, Martin
ST 2025	2400089	Decentralized Systems: Fundamentals, Modeling, and Applications	4 SWS	Lecture / Practice (/ 🗣	Hartenstein, Jacob
ST 2025	2400136	Seminar: Interactive Learning	2 SWS	Seminar / 🗣	Lioutikov
ST 2025	2400137	Embedded Machine Learning		Seminar / 🧩	Henkel, Sikal, Khdr, Ahmed, Demirdag, Mentzos
ST 2025	2400145	Do LLMs understand cause and effect?	2 SWS	Seminar / 🧩	Janzing
ST 2025	2400148	Embedded Security and Architectures		Seminar / 🧩	Henkel, Nassar, Khdr, Sikal, Tobar, Alsharkawy
ST 2025	2400161	Exploring Robotics: Insights from Science Fiction, Research and Society	2 SWS	Seminar / 🗣	Bruno, Maure, Yang
ST 2025	2400178	Seminar Machine Learning in Climate and Environmental Sciences	2 SWS	Seminar / 🗣	Nowack, Amiramjadi
ST 2025	2400181	Interpretability and Causality in Machine Learning	2 SWS	Seminar / 🗣	Stühmer
ST 2025	2400196	Practical Graph Algorithms	2 SWS	Seminar	Meyerhenke

ST 2025	2400210	Seminar: Critical topics in AI	2 SWS	Seminar /	Friederich, Zhou, Reiser, Torresi, Neubert, Eberhard, Schlöder
ST 2025	2424344	Advanced Methods of Information Fusion	2 SWS	Seminar /	Hanebeck, Walker
ST 2025	2424816	Seminar Fortgeschrittene Algorithmen in der Computergrafik	2 SWS	Seminar /	Schudeiske, Dachsbacher
ST 2025	24844	Seminar: Ubiquitous Systems	2 SWS	Seminar /	Riedel, Beigl, Röddiger
ST 2025	2500056	ABBA Summer School Seminar: Biosignal-Adaptive GenAI Systems	2 SWS	Seminar /	Mädche
ST 2025	2500125	Human-Centered Systems Seminar: Engineering	3 SWS	Seminar /	Mädche
ST 2025	2540553	User-Adaptive Systems Seminar	2 SWS	Seminar /	Mädche, Beigl
ST 2025	2540557	Human-Centered Systems Seminar: Research	3 SWS	Seminar /	Mädche
WT 25/26	2400006	Seminar Fortgeschrittene Algorithmen in der Computergrafik	2 SWS	Seminar /	Schudeiske, Dachsbacher
WT 25/26	2400013	Seminar: Energy Informatics	2 SWS	Seminar /	Hagenmeyer, Bauer, Geiges, Schmurr, Langner
WT 25/26	2400040	Hot Topics in Networking	2 SWS	Seminar /	Zitterbart, Bless
WT 25/26	2400048	Humanoid Robots - Seminar	2 SWS	Seminar /	Asfour
WT 25/26	2400060	Data in Software-Intensive Technical Systems – Modeling – Analysis – Protection	2 SWS	Seminar /	Reussner, Raabe, Werner, Müller-Quade
WT 25/26	2400074	Advanced Topics in Natural Language Processing	2 SWS	Seminar	Niehues, Li
WT 25/26	2400099	Deep Learning for Robotics	2 SWS	Seminar /	Neumann
WT 25/26	2400108	Continuous Software Engineering	2 SWS	Seminar	Koziolek
WT 25/26	2400126	Seminar Post-Quantum Cryptography	2 SWS	Seminar /	Müller-Quade, Hellmich
WT 25/26	2400129	Seminar Digital Accessibility and Assisitive Technologies	2 SWS	Seminar /	Stiefelhagen, Schwarz
WT 25/26	2400137	Embedded Machine Learning Seminar		Seminar /	Sikal, Ahmed, Dietrich, Demirdag, Henkel, Khdr, Mentzos
WT 25/26	2400142	Forschungspraktikum: Explainable Artificial Intelligence	4 SWS	Practical course /	Lioutikov, Li, Mattes
WT 25/26	2400143	Seminar: Explainable Artificial Intelligence	2 SWS	Seminar /	Lioutikov, Mattes, Li
WT 25/26	2400148	Embedded Security and Architectures		Seminar /	Nassar, Khdr, Sikal, Henkel, Alsharkawy, Tobar
WT 25/26	2400194	Failing Forward: Robotics, Critical Reading and the Making of Good Research - Seminar	2 SWS	Seminar /	Bruno, Maure, Neef
WT 25/26	2400196	Seminar: Applications and Extensions of Timed Systems	2 SWS	Seminar /	Schwammberger
WT 25/26	2400202	Advances in Data Science		Seminar /	Böhm, Matteucci
WT 25/26	2400231	Seminar: Critical topics in AI	2 SWS	Seminar /	Friederich, Zhou, Torresi, Neubert, Eberhard, Schlöder
WT 25/26	2400245	Do LLMs understand cause and effect?	2 SWS	Seminar /	Janzing
WT 25/26	2424344	Advanced Methods of Information Fusion	2 SWS	Seminar /	Hanebeck, Walker

WT 25/26	2500125	Human-Centered Systems Seminar: Engineering	2 SWS	Seminar /	Mädche
Exams					
ST 2025	7500013	Advanced Methods of Information Fusion			Hanebeck
ST 2025	7500014	Seminar: Hot Topics in Bioinformatics			Stamatakis
ST 2025	7500046	Seminar Speech-to-Speech Translation			Waibel, Niehues
ST 2025	7500070	Decentralized Systems: Fundamentals, Modeling, and Applications			Hartenstein
ST 2025	7500097	Seminar: Critical topics in AI			Friederich
ST 2025	7500108	Seminar Advanced Algorithms in Computer Graphics			Dachsbacher
ST 2025	7500110	Seminar: Exploring Robotics - Insights from Science Fiction, Research and Society			Bruno
ST 2025	7500213	Seminar Machine Learning in Climate and Environmental Sciences			Nowack
ST 2025	7500270	Seminar: Interactive Learning			Lioutikov
ST 2025	7500277	Seminar: Robot Reinforcement Learning			Neumann
ST 2025	7500287	Seminar Advanced Topics in Machine Translation			Waibel, Niehues
ST 2025	7500289	Motion in Man and Machine - Seminar			Asfour
ST 2025	7500297	Seminar: Hot Topics in Decentralized Systems			Hartenstein
ST 2025	7500319	Seminar: Interpretability and Causality in Machine Learning			Stühmer
ST 2025	7500331	Research Focus Class: Blockchain & Cryptocurrencies - Seminar			Hartenstein
ST 2025	7500335	CES - Seminar: Machine Learning			Henkel
ST 2025	7500336	CES - Seminar: Embedded Systems: Architectures and Technologies, Embedded Security and Architectures			Henkel
ST 2025	7900261	Human-Centered Systems Seminar: Research			Mädche
WT 25/26	7500021	Advanced Methods of Information Fusion			Hanebeck
WT 25/26	7500141	Decentralized Systems: Fundamentals, Modeling, and Applications			Hartenstein
WT 25/26	7500175	Seminar: Energy Informatics			Hagenmeyer, Bläsius
WT 25/26	7500346	CES - Seminar: Embedded Systems: Architectures and Technologies			Henkel
WT 25/26	7500349	CES - Seminar: Embedded Machine Learning			Henkel

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 Bioinformatics

2400011, SS 2025, 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 chose 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

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 second week of the summer term** on April 29 from 09:45 - 11:15 in **SR -108**.

Seminar presentations will be conducted in a single block toward the end of the semester: July 28 in room **SR 010** - exact time to be determined

V **Seminar Speech-to-Speech Translation** **Seminar (S)**
2400032, SS 2025, 2 SWS, Language: English, Open in study portal **On-Site**

Content
Speech-to-Speech-Translation is a popular application that combines automatic speech recognition and machine translation. This requires more than just concatenating the individual systems.

In this seminar students familiarise themselves with topics from this area starting from initial literature provided.

Students will present their findings in an oral presentation and a written paper.

V **Seminar Image Analysis and Fusion** **Seminar (S)**
2400035, SS 2025, 2 SWS, Language: German, Open in study portal **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.

V **Advanced Topics in Machine Translation** **Seminar (S)**
2400038, SS 2025, 2 SWS, Language: English, Open in study portal **On-Site**

Content
In today's interconnected world, language barriers remains a major obstacle for global communication. Machine translation technology offers a powerful solution to bridge these gaps, with recent advancements in deep learning and large language models bringing state-of-the-art results.This seminar covers the newest developments in machine translation and natural language processing (NLP) research, designed for students passionate about artificial intelligence.

Organizational issues
(SR 223, Geb. 50.20)

V **Motion in Human and Machine** **Seminar (S)**
2400063, SS 2025, 3 SWS, Language: German/English, Open in study portal **On-Site**

Content
This interdisciplinary block seminar deals with methods of modeling, generating and controlling movements in humans and robot systems. Students gain an insight into this interdisciplinary field and learn the basics of capturing biological motion, biomechanical simulation, robotics, and machine learning. In the introduction, the generation of human movement as effect of muscle contraction is discussed. It is shown how observed movement patterns can be identified and categorized and how these patterns can be reproduced on a humanoid robot. Finally, methods for learning movement primitives from human demonstration are presented and their application to motion generation in humanoid robots are explained.

Competency Goals:

The student knows methods for modeling, processing and analyzing human motions. He/she knows methods for learning motion primitives and mapping human motion to robots with different kinematics and dynamics and can apply these in new contexts.

Organizational issues
Institutions: KIT IAR-H²T Prof. T. Asfour, University of Stuttgart, University of Tübingen

This interdisciplinary block seminar is offered in cooperation with the University of Stuttgart and the University of Tübingen.

Competency certificate: Success is assessed by preparing documentation and a final presentation as a different type of success assessment in accordance with Section 4 (2) No. 3 of the SPO.

Module for Masters in Information Management, Mechanical Engineering, Mechatronics and Information Technology, Electrical Engineering and Information Technology, Sports Science

Workload: 90 h

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.

V **Quantum Information Theory**
2400085, SS 2025, 2 SWS, Language: English, Open in study portal
Seminar (S)
Blended (On-Site/Online)

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.

V **Decentralized Systems: Fundamentals, Modeling, and Applications**
2400089, SS 2025, 4 SWS, Language: English, Open in study portal
Lecture / Practice (VÜ)
On-Site

Content

Content:

Decentralized Systems (like blockchain-based systems) represent distributed systems that are controlled by multiple parties who make their own independent 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, and Matrix. As a research-oriented lecture, we may cover additional current topics like verifiable computing and/or identity and access management in decentralized settings.

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 mutual exclusion in decentralized systems based on different models for node 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
  - The Matrix decentralized messaging platform
  - Distributed Ledgers and Blockchains at the examples of Bitcoin and Ethereum, in particular Proof-of-Work and Proof-of-Stake consensus
  - Payment Channel Networks and Rollups
  - Decentralized storage systems, at the example of IPFS

Compentency Goals:

1. Fundamentals & Modeling
   1. The student is able to recognize and distinguish distributed, federated, and decentralized systems.
   2. The student understands 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 for leader election and mutual exclusion 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, notably silent and noisy crash as well as byzantine 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 various models for and levels of consistency.
2. Applications
   1. The student understands conflict-free replicated data types and their use in decentralized systems like Matrix.
   2. The student has a fundamental understanding of blockchain-based systems (e.g. Bitcoin/Ethereum), Payment Channels, Rollups, and decentralized communication systems like Matrix.
   3. The student understands trust relations in distributed and decentralized systems and applications.
   4. The student is able to understand how theoretical foundations relate to networked and decentralized systems in practice.
   5. The student understands concepts of decentralized storage systems.

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)

   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: 45 h

Σ = 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.

V **Seminar: Interactive Learning** **Seminar (S)**
2400136, SS 2025, 2 SWS, Language: English, Open in study portal **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 indentify 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 “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.

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

KIT-Fakultät für Informatik/1. Informatik Lehrveranstaltungen/1.7 Seminare

V **Embedded Machine Learning** **Seminar (S)**
2400137, SS 2025, SWS, Language: German/English, Open in study portal **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.

V **Embedded Security and Architectures**
2400148, SS 2025, 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.

V **Exploring Robotics: Insights from Science Fiction, Research and Society** **Seminar (S) On-Site**
2400161, SS 2025, 2 SWS, Language: English, Open in study portal

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.).

V **Seminar Machine Learning in Climate and Environmental Sciences** **Seminar (S) On-Site**

2400178, SS 2025, 2 SWS, Language: English, Open in study portal

Content

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:

Attendance time in the seminar and personal meetings with the supervisors: 10 h

Literature research: 30 h

Writing the seminar paper and preparing the final presentation: 50 h

Competency certificate:

Success is assessed in the form of a different type of examination in accordance with Section § 4 Abs. 2 Nr. 3 SPO.
In the form of a written seminar paper and the presentation of the same.

Recommendations:

An interest in climate and environmental sciences topics is a prerequisite.

V **Advanced Methods of Information Fusion** **Seminar (S) On-Site**
2424344, SS 2025, 2 SWS, Language: German/English, Open in study portal

Content
The growing spread and performance of modern information and communication technologies produces an ever-increasing amount 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.

V **ABBA Summer School Seminar: Biosignal-Adaptive GenAI Systems** **Seminar (S) Blended (On-Site/Online)**
2500056, SS 2025, 2 SWS, Language: English, Open in study portal

Content
Background: In the ABBA Summer School Seminar hosted at the Karlsruhe Decision & Design Lab (KD²Lab) at KIT, we aim to enable students to explore biosignal sensors for designing user-adaptive systems, focusing on gaze-adaptive systems. This comprehensive block seminar is intended for both bachelor's and master's students who want to gain an understanding of biosignal and the development of user-adaptive systems. The learning objective is to design human-centered biosignal-adaptive systems to address user needs in learning scenarios.

Course Content: Throughout the summer school, students will learn the foundations of biosignal-adaptive systems through an introductory lecture and apply the knowledge in practical group work. For the group work, we offer students the concept of designing a gaze-adaptive tutor for immersive learning. Aiming to address user challenges in this context, we provide eye-tracking data and an existing gaze-adaptive VR learning application in the kick-off event. The students will have one week to work in groups to understand the task and existing resources, before returning one week later to attend the three-day group work sessions. During the three-day seminar, we encourage students to integrate GenAI technologies for their design and implementation. In the end, students should present their results to showcase the functionality, innovation, and prototype of their gaze-adaptive tutoring systems.

Learning Outcome: By successfully achieving the learning objective, students will receive a certificate from KIT and will have the opportunity to apply their acquired skills and knowledge for further research.

Organization: The seminar will be held **with a one-day kick-off event (with an introduction lecture, 16th July) and one week later a three-day block-seminar format (21st - 23rd July)** at KD²Lab (Etage 1, Fritz-Erler-Straße 1-3, 76131 Karlsruhe) with 3 ECTS. For any questions, please ask Luke Shi Liu (shi.liu@kit.edu) for more information!

V **Human-Centered Systems Seminar: Engineering** **Seminar (S) Blended (On-Site/Online)**
2500125, SS 2025, 3 SWS, Language: English, Open in study portal

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.

V **User-Adaptive Systems Seminar** **Seminar (S) Blended (On-Site/Online)**
2540553, SS 2025, 2 SWS, Language: English, Open in study portal

Content
User-adaptive systems collect and analyze biosignals from users to recognize user states as a basis for adaptation. Thermic, mechanical, electric, acoustic, and optical signals are collected using sensors which are integrated in wearables, e.g. glasses, earphones, belts, or bracelets. The collected data is processed with analytics and machine learning techniques in order to determine short-term, evolving over time, and long-term user states in the form of user characteristics, affective-cognitive states, or behavior. Finally, the recognized user states are leveraged for realizing user-centric adaptations.

In this seminar, interdisciplinary teams of students design, develop, and evaluate a user-adaptive system prototype leveraging state-of-the-art hard- and software. This seminar follows an interdisciplinary approach. Students from the fields of computer science, information systems and industrial engineering & management collaborate in the prototype design, development, and evaluation.

The seminar is carried out in cooperation between Teco/Chair of Pervasive Computing Systems (Prof. Beigl) and the Institute of Information Systems and Marketing (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 user-adaptive system is and how it can be conceptualized
- Suggest and evaluate different design solutions for addressing the identified problem
- Build a user-adaptive system prototype using state-of-the-art hard- and software
- Perform a user-centric evaluation of the user-adaptive system prototype

Prerequisites

Strong analytical abilities and profound software development skills are required.

Organizational issues
Termine werden bekannt gegeben

Literature
Required literature will be made available in the seminar.

V **Human-Centered Systems Seminar: Research** — **Seminar (S)**
2540557, SS 2025, 3 SWS, Language: English, Open in study portal — **Blended (On-Site/Online)**

Content
Formerly known as "Information Systems and Service Design Seminar"

With this seminar, we aim to provide students with the possibility to independently work on state-of-the-art research topics in addition to the knowledge gained in the lectures of the research group IS I (Prof. Mädche). The research group “Information Systems I” (IS I) headed by Prof. Mädche focuses in research, education, and innovation on designing interactive intelligent systems. It is positioned at the intersection of Information Systems and Human-Computer Interaction (HCI).

In the seminar, participants will get deeper insights in a contemporary research topic in the field of information systems, specifically interactive intelligent systems.

The actual seminar topics will be derived from current research activities of the research group. Our research assistants offer a rich set of topics from our research clusters (digital experience and participation, intelligent enterprise systems, or digital services design & innovation). Students can select among these topics individually depending on their personal interests. The seminar is carried out in the form of a literature-based thesis project. In the seminar, students will acquire the important methodological skills of running a systematic literature review.

Learning Objectives

- focus on a contemporary topic at the intersection of Information Systems and Human-Computer Interaction (HCI), specifically interactive intelligent systems
- carry out a structured literature search for a given topic
- aggregate the collected information in a suitable way to present and extract knowledge
- write a seminar thesis following academic writing standards
- deliver a presentation in a scientific context in front of an auditorium

Prerequisites

No specific prerequisites are required for the seminar.

Literature

Further literature will be made available in the seminar.

Organizational issues
Termine werden bekannt gegeben

V **Seminar: Energy Informatics** — **Seminar (S) On-Site**
2400013, WS 25/26, 2 SWS, Language: German/English, Open in study portal

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, economathematics, 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.

V **Humanoid Robots - Seminar** — **Seminar (S) On-Site**
2400048, WS 25/26, 2 SWS, Language: English, Open in study portal

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

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

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 Tor-trained 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

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

V **Continuous Software Engineering** **Seminar (S)**
2400108, WS 25/26, 2 SWS, Language: German/English, Open in study portal

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 **Embedded Machine Learning Seminar** **Seminar (S)** **Blended (On-Site/Online)**
2400137, WS 25/26, SWS, Language: German/English, Open in study portal

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.

V **Embedded Security and Architectures** **Seminar (S)** **Blended (On-Site/Online)**
2400148, WS 25/26, SWS, Language: German/English, Open in study portal

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.

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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.

V **Failing Forward: Robotics, Critical Reading and the Making of Good Research - Seminar** **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.).

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 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.

T 6.367 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	Credits	Grading	Term offered	Version
Examination of another type	3 CP	graded	Irregular	1

Courses					
ST 2025	24004	Seminar Laboratory Machine Learning and Intelligent Systems	2 SWS	Seminar / 🗣	Hanebeck, Prossel
Exams					
ST 2025	7500049	Seminar Laboratory Machine Learning and Intelligent Systems			Hanebeck
WT 25/26	7500135	Seminar Laboratory Machine Learning and Intelligent Systems			Hanebeck

Legend: 🖥 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

T 6.368 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	Credits	Grading	Term offered	Version
Examination of another type	4 CP	graded	Each winter term	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 6.369 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	Credits	Grading	Term offered	Version
Examination of another type	3 CP	graded	Each winter term	1

Courses					
WT 25/26	2400165	Seminar Commercial and Corporate Law in Information Technology	2 SWS	Seminar / 🖳	Nolte
Exams					
WT 25/26	7500182	Seminar: Legal Studies II			Boehm, Raabe, Melullis
WT 25/26	7500310	Seminar: Commercial and Corporate Law in the IT Industry			Matz

Legend: 🖳 Online, 🖧 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

T 6.370 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	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each summer term	2

Courses					
ST 2025	2400136	Seminar: Interactive Learning	2 SWS	Seminar / 🗣	Lioutikov
Exams					
ST 2025	7500270	Seminar: Interactive Learning			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: Interactive Learning

2400136, SS 2025, 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 indentify 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 “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.

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
KIT-Fakultät für Informatik/1. Informatik Lehrveranstaltungen/1.7 Seminare

T 6.371 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	Credits	Grading	Term offered	Version
Examination of another type	3 CP	graded	Each winter term	1

Courses					
WT 25/26	2424389	Seminar "IT security law"	2 SWS	Seminar / 🗣	Schallbruch

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

T 6.372 Module component: Seminar: Legal Studies I [T-INFO-101997]

Coordinators: N.N.
Organisation: KIT Department of Informatics
Part of: M-INFO-101218 - Seminar Module Law

Type	Credits	Grading	Term offered	Version
Examination of another type	3 CP	graded	Each term	1

Courses					
ST 2025	2400005	Governance, Risk & Compliance	2 SWS	Seminar / 🗣	Herzig, Siddiq
ST 2025	2400078	Intelligente Chatbots und Recht	2 SWS	Seminar / 🗣	Raabe
ST 2025	2400171	Regulating AI: from ethics to law	2 SWS	Seminar / 🗣	Gil Gasiola
ST 2025	2400177	Designing Data Governance of Digital Systems	2 SWS	Seminar / 🗣	Pathak
ST 2025	2400190	EU Digital Regulatory Framework	2 SWS	Seminar / 🗣	Zufall
ST 2025	2400204	(Generative) KI und Recht	2 SWS	Seminar / 🧩	Boehm
ST 2025	2400207	Rechtlicher Rahmen für die Europäische Datenökonomie	2 SWS	Seminar / 🗣	Sattler
ST 2025	2400208	Rechtlicher Rahmen für Künstliche Intelligenz	2 SWS	Seminar / 🗣	Sattler
ST 2025	24820	Current Issues in Patent Law	2 SWS	Seminar / 🗣	Melullis
WT 25/26	2400014	Current Issues in Patent Law	2 SWS	Seminar / 🗣	Melullis
WT 25/26	2400060	Data in Software-Intensive Technical Systems – Modeling – Analysis – Protection	2 SWS	Seminar / 🗣	Reussner, Raabe, Werner, Müller-Quade
WT 25/26	2400177	Human vs. Machine: (Un-)Biased Legal Decision-Making?	2 SWS	Seminar / 🗣	Holzhausen
WT 25/26	2400184	EU Digital Regulatory Framework	2 SWS	Seminar / 🗣	Zufall
WT 25/26	2400203	EU Fundamental Rights and EU Economic Law in Smart Cities	2 SWS	Seminar / 🗣	Kasper
WT 25/26	2400221	Environmental Legal Considerations regarding Artificial Intelligence	2 SWS	Seminar / 🧩	Boehm, Turkovic-Popovski
WT 25/26	2513214	Seminar Information security and Data protection (Bachelor)	2 SWS	Seminar / 🗣	Volkamer, Raabe, Schiefer, Werner
Exams					
ST 2025	7500140	Seminar: Legal Studies I			Raabe, Melullis, Boehm, Sattler
ST 2025	7500159	Seminar: Legal Studies I			Zufall
ST 2025	7500182	Public International Law with an Economic Law Focus			Zufall
ST 2025	7500237	Seminar: Law and Legal Studies			Zufall
WT 25/26	7500182	Seminar: Legal Studies II			Boehm, Raabe, Melullis
WT 25/26	7500232	Seminar Data in Software-Intensive Technical Systems – Modeling – Analysis – Protection			Reussner

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

Below you will find excerpts from courses related to this module component:

V Regulating AI: from ethics to law

2400171, SS 2025, 2 SWS, Language: English, Open in study portal

Seminar (S)
On-Site

Content
Credit points = ECTS

3 ECTS

Language:

English

Competency Goals:

Students comprehend the role of technology regulation.

They are able to identify different types of regulation and their impact on different stakeholders.

They know the main aspects of the regulation of AI systems.

They understand the foundations of the AI Act of the EU.

They know the content of AI principles and are able to assess their implementation in specific projects.

Content:

This seminar will provide an overview of the regulation of technologies and in particular the regulation of AI systems. After an introduction to forms of regulation, students will explore the different regulatory instruments from the perspective of the consolidated principles of AI: fairness, transparency, privacy, security and accountability. This will allow students to discuss how the principles and rules governing AI can be implemented in concrete cases. The seminar will cover the following topics:

- Introduction to technology regulation
- Objectives of regulation
- Types of regulation
- Challenges in regulating new / disruptive technologies
- Specific challenges in regulating AI
- Fragmented/vertical regulation of AI
- AI Act
- AI principles: fairness, transparency, privacy, security, and accountability
- The role of principles in regulating AI
    - Dealing with principles when developing and implementing AI systems

Competency certificate:

The assessment of this course is carried out by the following aspects, which will be considered in the grading (§ 4 Abs. 2 Nr. 3 SPO): term paper (approx. 5 pages), presentation (approx. 20 min.) and discussion.

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.

Organizational issues
Anmeldungen für das Seminar bitte NUR! über das WiWi-Portal!
***Für die Prüfung bitte NUR über CAS (Campus-Portal) anmelden!**

*ErläuterungNach 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).

Blockseminar im SoSe 2025 (2 Termine): Termine und Uhrzeit:

Donnerstag, 24.04.2025, 13:30 - 17:30 Uhr

Donnerstag, 10.07.2025, 13:30 - 17:30 Uhr.

Raum: jeweils im Seminarraum Nr. 313 (Geb. 07.08)**English:**Please register for the seminar ONLY via the WiWi-Portal!
*Please register for the exam ONLY via CAS (Campus-Portal)!

*ExplanationAfter 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 2024 (2 dates):

Dates and time:

Thursday, 24th April 2025, 13:30 - 17:30 h

Thursday, 10th July 2025, 13:30 - 17:30 h.

Room:each time in seminar room no. 313 (building 07.08)

V

Designing Data Governance of Digital Systems

2400177, SS 2025, 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.

V

EU Digital Regulatory Framework

2400190, SS 2025, 2 SWS, Language: English, Open in study portal

Seminar (S)
On-Site

Content
Note:
This class is mainly intended for Bachelor and Master students in Business Informatics and those wth Law as a minor subject, but also open interested students from other disciplines.

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 (proposal), 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 which 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
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).

***Termine im SoSe* 2025:**

Mittwoch, den 7. Mai 2025, 16-19 Uhr (Kick-off)

Donnerstag, den 17. Juli 2025, 14:00 - 18:00 Uhr (Präsentationen).

Raum:

jeweils im Seminarraum Nr. 313, Geb. 07.08.

English:

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 Campus System (necessary for recording the grade of the seminar papers).*

Dates in summer term 2025:

Wednesday, 7 May 2025, 16-19h (kick-off)

Thursday, 17th July 2025, 14:00 - 18:00 h (presentations).

Room:

In seminar room no. 313, building 07.08.

V **Human vs. Machine: (Un-)Biased Legal Decision-Making?** **Seminar (S)**
2400177, WS 25/26, 2 SWS, Language: English, Open in study portal **On-Site**

Content

Module:

Human vs. Machine: (Un-)Biased Legal Decision-Making?

Type

Seminar

Course Number:

2400177
Human vs. Machine: (Un-)Biased Legal Decision-Making?

Module Responsible:

T.-T. Prof. Frederike Zufall
Head of research group (Professor)
Program of Study:

Master **Informatics; B.Sc. / M.Sc. Business Informatics**

Area of Specialization
Master Informatik: Ergänzungsfach Recht
Master Wirtschaftsinformatik: Seminar aus Rechtswissenschaften
Master Computer Science: Seminar: Law and Legal Studies
For Master modules only

Recurrence

Winter term

Duration

One term

Academic Level 1 - 4:
Level 4: Master Program of Study

Credit points = ECTS

3 ECTS

We usually have a module for each course (lecture, seminar, practical course).

Language:

English

Competency Goals:

Students acquire basic knowledge of economic theory and its application to public institutions (*public choice theory*). They learn to identify different types of cognitive biases that influence human behavior. As a result, students understand the implications of these biases for public decision-makers as well as for citizens as recipients of public action. Conversely, they also comprehend how the law can be designed to steer or influence human behavior (*behavioral public law*).

Students will be able to assess how automation processes can mitigate undesirable biases, or intentionally incorporate them where such biases are desirable from a public interest perspective.

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

Workload

Annotation:

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.

Prerequisites:

This seminar is interdisciplinary and suitable for students with an interest in behavioral economics, policy design, and governance. Prior legal knowledge is helpful but not required.

Competency certificate:

The assessment of this course is carried out by the following aspects, which will be considered in the grading (§ 4 Abs. 2 Nr. 3 SPO):

- Term paper (approx. 5 pages),
- Presentation (approx. 20 min.) and
- Discussion participation.

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.

If the assessment is an examination of another type, the deadline for redraw must be set. These partial achievements can only be repeated once and are to be graded.

Course works are not graded and can be repeated indefinitely, if not otherwise specified.

Recommendations:

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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).

V **EU Digital Regulatory Framework** **Seminar (S) On-Site**

2400184, WS 25/26, 2 SWS, Language: English, Open in study portal

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 which 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).

V

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.

Studiengang:

Master **Wirtschaftsinformatik**

Level:

Leistungsstufe 4: Master

Organizational issues
In advance:

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.)

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Presentations:

- Friday, 6th February 2026, 09:00 - 18:00 h

and

- Saturday, 7th February 2026, 10:00 - 16:00

Place: see section "TERMINE" (below).

T 6.373 Module component: Service Design Thinking [T-WIWI-102849]

Coordinators: Prof. Dr. Gerhard Satzger
Prof. Dr. Orestis Terzidis

Organisation: KIT Department of Economics and Management

Part of: M-WIWI-101503 - Service Design Thinking

Type	Credits	Grading	Term offered	Version
Examination of another type	9 CP	graded	Irregular	5

Courses					
ST 2025	2595600	Service Design Thinking	2 SWS	Lecture / 🗣	Feldmann, Terzidis, Satzger
WT 25/26	2595600	Service Design Thinking	2 SWS	Lecture / 🗣	Terzidis, Satzger, Osaro, Feldmann
Exams					
ST 2025	7900319	Service Design Thinking			Satzger
ST 2025	7900320	Practical Seminar Service Innovation			Satzger

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** **Lecture (V) On-Site**
2595600, SS 2025, 2 SWS, Language: English, Open in study portal

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

V **Service Design Thinking** — **Lecture (V)**
2595600, WS 25/26, 2 SWS, Language: English, Open in study portal — **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 6.374 Module component: Service Operations and Cyber Security [T-WIWI-114109]

Coordinators: Esther Mohr
Organisation: KIT Department of Economics and Management
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 2025	00030	Service Operations and Cyber Security	Nickel

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

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 6.375 Module component: SIL Entrepreneurship Emphasis [T-WIWI-110287]

Coordinators: Prof. Dr. Orestis Terzidis
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-105010 - Student Innovation Lab (SIL) 1

Type	Credits	Grading	Term offered	Version
Examination of another type	3 CP	graded	Each winter term	1

Courses					
WT 25/26	2500002	SIL Entrepreneurship Emphasis	4 SWS	Seminar	Terzidis
Exams					
WT 25/26	7900041	SIL Entrepreneurship Emphasis			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 6.376 Module component: SIL Entrepreneurship Project [T-WIWI-110166]

Coordinators: Prof. Dr. Orestis Terzidis
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-105010 - Student Innovation Lab (SIL) 1

Type	Credits	Grading	Term offered	Version
Examination of another type	3 CP	graded	Each winter term	1

Courses					
WT 25/26	2545082	SIL Entrepreneurship Project	4 SWS	Seminar	Terzidis
Exams					
WT 25/26	7900037	SIL Entrepreneurship Project			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 6.377 Module component: Simulation Game in Energy Economics [T-WIWI-108016]

Coordinators: Dr. Massimo Genoese
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101451 - Energy Economics and Energy Markets

Type	Credits	Grading	Term offered	Version
Examination of another type	3,5 CP	graded	Each summer term	2

Courses					
ST 2025	2581025	Simulation Game in Energy Economics	3 SWS	Lecture / Practice (/	Genoese, Zimmermann
Exams					
ST 2025	7981025	Simulation Game in Energy Economics			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 2025, 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 ad 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 6.378 Module component: Smart Energy Infrastructure [T-WIWI-107464]

Coordinators: Dr. Armin Ardone
Dr. Dr. Andrej Marko Pustisek
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101452 - Energy Economics and Technology

Type	Credits	Grading	Term offered	Version
Written examination	5,5 CP	graded	Each winter term	2

Courses					
WT 25/26	2581023	(Smart) Energy Infrastructure	4 SWS	Lecture / 🗣	Ardone, Pustisek, Schuler
Exams					
ST 2025	7900228	Smart Energy Infrastructure NEW			Fichtner
WT 25/26	7900178	Smart Energy Infrastructure NEW			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 derivates, e-fuels, reactive metals)
- storage systems (e.g. batteries)

Additionally, the lecture provides a toolbox for energy system analysis such as an overview and classification of energy systems modelling approaches as well as the usage of scenario techniques for energy systems analysis.

The lecture also provides practical examples for the relevant methods presented.

T 6.379 Module component: Smart Grid Applications [T-WIWI-107504]

Coordinators: Prof. Dr. Christof Weinhardt
Organisation: KIT Department of Economics and Management
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 6.380 Module component: Social Choice Theory [T-WIWI-102859]

Coordinators: Prof. Dr. Clemens Puppe
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101500 - Microeconomic Theory
M-WIWI-101504 - Collective Decision Making

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each summer term	3

Courses					
ST 2025	2520537	Social Choice Theory	2 SWS	Lecture / 🗣	Puppe, Kretz
ST 2025	2520539	Übung zu Social Choice Theory	1 SWS	Practice / 🗣	Puppe, Kretz
Exams					
ST 2025	7900039	Social Choice Theory (main date)			Puppe
ST 2025	7900045	Social Choice Theory (make-up date)			Puppe

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 2025, 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 prooving 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 6.381 Module component: Social Dimensions of Energy Transitions [T-WIWI-113935]

Coordinators: Prof. Dr. Wolf Fichtner
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101451 - Energy Economics and Energy Markets

Type	Credits	Grading	Term offered	Version
Written examination	3,5 CP	graded	Each summer term	1

Courses					
ST 2025	2581051	Social Dimensions of Energy Transitions	2 SWS	Lecture / 🗣	Fichtner, Sloot
Exams					
ST 2025	7900271	Social Dimensions of Energy Transitions			Fichtner
WT 25/26	7900280	Social Dimensions of Energy Transitions			Fichtner

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Assessment
Written examination (60 minutes). The examination is offered every semester and can be repeated at any regular examination date.

Workload
105 hours

Below you will find excerpts from courses related to this module component:

V Social Dimensions of Energy Transitions

2581051, SS 2025, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
Course topics:

Part I: Household energy use

1. Introduction: Energy use and human behavior
2. Bounded rationality and bias in decision-making
3. Identifying and measuring sustainable energy behavior
4. Financial incentives and demand response
5. Energy feedback
6. Social influence and energy behavior

Part II: Energy technology acceptance

7. Social acceptance of energy technologies
8. Efficacy and energy policy support
9. NIMBYism and local support for energy technologies
10. Framing, moral hazard and geoengineering
11. Political orientation
12. Public perceptions of energy security

T 6.382 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

Type	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each winter term	2

Courses					
WT 25/26	2424667	Software Architecture and Quality	2 SWS	Lecture / 🗣	Reussner
Exams					
ST 2025	7500021	Software Architecture and Quality			Reussner
WT 25/26	7500032	Software Architecture and Quality			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 120 minutes.

Prerequisites
This lecture and the lectures *Component-Based Software Development* and *Software Architecture* are mutually exclusive.

T 6.383 Module component: Software Architecture and Quality [T-INFO-101381]

Coordinators: Prof. Dr. Ralf Reussner
Organisation: KIT Department of Informatics
Part of: M-WIWI-107529 - Information Systems: Software & Systems Engineering

Type	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each winter term	2

Courses					
WT 25/26	2424667	Software Architecture and Quality	2 SWS	Lecture / 🗣	Reussner
Exams					
ST 2025	7500021	Software Architecture and Quality			Reussner
WT 25/26	7500032	Software Architecture and Quality			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 120 minutes.

Prerequisites
This lecture and the lectures *Component-Based Software Development* and *Software Architecture* are mutually exclusive.

T 6.384 Module component: Software Engineering II [T-INFO-114259]

Coordinators: Prof. Dr.-Ing. Anne Koziolek
Prof. Dr. Raffaela Mirandola
Prof. Dr. Ralf Reussner

Organisation: KIT Department of Informatics

Part of: M-INFO-107235 - Software Engineering II

Type	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each summer term	1

Courses					
ST 2025	24076	Software Engineering II	4 SWS	Lecture / 🗣	Reussner, Mirandola, Dehghani
Exams					
ST 2025	7500207	Software Engineering II			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 6.385 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

Courses					
ST 2025	2424880	Projektorientiertes Softwarepraktikum (Parallele Numerik)	6 SWS	Practical course /	Karl, Alefeld, Hoffmann

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

T 6.386 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	Credits	Grading	Term offered	Version
Oral examination	3 CP	graded	Each summer term	1

Courses					
ST 2025	2400050	Software Product Line Engineering	2 SWS	Lecture / Practice (/	Feichtinger
Exams					
ST 2025	7500280	Software Product Line Engineering			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 6.387 Module component: Software Quality Management [T-WIWI-102895]

Coordinators: Prof. Dr. Andreas Oberweis
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101477 - Development of Business Information Systems
M-WIWI-107529 - Information Systems: Software & Systems Engineering

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each summer term	3

Courses					
ST 2025	2511208	Software Quality Management	2 SWS	Lecture / 🗣	Oberweis
ST 2025	2511209	Übungen zu Software-Qualitätsmanagement	1 SWS	Practice / 🗣	Oberweis, Forell
Exams					
ST 2025	79AIFB_STQM_A5	Software Quality Management (Registration extended until 28.07.2025)			Oberweis
WT 25/26	79AIFB_STQM_C1	Software Quality Management			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 2025, 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 mail models of sofware 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 6.388 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	Credits	Grading	Term offered	Version
Oral examination	3 CP	graded	Each summer term	1

Courses					
ST 2025	2400059	Software Security Engineering	2 SWS	Lecture / 🗣	Gerking
Exams					
ST 2025	7500357	Software Security Engineering			Gerking
WT 25/26	7500040	Software Security Engineering			Gerking

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 Engineering I and Software Engineering II is recommended.

T 6.389 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	Software Evolution	2 SWS	Lecture / 🗣	Lange
Exams					
ST 2025	7500023	Software-Evolution			Reussner
WT 25/26	7500004	Software-Evolution			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 6.390 Module component: Spatial Economics [T-WIWI-103107]

Coordinators: Prof. Dr. Ingrid Ott
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101485 - Transport Infrastructure Policy and Regional Development
M-WIWI-107010 - Economics in a Connected World

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each winter term	1

Courses					
WT 25/26	2561260	Spatial Economics	2 SWS	Lecture / 🗣	Ott
WT 25/26	2561261	Exercise for Spatial Economics	1 SWS	Practice / 🗣	Ott, Mirzoyan
Exams					
WT 25/26	7900075	Spatial Economics			Ott
WT 25/26	7900276	Spatial Economics			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 6.391 Module component: Special Topics in Information Systems [T-WIWI-113726]

Coordinators: Prof. Dr. Christof Weinhardt
Organisation: KIT Department of Economics and Management
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.

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 6.392 Module component: Special Topics in Information Systems [T-WIWI-113727]

Coordinators: Prof. Dr. Christof Weinhardt
Organisation: KIT Department of Economics and Management
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.

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 6.393 Module component: Special Topics in Information Systems [T-WIWI-113724]

Coordinators: Prof. Dr. Christof Weinhardt
Organisation: KIT Department of Economics and Management
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.

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 6.394 Module component: Special Topics in Information Systems [T-WIWI-113725]

Coordinators: Prof. Dr. Christof Weinhardt
Organisation: KIT Department of Economics and Management
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.

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 6.395 Module component: Startup Experience [T-WIWI-111561]

Coordinators: Prof. Dr. Orestis Terzidis
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101488 - Entrepreneurship (EnTechnon)

Type	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Each term	1

Courses					
ST 2025	2545004	Startup Experience	4 SWS	Seminar / 🗣	Weimar, Terzidis, Rosales Bravo, Martjan
WT 25/26	2545004	Startup Experience	4 SWS	Seminar / 🗣	Weimar, Martjan, Terzidis
Exams					
ST 2025	7900186	Startup Experience			Terzidis
WT 25/26	7900186	Startup Experience			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** — **Seminar (S) On-Site**
2545004, SS 2025, 4 SWS, Language: English, Open in study portal

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.

V **Startup Experience** **Seminar (S)**
2545004, WS 25/26, 4 SWS, Language: English, Open in study portal **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.

T 6.396 Module component: Statistical Modeling of Generalized Regression Models [T-WIWI-103065]

Coordinators: apl. Prof. Dr. Wolf-Dieter Heller
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101638 - Econometrics and Statistics I
M-WIWI-101639 - Econometrics and Statistics II
M-WIWI-105414 - Statistics and Econometrics II

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each winter term	1

Courses					
WT 25/26	2521350	Statistical Modeling of Generalized Regression Models	2 SWS	Lecture	Heller
Exams					
WT 25/26	7900011	Statistical Modeling of Generalized Regression Models			Heller
WT 25/26	7900146 (WS23/24)	Statistical Modeling of generalized regression models			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 6.397 Module component: Stochastic Calculus and Finance [T-WIWI-103129]

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

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each winter term	1

Courses					
WT 25/26	2521331	Stochastic Calculus and Finance	2 SWS	Lecture	Safarian
WT 25/26	2521332	Übungen zu Stochastic Calculus and Finance	2 SWS	Practice	Safarian
Exams					
WT 25/26	7900225	Stochastic Calculus and Finance			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 we be put on both finance and the theory behind it.

Content:

The course will provide rigorous yet focused training in stochastic calculus and mathematical finance. Topics to be covered:

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 6.398 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	Stochastic Information Processing	3 SWS	Lecture / 🗣	Hanebeck
Exams					
ST 2025	7500010	Stochastic Information Processing			Hanebeck
WT 25/26	7500031	Stochastic Information Processing			Hanebeck

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

Below you will find excerpts from courses related to this module component:

V Stochastic Information Processing

2424113, WS 25/26, 3 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
In order to handle complex dynamic systems (e.g., in robotics), an in-step estimation of the system's internal state (e.g., position and orientation of the actuator) is required. Such an estimation is ideally based on the system model (e.g., a discretized differential equation describing the system dynamics) and the measurement model (e.g., a nonlinear function that maps the state space to a measurement subspace). Both system and measurement model are uncertain (e.g., include additive or multiplicative noise).

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 distribution densities at discrete points in the state space. Although the working principle of these procedures is usually quite simple, a practical implementation often turns out to be difficult and especially for higher-dimensional systems it is computationally complex.

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 presented 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 6.399 Module component: Strategy and Management Theory: Developments and “Classics” [T-WIWI-106190]

Coordinators: Prof. Dr. Hagen Lindstädt
Organisation: KIT Department of Economics and Management
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	Strategy and Management Theory: Developments and "Classics" (Master)	2 SWS	Seminar / 🗣	Lindstädt
Exams					
WT 25/26	7900120	Strategy and Management Theory: Developments and “Classics”			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)** — **Seminar (S) On-Site**
2577921, WS 25/26, 2 SWS, Language: German, Open in study portal

Content

This course covers highly topical issues of great relevance to the management of organizations. Students will be enabled to take strategic management positions. By applying appropriate models from the fields of strategy and management - or models developed in-house - participants will learn to evaluate the strategic starting position of an organization and derive precise and well-founded recommendations for action based on this.

This course offers students the opportunity to explore current management issues and sharpen their skills in strategic analysis and evaluation. Through intensive collaboration and practical application of the knowledge learned, students are optimally prepared for the demands and challenges of modern business management.

Structure

The course begins with an overarching theme, based on which students are divided into groups of two. The core of the course consists of the preparation of a written paper as well as the presentation and discussion of the results.

Learning Objectives

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

- analyze complex business situations, think strategically and derive sound management decisions.
- compose clear and convincing written papers that accurately present the analyses and recommendations developed.
- present results in an engaging manner and actively participate in substantive discussions.

Recommendations:

Prior attendance of the Bachelor's module "Strategy and Organization" or another module with comparable content at another university is recommended.

Workload:

Total effort approx. 90 hours

Attendance time: 15 hours

Preparation and follow-up: 75 hours

Examination and preparation: not applicable

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 6.400 Module component: Successful Transformation Through Innovation [T-WIWI-111823]

Coordinators: Malte Busch
Organisation: KIT Department of Economics and Management
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 2025	2500018	Successful transformation through innovation	2 SWS	Seminar / 🗣	Busch
Exams					
ST 2025	7900025	Successful Transformation Through Innovation			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 2025, 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

T 6.401 Module component: Supplement Enterprise Information Systems [T-WIWI-110346]

Coordinators: Prof. Dr. Andreas Oberweis
Organisation: KIT Department of Economics and Management
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
The assessment of this course is a written or (if necessary) oral examination.

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 6.402 Module component: Supply Chain Management with Advanced Planning Systems [T-WIWI-102763]

Coordinators: Claus J. Bosch
Dr. Mathias Göbelt

Organisation: KIT Department of Economics and Management

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 summer term	1

Courses					
ST 2025	2581961	Supply Chain Management with Advanced Planning Systems	2 SWS	Lecture / 🗣	Göbelt, Bosch
Exams					
ST 2025	7981961	Supply Chain Management with Advanced Planning Systems			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 2025, 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 6.403 Module component: Tax Law [T-INFO-111437]

Coordinators: Detlef Dietrich
Organisation: KIT Department of Informatics
Part of: M-INFO-101216 - Private Business Law

Type	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each summer term	1

Courses					
ST 2025	24646	Tax Law	2 SWS	Lecture / 🗣	Dietrich
Exams					
ST 2025	7500120	Tax Law			Sattler
WT 25/26	7500062	Tax Law			Matz

Legend: 💻 Online, 🎲 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

T 6.404 Module component: Telecommunications and Internet – Economics and Policy [T-WIWI-113147]

Coordinators: Prof. Dr. Kay Mitusch
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101406 - Network Economics
M-WIWI-101409 - Electronic Markets
M-WIWI-107010 - Economics in a Connected World

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each winter term	1

Courses					
WT 25/26	2561232	Telecommunication and Internet - Economics and Policy	2 SWS	Lecture /	Mitusch
WT 25/26	2561233	Excercises to Telecommunication and Internet - Economics and Policy	1 SWS	Practice /	Mitusch, Corbo
Exams					
ST 2025	7900276	Telecommunications and Internet – Economics and Policy			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 6.405 Module component: Telecommunications Law [T-INFO-101309]

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	1

Courses					
ST 2025	2424632	Telekommunikationsrecht	2 SWS	Lecture / 🗣	Döveling
Exams					
ST 2025	7500085	Telecommunications Law			Zufall

Legend: 📱 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

T 6.406 Module component: Telematics [T-INFO-114269]

Coordinators: Prof. Dr. Martina Zitterbart
Organisation: KIT Department of Informatics
Part of: M-INFO-107243 - Telematics

Type	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each winter term	1

Courses					
WT 25/26	2400007	Telematics	4 SWS	Lecture / 🗣	Zitterbart, Helmig, Mahrt, Seehofer
Exams					
ST 2025	7500098	Telematics			Zitterbart
WT 25/26	7500166	Telematics			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 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

- 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** — **Lecture (V) On-Site**
2400007, WS 25/26, 4 SWS, Language: English, Open in study portal

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.

Familiary 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 6.407 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	Each summer term	1

Courses					
WT 25/26	2400151	Testing Digital Systems I	2 SWS	Lecture / 🗣	Tahoori
Exams					
WT 25/26	7500039	Testing Digital Systems I			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 6.408 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 6.409 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	Credits	Grading	Version
Oral examination	3 CP	graded	1

Courses					
WT 25/26	2400170	The Casteljau's Algorithms	2 SWS	Lecture / 🗣	Prautzsch
Exams					
WT 25/26	7500020	De Casteljau's Algorithm			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 6.410 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	Code, Capital, and Conscience: the Ethics and Politics of Information Technology in Market Economies	2 SWS	Block / 🗣	Derpmann
Exams					
WT 25/26	7400772	The Ethics and Politics of Information Technology in Market Economies			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

Block (B) On-Site

5012090, WS 25/26, 2 SWS, Language: English, Open in study portal

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 6.411 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	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each winter term	1

Courses					
WT 25/26	2400237	Theoretical Foundations of Cryptography	3 SWS	Lecture / 🗣	Müller-Quade, Berger, Klooß
Exams					
ST 2025	7500002	Theoretical Foundations of Cryptography			Müller-Quade

Legend: 📱 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

T 6.412 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

Courses					
ST 2025	2400146	Timed Systems	4 SWS	Lecture	Schwammberger, Hamarneh
Exams					
ST 2025	7500348	Timed Systems			Schwammberger

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).

Below you will find excerpts from courses related to this module component:

V **Timed Systems** **Lecture (V)**
2400146, SS 2025, 4 SWS, Language: English, Open in study portal

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. We also expect fast response times from the various apps on our smartphones so that we can use them conveniently and effectively.
“Time” is therefore a crucial factor when modeling software systems. In this lecture, various mechanisms are described for formalizing so-called real-time systems. In addition to modeling, the lecture also focuses on analyzing the systems. The following topics in particular are covered:

- Timed Automata (an extension of finite automata to include time)
- Temporal Logics (Computation Tree Logic)
- Model checking of Timed Automata using the Tool 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. Exercises are offered to apply and transfer the lecture content and are discussed in the bi-weekly exercise. Additionally, interactive lecture parts will be included in the lecture schedule, to foster active learning instead of purely theoretical and frontal content. Invited talks from academia and industry will further on shed light on real-world applications of timed systems.

Organizational issues
IMPORTANT NOTE:

The first lecture will be on THURSDAY, 24. April 2025, 11:30-13:00.

Thus, there will be NO LECTURE on TUESDAY, 22nd April, 9:45-11:15.

T 6.413 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	graded	Each winter term	1

Courses					
WT 25/26	2400215	Tools for Probabilistic Machine Learning	3 SWS	Lecture / 🗣	Frisch
Exams					
ST 2025	7500487	Tools for Probabilistic Machine Learning			Hanebeck
WT 25/26	7500093	Tools for Probabilistic Machine Learning			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 (V)
On-Site

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 the lecturer. Don't forget the additional registration in CAS.

Organizational issues

Enthält eine digitale Übung mit Programmieraufgaben.

T 6.414 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	Tools for Probabilistic Machine Learning	3 SWS	Lecture / 🗣	Frisch
Exams					
ST 2025	7500488	Tools for Probabilistic Machine Learning - Pass			Hanebeck
WT 25/26	7500096	Tools for Probabilistic Machine Learning - Pass			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 (V)
On-Site

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 the lecturer. Don't forget the additional registration in CAS.

Organizational issues
Enthält eine digitale Übung mit Programmieraufgaben.

T 6.415 Module component: Topics in Experimental Economics [T-WIWI-102863]

Coordinators: Prof. Dr. Johannes Philipp Reiß
Organisation: KIT Department of Economics and Management
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 6.416 Module component: Topics in Stochastic Optimization [T-WIWI-112109]

Coordinators: Prof. Dr. Steffen Rebennack
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101473 - Mathematical Programming
M-WIWI-101637 - Analytics and Statistics
M-WIWI-102832 - Operations Research in Supply Chain Management
M-WIWI-103289 - Stochastic Optimization

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 6.417 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	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each term	1

Courses					
ST 2025	24609	Trademark and Unfair Competition Law	2 SWS	Lecture / 🗣	Matz
WT 25/26	2424136	Trademark and Unfair Competition Law	2 SWS	Lecture / 🗣	Matz
Exams					
ST 2025	7500051	Trademark and Unfair Competition Law			Matz
WT 25/26	7500061	Trademark and Unfair Competition Law			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 6.418 Module component: Transport Economics [T-WIWI-100007]

Coordinators: Prof. Dr. Kay Mitusch
Dr. Eckhard Szimba

Organisation: KIT Department of Economics and Management

Part of: M-WIWI-101406 - Network Economics
M-WIWI-101468 - Environmental Economics
M-WIWI-101485 - Transport Infrastructure Policy and Regional Development

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each summer term	1

Courses					
ST 2025	2560230	Transport Economics	2 SWS	Lecture	Mitusch, Szimba
ST 2025	2560231	Übung zu Transportökonomie	1 SWS	Practice	Krenn
Exams					
ST 2025	7900275	Transport Economics			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 2025, 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 logisticans 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, 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 6.419 Module component: Ubiquitous Computing [T-INFO-101326]

Coordinators: Prof. Dr.-Ing. Michael Beigl
Organisation: KIT Department of Informatics
Part of: M-WIWI-107531 - Information Systems: Interactive Systems

Type	Credits	Grading	Term offered	Version
Oral examination	5 CP	graded	Each winter term	1

Courses					
WT 25/26	2424146	Ubiquitäre Informationstechnologien		Lecture / Practice (	Beigl, Röddiger
Exams					
ST 2025	7500367_14.07.2025	Ubiquitous Computing			Beigl
ST 2025	7500395.07.04.2025	Ubiquitous Computing			Beigl
WT 25/26	7500367_07.11.2025	Ubiquitous Computing			Beigl

Assessment
The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting 20 minutes.

Prerequisites
None.

T 6.420 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

Type	Credits	Grading	Term offered	Version
Oral examination	5 CP	graded	Each winter term	1

Courses					
ST 2025	24844	Seminar: Ubiquitous Systems	2 SWS	Seminar /	Riedel, Beigl, Röddiger
Exams					
ST 2025	7500367_14.07.2025	Ubiquitous Computing			Beigl
ST 2025	7500395.07.04.2025	Ubiquitous Computing			Beigl
WT 25/26	7500367_07.11.2025	Ubiquitous Computing			Beigl

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.

T 6.421 Module component: Valuation [T-WIWI-102621]

Coordinators: Prof. Dr. Martin Ruckes
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101480 - Finance 3
M-WIWI-101482 - Finance 1
M-WIWI-101483 - Finance 2
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	Valuation	2 SWS	Lecture / 🗣	Ruckes
WT 25/26	2530213	Übungen zu Valuation	1 SWS	Practice / 🗣	Ruckes, Luedecke
Exams					
ST 2025	7900072	Valuation			Ruckes
WT 25/26	7900057	Valuation			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 6.422 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 2025	2400175	Visualisierung	2 SWS	Lecture / 🗣	Dachsbacher, Piochowiak
Exams					
ST 2025	7500193	Visualization			Dachsbacher
WT 25/26	7500563	Visualization			Dachsbacher

Legend: 💻 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

T 6.423 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	Credits	Grading	Term offered	Version
Written examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	2400062	Wearable Robotic Technologies	2 SWS	Lecture / 🗣	Asfour, Beigl
Exams					
ST 2025	7500219	Wearable Robotic Technologies			Asfour, Beigl
WT 25/26	7500073	Wearable Robotic Technologies			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
Attending the lecture Mechano-Informatics and Robotics is recommended.

Recommendations
Attending the lecture Mechano-Informatics and Robotics is recommended.

Below you will find excerpts from courses related to this module component:

V Wearable Robotic Technologies

2400062, SS 2025, 2 SWS, Language: English, Open in study portal

Lecture (V)
On-Site

Content
The lecture starts with an overview of wearable robot technologies (exoskeletons, prostheses and ortheses) and its potentials, followed by the basics of wearable robotics. In addition to different approaches to the design of wearable robots and their related actuator and sensor technology, the lecture focuses on modeling the neuromusculoskeletal system of the human body and the physical and cognitive human-robot interaction for tightly coupled hybrid human-robot systems. Examples of current research and various applications of lower, upper and full body exoskeletons as well as prostheses are presented.

Learning Objectives:

The students have received fundamental knowledge about wearable robotic technologies and understand the requirements for the design, the interface to the human body and the control of wearable robots. They are able to describe methods for modelling the human neuromusculoskeletal system, the mechatronic design, fabrication and composition of interfaces to the human body. The students understand the symbiotic human–machine interaction as a core topic of Anthropomatics and have knowledge of state-of-the-art examples of exoskeletons, orthoses and prostheses.

Organizational issues
Sucess is assessed in the form of a written examination, usually lasting 60 minutes in accordance with § 4 (2) No. 1 SPO.

Module for Master Mechanical Engineering, Mechatronics and Information Technology, Electrical Engineering and Information Technology, Sports Science, and Bachelor Mechatronics and Information Technology

Recommendations: Attendance of the lecture *Mechano-Informatics and Robotics* is recommended.

Workload: 120h

Literature
Lecture slides and selected current literature references will be given in the lecture and made available in ILIAS.

T 6.424 Module component: Web App Programming for Finance [T-WIWI-110933]

Coordinators: Prof. Dr. Julian Thimme
Organisation: KIT Department of Economics and Management
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 6.425 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	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2025	24677	Web Applications and Service oriented Architectures (II)	2 SWS	Lecture / 🗣	Abeck, Schneider, Throner
Exams					
ST 2025	7500138	Web Applications and Service-oriented Architectures (II)			Abeck

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

T 6.426 Module component: Workshop Business Wargaming – Analyzing Strategic Interactions [T-WIWI-106189]

Coordinators: Prof. Dr. Hagen Lindstädt
Organisation: KIT Department of Economics and Management
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 2025	2577922	Workshop Business Wargaming - Analyse strategischer Interaktionen (Master)	2 SWS	Seminar / 🗣	Lindstädt
Exams					
ST 2025	7900071	Workshop Business Wargaming – Analyzing Strategic Interactions			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)** — **Seminar (S) On-Site**
2577922, SS 2025, 2 SWS, Language: German, Open in study portal

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 6.427 Module component: Workshop Current Topics in Strategy and Management [T-WIWI-106188]

Coordinators: Prof. Dr. Hagen Lindstädt
Organisation: KIT Department of Economics and Management
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 2025	2577923	Workshop aktuelle Themen Strategie und Management (Master)	2 SWS	Seminar / 🗣	Lindstädt
WT 25/26	2577923	Workshop aktuelle Themen Strategie und Management (Master)	2 SWS	Seminar / 🗣	Lindstädt
Exams					
ST 2025	7900122	Workshop Current Topics in Strategy and Management			Lindstädt
WT 25/26	7900171	Workshop Current Topics in Strategy and Management			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, SS 2025, 2 SWS, Language: German, Open in study portal

Seminar (S)
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.

Note:

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.

V **Workshop aktuelle Themen Strategie und Management (Master)** **Seminar (S)**
2577923, WS 25/26, 2 SWS, Language: German, Open in study portal **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.