Karlsruher Institut für Technologie

Module Handbook
Computer Science Master 2025 (Master of Science (M.Sc.))

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KIT DEPARTMENT OF INFORMATICS

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5.130. Practical Course: Movement and Technology - T-INFO-113394 414
5.131. Practical Course: Natural Language Dialog Systems - T-INFO-114206 415
5.132. Practical Course: Neural Network Acceleration on FPGAs - T-INFO-113122 416
5.133. Practical Course: Performance Engineering in C++ and Rust - T-INFO-115280 417
5.134. Practical Course: Programming Language Design and Implementation - T-INFO-115486 418
5.135. Practical Course: Real-world Vulnerability Discovery and Exploits - T-INFO-113350 419
5.136. Practical Course: Robotics - T-INFO-114172 420
5.137. Practical Course: Route Planning - T-INFO-114899 421
5.138. Practical Course: Security, Usability and Society - T-INFO-110990 422
5.139. Practical Course: Smart Energy System - T-INFO-112030 423
5.140. Practical Course: Software Development and Application of Mobile, Bio-Inspired Robots - T-MACH-113854 424
5.141. Practical Course: Visual Computing - T-INFO-103000 425
5.142. Practical Introduction to Hardware Security - T-INFO-114267 426
5.143. Practical SAT Solving - T-INFO-114262 427
5.144. Practice of Research (Methods, 1st Semester) - T-INFO-115231 428
5.145. Practice of Research (Methods, 2nd Semester) - T-INFO-115232 429
5.146. Practice of Research (Project, 1st Semester) - Oral Exam - T-INFO-115235 430
5.147. Practice of Research (Project, 1st Semester) - Presentation - T-INFO-115233 431
5.148. Practice of Research (Project, 1st Semester) - Project Proposal - T-INFO-115234 432
5.149. Practice of Research (Project, 2nd Semester) - Oral Exam - T-INFO-115236 433
5.150. Practice of Research (Project, 2nd Semester) - Presentation - T-INFO-115237 434
5.151. Privacy Enhancing Technologies - T-INFO-110989 435
5.152. Probability and Computing - T-INFO-114196 436
5.153. Public International Law - T-INFO-113381 437
5.154. Reading Group - T-INFO-102051 438
5.155. Reinforcement Learning - T-INFO-111255 439
5.156. Reliable Computing I - T-INFO-101387 440
5.157. Research Focus Class: Blockchain & Cryptocurrencies - T-INFO-113400 441
5.158. Research Focus Class: Blockchain & Cryptocurrencies - Seminar - T-INFO-113401 442
5.159. Research Practical Course on Behavior Foundation Models - T-INFO-115118 443
5.160. Research Practical Course: Artificial Intelligence & Security - T-INFO-113759 444
5.161. Research Practical Course: Explainable Artificial Intelligence - T-INFO-113114 445
5.162. Research Project (Project, 2nd Semester) - Scientific Report - T-INFO-115238 446
5.163. Research Project Deep Learning for Robotics - T-INFO-114203 447
5.164. Research Project: Generative AI for Autonomous Agents - T-INFO-114189 448
5.165. Resilient Networking - T-INFO-111209 449
5.166. Robotic Intelligence: Navigation and Mobile Manipulation - T-MACH-114952 450
5.167. Robotic Intelligence: Perception and Scene Understanding - T-MACH-114813 451
5.168. Robotics I - Introduction to Robotics - T-INFO-114190 452
5.169. Robotics II - Humanoid Robotics - T-INFO-114152 453
5.170. Robotics III - Sensors and Perception in Robotics - T-INFO-114155 454
5.171. Robotics Institute Germany - Lecture Series - T-INFO-114895 455
5.172. Sampling Methods for Machine Learning - T-INFO-114133 456
5.173. Sampling Methods for Machine Learning - Pass - T-INFO-114134 457
5.174. Scalable Graph and Sparse Matrix Algorithms for Learning - T-INFO-115282 458
5.175. Scientific Methods to Design and Analyze Secure Decentralized Systems - T-INFO-111568 459
5.176. Self-Booking-HOC-SPZ-FORUM-PEBA-Graded - T-INFO-111475 460
5.177. Self-Booking-HOC-SPZ-FORUM-PEBA-Graded - T-INFO-115028 461
5.178. Self-Booking-HOC-SPZ-FORUM-PEBA-Graded - T-INFO-115027 462
5.179. Self-Booking-HOC-SPZ-FORUM-PEBA-Graded - T-INFO-111474 463
5.180. Self-Booking-HOC-SPZ-FORUM-PEBA-Graded - T-INFO-111476 464
5.181. Self-Booking-HOC-SPZ-FORUM-PEBA-ungraded - T-INFO-115077 465
5.182. Self-Booking-HOC-SPZ-FORUM-PEBA-ungraded - T-INFO-111479 466

5.183. Self-Booking-HOC-SPZ-FORUM-PEBA-ungraded - T-INFO-115030 467
5.184. Self-Booking-HOC-SPZ-FORUM-PEBA-ungraded - T-INFO-115029 468
5.185. Self-Booking-HOC-SPZ-FORUM-PEBA-Ungraded - T-INFO-111478 469
5.186. Self-Booking-HOC-SPZ-FORUM-PEBA-Ungraded - T-INFO-111477 470
5.187. Seminar Dependable Computing - T-INFO-105577 471
5.188. Seminar for Practical Course: Machine Learning and Intelligent Systems - T-INFO-115260 472
5.189. Seminar in Privacy - T-INFO-114268 473
5.190. Seminar on Behavior Foundation Models - T-INFO-115119 474
5.191. Seminar Radiation Protection in Medicine - T-ETIT-115253 475
5.192. Seminar: Advanced Topics in Natural Language Processing - T-INFO-114433 476
5.193. Seminar: Advanced Topics on SAT Solving - T-INFO-114231 477
5.194. Seminar: Algorithm Engineering - T-INFO-112312 478
5.195. Seminar: Artificial Intelligence for Energy Systems - T-INFO-113110 479
5.196. Seminar: Bionic Algorithms and Robot Technologies - T-MACH-113842 480
5.197. Seminar: Continuous Software Engineering - T-INFO-110794 481
5.198. Seminar: Critical Topics in AI - T-INFO-113915 482
5.199. Seminar: Current Trends in Theoretical Computer Science - T-INFO-114091 483
5.200. Seminar: Deep Learning for Robotics - T-INFO-114204 484
5.201. Seminar: Embedded Systems I - T-INFO-114255 485
5.202. Seminar: Embedded Systems II - T-INFO-114256 486
5.203. Seminar: Exoskeletons & Motion Capture - T-INFO-113892 487
5.204. Seminar: Explainable Artificial Intelligence - T-INFO-113115 488
5.205. Seminar: Exploring Robotics - Insights from Science Fiction, Research and Society - T-INFO-113398 489
5.206. Seminar: Failing Forward: Robotics, Critical Reading and the Making of Good Research - T-INFO-114604 490
5.207. Seminar: Fine-Grained Complexity Theory & Algorithms - T-INFO-113392 491
5.208. Seminar: Hot Topics in Artificial Intelligence & Security 1 - T-INFO-113761 492
5.209. Seminar: Hot Topics in Artificial Intelligence & Security 2 - T-INFO-113762 493
5.210. Seminar: Hot Topics in Bioinformatics - T-INFO-101287 494
5.211. Seminar: Hot Topics in Decentralized Systems - T-INFO-109922 495
5.212. Seminar: Hot Topics in Explainable Artificial Intelligence (XAI) - T-INFO-112917 496
5.213. Seminar: Information Systems - T-INFO-115055 497
5.214. Seminar: Interpretability and Causality in Machine Learning - T-INFO-114237 498
5.215. Seminar: Law and Legal Studies - T-INFO-114094 499
5.216. Seminar: Machine Learning in Climate and Environmental Sciences - T-INFO-113519 500
5.217. Seminar: Neural Networks and Artificial Intelligence - T-INFO-115209 501
5.218. Seminar: Operating Systems - T-INFO-114230 502
5.219. Seminar: Post-Quantum Cryptography - T-INFO-111200 503
5.220. Seminar: Practical Graph Algorithms - T-INFO-114297 504
5.221. Seminar: Privacy and Security - T-INFO-114236 505
5.222. Seminar: Proofs from THE BOOK - T-INFO-106604 506
5.223. Seminar: Quantum Information Theory - T-INFO-110904 507
5.224. Seminar: Recent Highlights in Algorithms - T-INFO-114201 508
5.225. Seminar: Robot Reinforcement Learning - T-INFO-115349 509
5.226. Seminar: Secure Multiparty Computation - T-INFO-111501 510
5.227. Seminar: Software Architecture, Security and Privacy - T-INFO-114260 511
5.228. Seminar: Speech-to-Speech Translation - T-INFO-114208 512
5.229. Seminar: Type Systems and Static Program Analysis - T-INFO-114955 513
5.230. Service Design Thinking - T-WIWI-102849 514
5.231. SIL Entrepreneurship Project - T-WIWI-110166 515
5.232. Simulation and Optimization in Robotics and Biomechanics - T-INFO-113123 516
5.233. Simulation and Optimization in Robotics and Biomechanics - Pass - T-INFO-114838 517
5.234. Software Architecture and Quality - T-INFO-114261 518
5.235. Software Engineering II - T-INFO-114259 519
5.236. Software Product Line Engineering - T-INFO-114234 520
5.237. Software Security Engineering - T-INFO-112862 521
5.238. Software-Evolution - T-INFO-101256 522
5.239. Softwaretest and Quality Management (SQM) - T-INFO-114263 523
5.240. Stochastic Information Processing - T-INFO-115261 524
5.241. Systems and Software Engineering - T-ETIT-100675 525
5.242. Systems Engineering for Automotive Electronics - T-ETIT-100677 526
5.243. Telematics - T-INFO-114269 527
5.244. Testing Digital Systems I - T-INFO-101388 528

5.245. Testing Digital Systems II - T-INFO-105936 529
5.246. Text-Indexing - T-INFO-114226 530
5.247. Text-Indexing Project/Experiment - T-INFO-114227 531
5.248. Theory of Satisfiability Algorithms - T-INFO-114982 532
5.249. Type Systems and Program Analysis - T-INFO-115016 533
5.250. Ubiquitous Computing - T-INFO-114188 534
5.251. User Studies in Human-Robot Interaction - T-INFO-115244 535
5.252. Wearable Robotic Technologies - T-INFO-114145 536

1 Introduction

The module handbook is the official guide for students regarding their academic progress and program of study. It describes the modules and the corrsponding exams. It also explains their interdependencies, for example the need to pass one module before taking another. For each module its content and the qualification goals are provided. Furthermore, the module handbook explains the means of measuring academic success, such as the type of exam or course work (in German: "Studienleistung") the students must pass. The scope of each module is indicated by credit points (CP), which are credited after the successful completion of the module. CP = ECTS (European Credit Transfer System) = Leistungspunkte in German (LP).

The course catalog (in German: "Vorlesungsverzeichnis", https://campus.studium.kit.edu/events/catalog.php) complements the module handbook and provides up-to-date information on various event data (e.g. time and place of the course) for each semester.

Every semester the module handbook is updated. The new module handbook is available about a month before the semester begins. Prior to that students can refer to the current module handbook but should expect changes, especially with elective modules.

The most important information regarding modules is:

- Are there prerequisites or other requirements for this module?
- How many credits are you awarded for the module?
- What term is the module held in? E.g. summer / winter term
- Which language is the module held in?
- Who is responsible for the module? E.g. which professor

The purpose of this introduction is to give an overview of the study program in computer science at KIT and provide additional regulations, not specified in the Study and Examination Regulations (in German Prüfungsordnung). It provides students with a more well-rounded idea of the requirements of the modules and their field of study. It also gives information on elective modules, study minors and interdisciplinary qualifications (= soft skills), helping the students to make a more personal plan of study, taking into consideration factors like the turns of the modules.

1.1 Program and Qualification Profile

The Master of Science in Computer Science continues the education and development of the scientific competences that the students have acquired during their Bachelor program of study. The Master Program of Study provides students with the knowledge and skills necessary for scientific work and research. The program stands out due to the variety and broad range of the courses. This Master Program of Study is structured to provide well-grounded and a broad based education at the same time. Students are required to take two graduate specializations. The program offers a wide variety of specializations in computer science areas including Theoretical Foundations, Algorithm Engineering, Cryptography and Security, Parallel Computing, Software Engineering and Compiler Construction, Design of Embedded Systems and Computer Architectures, Telematics, Anthropomatics and Cognitive Systems and Robotics and Automation.

The core focus of the program is the two graduate specializations. For each specialization, students have to select courses of at least 15 ECTS. For a comprehensive education the program offers a broad variety of compulsory courses. Students must also select a minor in a related interdisciplinary field (minor studies). Key competences such as social and teamwork skills are also mandatory (key competences).

Graduates of the Master of Science in Computer Science are equipped with essential skills:

- *Computer Science Competences (Core Competences)*
  Graduates are able to independently apply and enhance their scientific knowledge and methods in computer science. They can assess the relevance and consequences of different computer science methods in solving complex scientific and social problems. Graduates have the necessary skills needed to successfully solve applied as well as scientifically complex problems in the field of computer science and related interdisciplinary fields.
- *Communication Skills*
  Graduates can present and explain computer science ideas clearly and convincingly, both orally and in writing. They are able to communicate effectively to and with technical and non-technical audiences.
- *Team-work and Project Work*
  Graduates are able to work in multidisciplinary teams. They have project planning and organizing skills.
- *Commitment to Society (Commitment to the Civil Society)*
  Graduates recognize the impact of computer science in a societal context. They have the understanding of professional and ethical responsibilities and are able to act accordingly.
- *Personal and Professional Development*
  Graduates are able to adapt to the newest technologies and use their knowledge for further development.

1.2 Additional certficates within the Master's program

The KIT Department of Informatics offers eight different certificates within the Master's program. The Master Computer Science can be completed with or without a certificate. The regulations for completing a certificate are ment as guidelines for structuring the study plans, no additional effort should be necessary. The study and examination regulations for the Master's degree program apply unchanged, when students aim to achieve a certificate. Certificates are awarded at the end of the studies in addition to the Master's certificate in computer science, e.g. “Master of Computer Science with an IT Security profile”. An

overview of the certificates and the associated guidelines and regulations can be found at: https://www.informatik.kit.edu/english/9378.php

1.3 Modularization of computer science studies

The Computer Science program has a structure based on modules. A module may consist of several courses or only one course. Modules themselves are classified into ten areas of specialization. The module hand book only contains those areas of specialization, that can be studied completly in english. For further areas of specialization, you may refer to the german module hand book of "Master of Science in Informatik". The structure of the Master Program of Study is:

- 2 Areas of specialization
- Elective Studies in Computer Science
- Minor Studies
- Interdisciplinary Qualifications

Further constraints students must fulfill are:

- to choose four advanced mandatory modules (in German Stammmodule, see 2.1) in their areas of specialization or their elective studies
- to choose 12 – 18 CP of practical courses and seminars (see 2.2) in their areas of specialization or their elective studies.

1.3.1 Credit points

To keep track of the students' performance, study and examination achievements are evaluated with credit points (CP = ECTS European Credit Transfer System, in German Leistunspunkte = LP). One credit point corresponds to approximately 30 hours of workload for an average student.

1.3.2 Modules and partial achievements

Modules contain one or more partial achievements and their description. Partial achievements are abstract descriptions of the examinations or of the type of course work required for passing the module. Prerequisites and recommendations are also specified for each partial achievement.

Modules and partial achievements are assigned credit points. On the one hand the credits indicate the amount of work necessary in order to pass the examinations and fullfill all requirements in a module. On the other hand, the credits usually also indicate the weight of a partial achievement in a specific module. Exceptions from this rule are specified accordingly.Details on the calculation of the module grades or of the Bachelor final grade are published on the department website: https://www.informatik.kit.edu/faq-wiki/doku.php?id=notenberechnung.

The section field of study (see section 3) in the handbook contains the structure of the master program of study and the specific modules to be chosen in each area. From there you can navigate to each module and their partial achievements. The courses are also linked to the partial achievements, making it easier to understand modules.

Modules are dynamic constructs, in which updates and changes can occur on a regular basis. Some modules are no longer offered, some partial achievements and associated courses or prerequisites change (e.g. if the type of the exam changes). The module handbook of the current semester is therefore always binding for students. If the requirements of a module change, students usually may still complete the module in the version they started with (e.g. if they already took an exam). This means, that the exams in the modules can be taken, even if the course is not being offered anymore, provided that students have already begun the module. Changes and associated rules for changing between module versions are usually announced in advance. In case of problems with the online registration for examinations, the Informatics Study Program Service (ISS) (e-mail: beratung-informatik@informatik.kit.edu) can assist. ISS should also be contacted, if a module has been started, but can no longer be completed.

The completed module will appear in the individual study plan (in German Studienablaufplan).

1.3.3 Academic levels

The Master Program of Study in Computer Science is structured for a period of two years with two semesters each. All modules have level four, i.e. master level.

1.4 Exams

Exams can be written, oral or they can be in form of an examination of another type (in German: Prüfungsleistung anderer Art). These exams are graded. Partial achievements can also be in form of ungraded course work (in German: Studienleistung). For further information, please refer to the Study and Examination Regulations (in German: Studien- und Prüfungsordnung) §4. Each partial achievement is linked to the corresponding courses (exercise, lecture, seminar, practical course etc.) and the exam event (in German Prüfungsveranstaltung, see next section).

1.4.1 Registration for / withdraw from exams and repetition of exams

Registration and withdraw (or sometimes de-registration, in German: Abmeldung) from exams or course works take place in the Campus-Management Portal (CMS https://campus.studium.kit.edu). Deadlines on registration and withdraw are provided on the website of the course and in CMS. Most courses use the ILIAS E-Learning-Platform at KIT for posting and exchanging information (https://www.zml.kit.edu/lms-ilias.php).

In order to register for an exam (or course work) students have to access the exam event (in German Prüfungsveranstaltung). Students must ensure that they first select the module and the partial achievement in their individual study plan in CMS. An exam event specifies not only the time and place when and where an exam takes place, but also provides students with further information regarding the exam or course work as well as deadlines.

Students are encouraged to verify that they are actually registered for the exam or course work and that the status is registered (in German: angemeldet). If there are concerns regarding the registration, students should contact the ISS (e-mail: beratung-informatik@informatik.kit.edu). Participating in exams without registration is not permitted! Further information regarding registration and withdrwal can be found in https://www.informatik.kit.edu/faq-wiki/doku.php?id=start

Each exam (oral, written or of another type) can usually be repeated once. In the case of a written exam, after failing twice, an oral re-examination takes place promptly (usually in the same examination period). This exam can only be “passed” (4.0) or “not passed” (5.0). If an exam is not passed after the re-examination, students lose their right to study computer science. Participation in further exams is not permitted. There is the possibility to request a second re-examination, which has to be approved by the examination board. If the request is approved, further exams can be taken. However, students will not receive the credits for these exams, until the failed exam has been passed in the second re-examination. The second re-examination consists in the participation in a written exam and if this exam is not passed either, in the participation in a further oral re-examination. If the second re-examination is failed, the credits passed in between are discarded.

Course work can be repeated until they are being passed, if no further regulations are provided in the module handbook.

1.5 Student advising

The Department of Informatics at KIT offers help with questions regarding studies, applications or student organization through the Informatics Study Program Services (ISS) (e-mail: beratung-informatik@informatik.kit.edu). ISS is an official service and provides official information.

The student representative body for informatics (Fachschaft Mathe-Info, FSMI) also gives helpful and in some cases more tailored advice. They offer assistance with queries and give advice regarding your studies.

2 Structure of the Master Program of Study

To complete the masters' degree in computer science students need to complete 120 CP. The credits are mostly achieved through taking different modules but also through the master thesis (30 CP). Students are allowed to exceed the maximum of 120 CP by one single module. Credits should be spread out evenly over all semesters.

The table in Figure 1 contains an overview of the Master Program of Study.

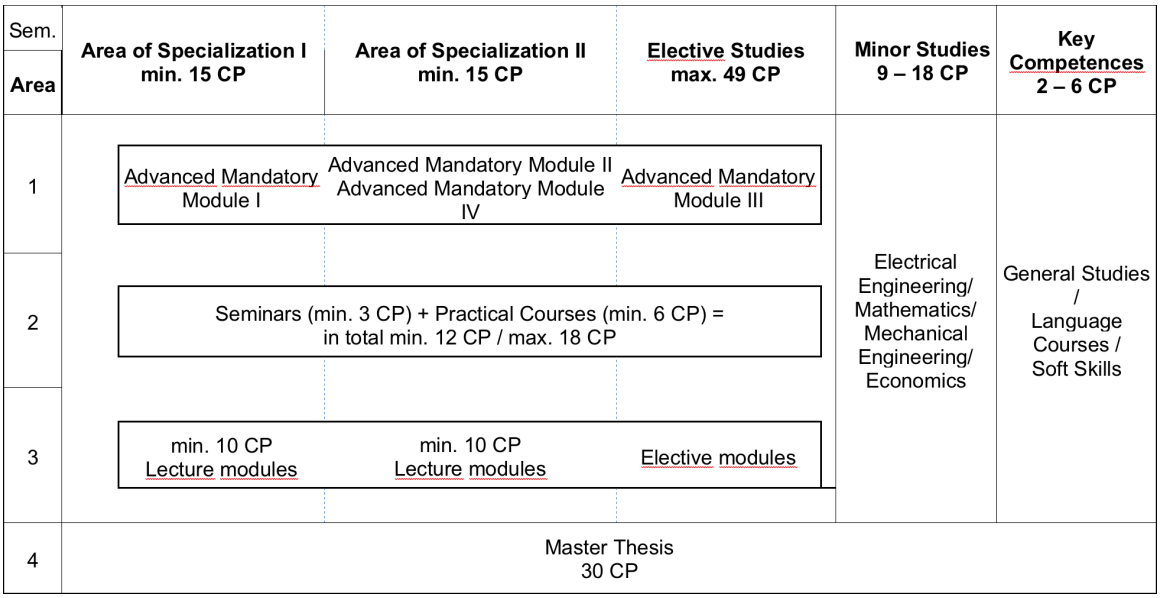

Figure 1: Structure of the Master Program of Study

During the studies at least four advanced mandatory modules (with 6 CP each) must be completed. They can be chosen in one of the specialization areas or in the elective studies area.

There are ten areas of specializations in English. This module handbook only features ten areas of specialization that can be studied completely in English. Further two specialization: Cryptography and System Architecture can be chosen by students with sufficient German language skills.

Students must choose two specilization areas. In each area of specialization students must choose modules of at least 15 CP. 10 CP must be of modules containing lectures. The advanced mandatory modules cannot be chosen to achieve 10 CP on lectures. In the specialization areas Telematics and System Architecture only 8 CP of module containing lectures are required.

A total of overall 73 CP in both specialization areas can not be exceeded.

Once exams have been taken in a specialization area, this specialization area is set. A change of the specialization area is possible with the permission of the examination board. For that students have to fill in a form (for details see https://www.informatik.kit.edu/faq-wiki/doku.php?id=start) and submit it to ISS via E-mail (berating-informatik@informatik.kit.edu). In the section 3 the list of modules for each specialization is listed.

This module handbook contains only modules in Englisch. **Students may choose a maximum of 30 CP of the 120 CP in German, if they have the necessary language skills.** The geman module handbook should be consulted, in order to know which german modules can be chosen in which areas (spcialization, elective studies etc.) and their specific regulations regarding the exams.

2.1 Advanced mandatory modules (in German Stammmodule)

Advanced mandatory modules cover important basic themes in computer science. They assure, that students have a broad education and prepare them for the area of specialization. They are offered once each year. This cannot be guaranteed for other elective modules. Students may also choose advanced mandatory modules in German as part of the four advanced mandatory modules.

Students must take four advanced mandatory modules in their master studies. Advanced mandatory modules, that have been completed during the bachelor studies, cannot be repeated during master studies. The table in Figure 2 provides the list of advanced mandatory modules.

The advanced mandatory modules can be taken either in one of the specialization areas or in the elective studies area.

	Advanced Mandatory	CP	Term	Language
M-INFO-107201	Algorithms II	6	Winter term	English
M-INFO-100818	Computer Architecture	6	Summer term	German
M-INFO-100856	Computer Graphics	6	Winter term	German
M-INFO-100799	Formal Systems	6	Winter term	German
M-INFO-107166	Human Computer Interaction	6	Summer term	English
M-INFO-106998	IT Security	6	Winter term	English
M-INFO-107169	Machine Learning - Foundations and Algorithms	6	Summer term	Englisch
M-INFO-107676	Multimodal Artificial Intelligence	6	Summer term	English
M-INFO-107162	Robotics I- Introduction to Robotics	6	Winter term	English
M-INFO-107235	Software Engineering II	6	Summer term	English
M-INFO-107243	Telematics	6	Winter term	English

Figure 2: List of advanced mandatory modules

2.2 Seminars and practical courses in computer science

Students have to take at least 3 CP in seminars. They also have to take at least 6 CP in practical courses. A minimum of 12 CP of seminars and practical courses must be achieved in total. A maximum of 18 CP of seminars and practical courses is permitted.

Seminars and practical courses in minor studies are not subject to these constraints. These constraints regard only seminars and practical courses to be chosen in the areas of specialization and elective studies.

2.3 Elective Studies in computer science

Elective modules are not necessarily offered regularly. The current ones can be found in section 3. All modules of all specialization areas can be chosen in the elective studies area. A maximum of 49 CP is permitted (120 CP minus the minimum of credit points to be achieved in the specialization areas, the minor studies, interdisciplinary qualifications and the master thesis).

2.4 Minor Studies

To give the students a broader education, minor studies provide knowledge of an adjacent field of study. Students must choose at least 9 CP and a maximum of 18 CP. Additional credits will be discarded. Minor Studies have a significant importance for the future career, to have learned of other fields outside of the computer science core. The minor modules are listed in section 3. Some minor studies have only one module, others consist of several. Students can only choose one minor subject.

Students may also choose an individual compiled list of modules for their minor. The constraints can be read in the FAQ: https://www.informatik.kit.edu/faq-wiki/doku.php?id=ergaenzungsfach.

2.5 Interdisciplinary Qualifications

Another part of the studies are the interdisciplinary qualifications (2 – 6 CP). This area includes key competences and soft skills on social topics, interdisciplinary academic topics as well as foreign languages.

All courses from the House of Competence (HoC), FORUM Science and Society (except computer science or minor studies courses) and from the Language Center (SpZ), but also special courses of the informatics department, can be validated in this area. The courses are not listed in the module handbook, but can be found on the webpages of these institutions. In order to be accepted, English language certificates must demonstrate a level above B2.

These qualifications are not graded. Although some exams are graded and the partial achievement may also be listed in the individual study plan with a grade, the interdisciplinary qualifications can only be passed/failed, so these grades does no contribute to the overall grade of the Master program.

Participation certificats (in German: Teilnahmebescheinigungen) cannot not be validated as interdisciplinary qualifications. An exam or coursework must be done.

2.6 Additional modules (in German: Zusatzleistungen)

During the master studies, students may take additional courses (max. 30 CP). These achievements are not included in the overall grade. If the corresponding partial achievements cannot be selected in the individual study plan, students should contact ISS.

3 Study Program Structure

Election notes
Please note that two specialization subjects and one minor subject must be taken in the Master's program. You can select these in your study plan when clicking on the elective button "Select areas" next to the study program identifier Informatics / Computer Science Master 2025.

Mandatory	
Master‘s Thesis	**30 CP**
Areas of Specialization (Elective: 2 items)	
Area of Specialization: Algorithm Engineering	**15-73 CP**
Area of Specialization: Cryptography and Security	**15-73 CP**
Area of Specialization: Data Science	**15-73 CP**
Area of Specialization: Design of Embedded Systems and Computer Architectures	**15-73 CP**
Area of Specialization: Human-centred Machine Intelligence	**15-73 CP**
Area of Specialization: Robotics and Automation	**15-73 CP**
Area of Specialization: Software Engineering and Compiler Construction	**15-73 CP**
Area of Specialization: Telematics	**15-73 CP**
Area of Specialization: Theoretical Foundations	**15-73 CP**
Mandatory	
Elective Studies in Informatics	**6-49 CP**
Minor Studies (Elective: 1 item)	
Minor Studies: Biologically Inspired Robotics ***First usage possible from Apr 01, 2026.***	**9-18 CP**
Minor Studies: Electrical Engineering	**9-18 CP**
Minor Studies: Mathematics	**9-18 CP**
Minor Studies: Economics	**9-18 CP**
Minor Studies: Law	**9-18 CP**
Mandatory	
Interdisciplinary Qualifications	**2-6 CP**

3.1 Master‘s Thesis

Credits
30

ID	Name	Language	Term offered	Credits
Mandatory				
M-INFO-106828	Master's Thesis	**EN**	**WT+ST**	**30 CP**

3.2 Area of Specialization: Algorithm Engineering

Credits
15-73

Specialization Coordinator: Prof. P. Sanders

Election notes
Students must choose at least 10 CP of lectures (no practical courses, no seminars, no advanced mandatory courses). In total students must choose at least 15 CP in each specialization.

ID	Name	Language	Term offered	Credits
Elective Modules: Algorithm Engineering (Elective: between 15 and 73 credits)				
M-INFO-107863	Advanced Competitive Programming neu ***First usage possible from Oct 01, 2026.***	**EN**	**Irreg.**	**6 CP**
M-INFO-107200	Advanced Data Structures	**EN**	**ST**	**5 CP**
M-INFO-100795	Algorithm Engineering	**EN**	**ST**	**5 CP**
M-INFO-106960	Algorithmic Graph Theory	**EN**	**Irreg.**	**5 CP**
M-INFO-106961	Algorithms for Visualization of Graphs	**EN**	**Irreg.**	**5 CP**
M-INFO-107201	Algorithms II	**EN**	**WT**	**6 CP**
M-INFO-104447	Automated Planning and Scheduling	**EN**	**Irreg.**	**5 CP**
M-INFO-107599	Beating the Worst-Case in Practice: Unexpectedly Efficient Algorithms	**EN**	**Irreg.**	**6 CP**
M-INFO-107228	Computational Geometry	**EN**	**Irreg.**	**6 CP**
M-INFO-106644	Fine-Grained Complexity Theory & Algorithms	**EN**	**Irreg.**	**6 CP**
M-INFO-107211	Graph Partitioning and Graph Clustering in Theory and Practice	**EN**	**Irreg.**	**5 CP**
M-INFO-101573	Hands-on Bioinformatics Practical	**EN**	**Irreg.**	**3 CP**
M-INFO-100749	Introduction to Bioinformatics for Computer Scientists	**EN**	**WT**	**3 CP**
M-INFO-107199	Parallel Algorithms	**EN**	**WT**	**5 CP**
M-INFO-107167	Parameterized Algorithms	**EN**	**Irreg.**	**6 CP**
M-INFO-106784	Practical Course: Fine-grained Algorithm Design and Engineering	**EN**	**Irreg.**	**6 CP**
M-INFO-107865	Practical Course: Performance Engineering in C++ and Rust neu ***First usage possible from Oct 01, 2026.***	**EN**	**Irreg.**	**6 CP**
M-INFO-107600	Practical Course: Route Planning	**EN**	**Irreg.**	**6 CP**
M-INFO-107831	Practice of Research (Project, 1st Semester) neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT+ST**	**10 CP**
M-INFO-107832	Practice of Research (Project, 2nd Semester) neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT+ST**	**10 CP**
M-INFO-107168	Probability and Computing	**EN**	**Irreg.**	**5 CP**
M-INFO-107867	Scalable Graph and Sparse Matrix Algorithms for Learning neu	**EN**	**Irreg.**	**5 CP**
M-INFO-107209	Seminar: Advanced Topics on SAT Solving	**EN**	**WT**	**3 CP**
M-INFO-106086	Seminar: Algorithm Engineering	**EN**	**Irreg.**	**4 CP**
M-INFO-107027	Seminar: Current Trends in Theoretical Computer Science	**EN**	**Irreg.**	**4 CP**
M-INFO-106645	Seminar: Fine-Grained Complexity Theory & Algorithms	**EN**	**Irreg.**	**4 CP**
M-INFO-100750	Seminar: Hot Topics in Bioinformatics	**EN**	**ST**	**3 CP**
M-INFO-107264	Seminar: Practical Graph Algorithms	**EN**	**Irreg.**	**4 CP**
M-INFO-107172	Seminar: Recent Highlights in Algorithms	**EN**	**Irreg.**	**4 CP**
M-INFO-107202	Text Indexing	**EN**	**WT**	**5 CP**
M-INFO-107639	Theory of Satisfiability Algorithms ***First usage possible from Apr 01, 2026.***	**EN**	**Irreg.**	**4 CP**

3.3 Area of Specialization: Cryptography and Security

Credits
15-73

Specialization Coordinator: Prof. J. Müller-Quade

Election notes
Students must choose at least 10 CP of lectures (no practical courses, no seminars, no advanced mandatory courses). In total students must choose at least 15 CP in each specialization.

ID	Name	Language	Term offered	Credits
Elective Modules: Cryptography and Security (Elective: between 15 and 73 credits)				
M-INFO-106303	Access Control Systems: Models and Technology	**EN**	**ST**	**5 CP**
M-INFO-106810	Artificial Intelligence & IT-Security	**EN**	**WT**	**6 CP**
M-INFO-107435	Cryptographic Protocols II: Universal Composability	**EN**	**WT**	**3 CP**
M-INFO-105334	Decentralized Systems: Fundamentals, Modeling, and Applications	**EN**	**ST**	**6 CP**
M-INFO-106998	IT Security	**EN**	**WT**	**6 CP**
M-INFO-107218	Network Security: Architectures and Protocols ***First usage possible from Apr 01, 2025.***	**EN**	**ST**	**4 CP**
M-INFO-107642	Post-quantum Cryptography from Lattices ***First usage possible from Apr 01, 2026.***	**EN**	**Irreg.**	**3 CP**
M-INFO-106996	Practical Course: Application Security	**EN**	**WT+ST**	**4 CP**
M-INFO-106867	Practical Course: Artificial Intelligence & Security Lab (AISEC-Lab)	**EN**	**ST**	**4 CP**
M-INFO-107412	Practical Course: Building PETs	**EN**	**WT**	**4 CP**
M-INFO-106627	Practical Course: Real-world Vulnerability Discovery and Exploits	**EN**	**WT+ST**	**4 CP**
M-INFO-105453	Practical Course: Security, Usability and Society	**EN**	**Irreg.**	**4 CP**
M-INFO-107241	Practical Introduction to Hardware Security	**EN**	**WT+ST**	**6 CP**
M-INFO-107831	Practice of Research (Project, 1st Semester) neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT+ST**	**10 CP**
M-INFO-107832	Practice of Research (Project, 2nd Semester) neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT+ST**	**10 CP**
M-INFO-105452	Privacy Enhancing Technologies	**EN**	**ST**	**6 CP**
M-INFO-106654	Research Focus Class: Blockchain & Cryptocurrencies	**EN**	**Irreg.**	**6 CP**
M-INFO-106866	Research Practical Course: Artificial Intelligence & Security	**EN**	**WT+ST**	**6 CP**
M-INFO-105591	Resilient Networking	**EN**	**WT**	**6 CP**
M-INFO-105780	Scientific Methods to Design and Analyze Secure Decentralized Systems	**EN**	**WT**	**6 CP**
M-INFO-107242	Seminar in Privacy	**EN**	**ST**	**4 CP**
M-INFO-106868	Seminar: Hot Topics in Artificial Intelligence & Security 1	**EN**	**WT**	**4 CP**
M-INFO-106869	Seminar: Hot Topics in Artificial Intelligence & Security 2	**EN**	**ST**	**4 CP**
M-INFO-104891	Seminar: Hot Topics in Decentralized Systems	**EN**	**Irreg.**	**3 CP**
M-INFO-106392	Seminar: Hot Topics in Explainable Artificial Intelligence (XAI)	**EN**	**ST**	**4 CP**
M-INFO-105585	Seminar: Post-Quantum Cryptography	**EN**	**Irreg.**	**3 CP**
M-INFO-107216	Seminar: Privacy and Security	**EN**	**WT**	**4 CP**
M-INFO-105408	Seminar: Quantum Information Theory	**EN**	**Irreg.**	**3 CP**
M-INFO-105761	Seminar: Secure Multiparty Computation	**EN**	**Irreg.**	**3 CP**
M-INFO-106344	Software Security Engineering	**EN**	**ST**	**3 CP**
M-INFO-107836	Practical Course: Decentralized Learning Lab neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT**	**3 CP**

3.4 Area of Specialization: Data Science

Credits
15-73

Specialization Coordinators: Prof. K. Böhm, Prof. G. Neumann

Election notes
Students must choose at least 10 CP of lectures (no practical courses, no seminars, no advanced mandatory courses). In total students must choose at least 15 CP in each specialization.

ID	Name	Language	Term offered	Credits
Elective Modules: Data Science (Elective: between 15 and 73 credits)				
M-INFO-106812	Advanced Bayesian Data Analysis	**EN**	**WT**	**5 CP**
M-INFO-106655	Data Science and Artificial Intelligence for Energy Systems	**EN**	**ST**	**6 CP**
M-INFO-106302	Explainable Artificial Intelligence ***First usage possible from Oct 01, 2025.***	**EN**	**ST**	**3 CP**
M-INFO-106959	Machine Learning for Natural Sciences	**EN**	**ST**	**6 CP**
M-INFO-106470	Machine Learning in Climate and Environmental Sciences	**EN**	**ST**	**6 CP**
M-INFO-107831	Practice of Research (Project, 1st Semester) neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT+ST**	**10 CP**
M-INFO-107832	Practice of Research (Project, 2nd Semester) neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT+ST**	**10 CP**

3.5 Area of Specialization: Design of Embedded Systems and Computer Architectures

Credits
15-73

Specialization Coordinators: Prof. J. Henkel, Prof. W. Karl

Election notes
Students must choose at least 10 CP of lectures (no practical courses, no seminars, no advanced mandatory courses). In total students must choose at least 15 CP in each specialization.

ID	Name	Language	Term offered	Credits
Elective Modules: Design of Embedded Systems and Computer Architectures (Elective: between 15 and 73 credits)				
M-INFO-107230	Design and Architectures of Embedded Systems (ESII)	**EN**	**WT**	**3 CP**
M-INFO-105775	Embedded Machine Learning Lab	**EN**	**WT+ST**	**4 CP**
M-INFO-107448	Hardware-efficient Artificial Intelligence	**EN**	**WT**	**3 CP**
M-INFO-100807	Low Power Design	**EN**	**ST**	**3 CP**
M-INFO-107229	Optimization and Synthesis of Embedded Systems (ESI)	**EN**	**WT**	**3 CP**
M-INFO-103706	Practical Course: Internet of Things (IoT)	**EN**	**WT+ST**	**4 CP**
M-INFO-107265	Practical Course: Chip Design I	**EN**	**WT+ST**	**3 CP**
M-INFO-107266	Practical Course: Chip Design II	**EN**	**WT+ST**	**3 CP**
M-INFO-102661	Practical Course: FPGA Programming	**EN**	**WT+ST**	**3 CP**
M-INFO-104031	Practical Course: Low Power Design and Embedded Systems	**EN**	**ST**	**4 CP**
M-INFO-106503	Practical Course: Neural Network Acceleration on FPGAs neu ***First usage possible from Apr 01, 2026.***	**EN**	**WT+ST**	**3 CP**
M-INFO-107241	Practical Introduction to Hardware Security	**EN**	**WT+ST**	**6 CP**
M-INFO-107831	Practice of Research (Project, 1st Semester) neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT+ST**	**10 CP**
M-INFO-107832	Practice of Research (Project, 2nd Semester) neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT+ST**	**10 CP**
M-INFO-100850	Reliable Computing I	**EN**	**Irreg.**	**3 CP**
M-INFO-102662	Seminar Dependable Computing	**EN**	**WT+ST**	**3 CP**
M-INFO-107231	Seminar: Embedded Systems I	**EN**	**WT+ST**	**3 CP**
M-INFO-107232	Seminar: Embedded Systems II	**EN**	**WT+ST**	**3 CP**
M-INFO-100851	Testing Digital Systems I	**EN**	**Irreg.**	**3 CP**
M-INFO-102962	Testing Digital Systems II	**EN**	**Irreg.**	**3 CP**
M-INFO-107897	Practical Course: Customized Embedded Processor Design neu ***First usage possible from Jul 13, 2026.***	**EN**	**ST**	**4 CP**

3.6 Area of Specialization: Human-centred Machine Intelligence

Credits
15-73

Specialization Coordinator: Prof. R. Stiefelhagen

Election notes
Students must choose at least 10 CP of lectures (no practical courses, no seminars, no advanced mandatory courses). In total students must choose at least 15 CP in each specialization.

ID	Name	Language	Term offered	Credits
Elective Modules: Human-centred Machine Intelligence (Elective: between 15 and 73 credits)				
M-INFO-106810	Artificial Intelligence & IT-Security	**EN**	**WT**	**6 CP**
M-INFO-106655	Data Science and Artificial Intelligence for Energy Systems	**EN**	**ST**	**6 CP**
M-INFO-107197	Deep Learning and Neural Networks	**EN**	**ST**	**6 CP**
M-INFO-107843	Deep Learning for Computer Vision: Advanced Topics neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT**	**3 CP**
M-INFO-105775	Embedded Machine Learning Lab	**EN**	**WT+ST**	**4 CP**
M-INFO-106302	Explainable Artificial Intelligence	**EN**	**ST**	**3 CP**
M-INFO-106237	Geometric Deep Learning	**EN**	**WT**	**6 CP**
M-INFO-106650	HRI and Social Robotics	**EN**	**ST**	**6 CP**
M-INFO-107166	Human Computer Interaction	**EN**	**ST**	**6 CP**
M-INFO-106649	Humanoid Robots - Locomotion and Whole-Body Control	**EN**	**ST**	**6 CP**
M-INFO-107152	Humanoid Robots - Seminar	**EN**	**WT**	**3 CP**
M-INFO-107176	Lab Project: Speech Translation	**EN**	**WT**	**6 CP**
M-INFO-107663	Localization of Mobile Agents ***First usage possible from Apr 01, 2026.***	**EN**	**ST**	**6 CP**
M-INFO-107169	Machine Learning - Foundations and Algorithms	**EN**	**ST**	**6 CP**
M-INFO-106959	Machine Learning for Natural Sciences	**EN**	**ST**	**6 CP**
M-INFO-106470	Machine Learning in Climate and Environmental Sciences	**EN**	**ST**	**6 CP**
M-INFO-102555	Motion in Human and Machine - Seminar	**EN**	**ST**	**3 CP**
M-INFO-107676	Multimodal Artificial Intelligence ***First usage possible from Apr 01, 2026.***	**EN**	**ST**	**6 CP**
M-INFO-107178	Natural Language Processing	**EN**	**WT**	**6 CP**
M-INFO-105329	Optimization Methods for Machine Learning and Engineering	**EN**	**WT**	**5 CP**
M-INFO-107170	Participatory Technology Design	**EN**	**WT**	**6 CP**
M-INFO-106867	Practical Course: Artificial Intelligence & Security Lab (AISEC-Lab)	**EN**	**ST**	**4 CP**
M-INFO-107836	Practical Course: Decentralized Learning Lab neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT**	**3 CP**
M-INFO-106646	Practical Course: Human-Centred Robotics ***First usage possible from Oct 01, 2025.***	**EN**	**WT+ST**	**6 CP**
M-INFO-107845	Practical Course: Machine Learning and Intelligent Systems neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT+ST**	**8 CP**
M-INFO-107609	Practical Course: Mathematical and Computational Methods in Robotics and AI ***First usage possible from Oct 01, 2025.***	**EN**	**WT+ST**	**6 CP**
M-INFO-106648	Practical Course: Movement and Technology	**EN**	**ST**	**6 CP**
M-INFO-107177	Practical Course: Natural Language Dialog Systems	**EN**	**Irreg.**	**6 CP**
M-INFO-107831	Practice of Research (Project, 1st Semester) neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT+ST**	**10 CP**
M-INFO-107832	Practice of Research (Project, 2nd Semester) neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT+ST**	**10 CP**
M-INFO-105623	Reinforcement Learning	**EN**	**WT**	**6 CP**
M-INFO-107728	Research Practical Course on Behavior Foundation Models neu ***First usage possible from Apr 01, 2026.***	**EN**	**ST**	**6 CP**
M-INFO-106866	Research Practical Course: Artificial Intelligence & Security	**EN**	**WT+ST**	**6 CP**
M-INFO-106495	Research Practical Course: Explainable Artificial Intelligence	**EN**	**WT**	**6 CP**
M-INFO-107174	Research Project Deep Learning for Robotics	**EN**	**WT**	**6 CP**
M-INFO-107163	Research Project: Generative AI for Autonomous Agents	**EN**	**ST**	**6 CP**
M-INFO-107155	Robotics - Practical Course	**EN**	**ST**	**6 CP**
M-INFO-107123	Robotics II - Humanoid Robotics	**EN**	**ST**	**3 CP**
M-INFO-107090	Sampling Methods for Machine Learning	**EN**	**ST**	**6 CP**

ID	Name	Language	Term offered	Credits
M-INFO-107846	Seminar for Practical Course: Machine Learning and Intelligent Systems neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT+ST**	**3 CP**
M-INFO-107729	Seminar on Behavior Foundation Models neu ***First usage possible from Apr 01, 2026.***	**EN**	**ST**	**3 CP**
M-INFO-107353	Seminar: Advanced Topics in Natural Language Processing ***First usage possible from Oct 01, 2025.***	**EN**	**WT+ST**	**3 CP**
M-INFO-106490	Seminar: Artificial Intelligence for Energy Systems	**EN**	**WT**	**4 CP**
M-INFO-106958	Seminar: Critical Topics in AI	**EN**	**ST**	**3 CP**
M-INFO-107175	Seminar: Deep Learning for Robotics	**EN**	**WT**	**3 CP**
M-INFO-106497	Seminar: Explainable Artificial Intelligence	**EN**	**WT**	**3 CP**
M-INFO-106651	Seminar: Exploring Robotics - Insights from Science Fiction, Research and Society	**EN**	**ST**	**3 CP**
M-INFO-107436	Seminar: Failing Forward: Robotics, Critical Reading and the Making of Good Research	**EN**	**WT**	**3 CP**
M-INFO-106868	Seminar: Hot Topics in Artificial Intelligence & Security 1	**EN**	**WT**	**4 CP**
M-INFO-106869	Seminar: Hot Topics in Artificial Intelligence & Security 2	**EN**	**ST**	**4 CP**
M-INFO-106392	Seminar: Hot Topics in Explainable Artificial Intelligence (XAI)	**EN**	**ST**	**4 CP**
M-INFO-107217	Seminar: Interpretability and Causality in Machine Learning	**EN**	**ST**	**3 CP**
M-INFO-106719	Seminar: Machine Learning in Climate and Environmental Sciences	**EN**	**Irreg.**	**3 CP**
M-INFO-107926	Seminar: Robot Reinforcement Learning neu ***First usage possible from Jul 29, 2026.***	**EN**	**Irreg.**	**3 CP**
M-INFO-107179	Seminar: Speech-to-Speech Translation	**EN**	**ST**	**3 CP**
M-INFO-107847	Stochastic Information Processing neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT**	**6 CP**
M-INFO-107834	User Studies in Human-Robot Interaction neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT**	**6 CP**
M-INFO-107113	Wearable Robotic Technologies	**EN**	**ST**	**4 CP**

3.7 Area of Specialization: Robotics and Automation

Credits
15-73

Specialization Coordinator: Prof. T. Asfour

Election notes
Students must choose at least 10 CP of lectures (no practical courses, no seminars, no advanced mandatory courses). In total students must choose at least 15 CP in each specialization.

ID	Name	Language	Term offered	Credits
Elective Modules: Robotics and Automation (Elective: between 15 and 73 credits)				
M-INFO-106608	Autonomous Learning for Intelligent Robot Perception	**EN**	**WT**	**4 CP**
M-INFO-106190	Computational Imaging	**EN**	**WT**	**5 CP**
M-INFO-106650	HRI and Social Robotics	**EN**	**ST**	**6 CP**
M-INFO-106649	Humanoid Robots - Locomotion and Whole-Body Control	**EN**	**ST**	**6 CP**
M-INFO-107152	Humanoid Robots - Seminar	**EN**	**WT**	**3 CP**
M-INFO-107663	Localization of Mobile Agents ***First usage possible from Apr 01, 2026.***	**EN**	**ST**	**6 CP**
M-INFO-106959	Machine Learning for Natural Sciences	**EN**	**ST**	**6 CP**
M-INFO-106646	Practical Course: Human-Centred Robotics ***First usage possible from Oct 01, 2025.***	**EN**	**WT+ST**	**6 CP**
M-INFO-107845	Practical Course: Machine Learning and Intelligent Systems neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT+ST**	**8 CP**
M-INFO-107609	Practical Course: Mathematical and Computational Methods in Robotics and AI ***First usage possible from Oct 01, 2025.***	**EN**	**WT+ST**	**6 CP**
M-INFO-106648	Practical Course: Movement and Technology	**EN**	**ST**	**6 CP**
M-INFO-107831	Practice of Research (Project, 1st Semester) neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT+ST**	**10 CP**
M-INFO-107832	Practice of Research (Project, 2nd Semester) neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT+ST**	**10 CP**
M-INFO-107728	Research Practical Course on Behavior Foundation Models neu ***First usage possible from Apr 01, 2026.***	**EN**	**ST**	**6 CP**
M-INFO-107174	Research Project Deep Learning for Robotics	**EN**	**WT**	**6 CP**
M-INFO-107155	Robotics - Practical Course	**EN**	**ST**	**6 CP**
M-INFO-107162	Robotics I - Introduction to Robotics	**EN**	**WT**	**6 CP**
M-INFO-107123	Robotics II - Humanoid Robotics	**EN**	**ST**	**3 CP**
M-INFO-107130	Robotics III - Sensors and Perception in Robotics	**EN**	**ST**	**3 CP**
M-INFO-107598	Robotics Institute Germany - Lecture Series	**EN**	**WT**	**3 CP**
M-INFO-107090	Sampling Methods for Machine Learning	**EN**	**ST**	**6 CP**
M-INFO-107846	Seminar for Practical Course: Machine Learning and Intelligent Systems neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT+ST**	**3 CP**
M-INFO-107729	Seminar on Behavior Foundation Models neu ***First usage possible from Apr 01, 2026.***	**EN**	**ST**	**3 CP**
M-INFO-107175	Seminar: Deep Learning for Robotics	**EN**	**WT**	**3 CP**
M-INFO-106927	Seminar: Exoskeletons & Motion Capture ***First usage possible from Oct 01, 2025.***	**EN**	**WT**	**3 CP**
M-INFO-106651	Seminar: Exploring Robotics - Insights from Science Fiction, Research and Society	**EN**	**ST**	**3 CP**
M-INFO-107436	Seminar: Failing Forward: Robotics, Critical Reading and the Making of Good Research	**EN**	**WT**	**3 CP**
M-INFO-107926	Seminar: Robot Reinforcement Learning neu ***First usage possible from Jul 29, 2026.***	**EN**	**Irreg.**	**3 CP**
M-INFO-107847	Stochastic Information Processing neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT**	**6 CP**
M-INFO-107834	User Studies in Human-Robot Interaction neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT**	**6 CP**
M-INFO-107113	Wearable Robotic Technologies	**EN**	**ST**	**4 CP**

3.8 Area of Specialization: Software Engineering and Compiler Construction

Credits 15-73

Specialization Coordinators: Prof. A. Koziolek, Prof. R. Reussner

Election notes
Students must choose at least 10 CP of lectures (no practical courses, no seminars, no advanced mandatory courses). In total students must choose at least 15 CP in each specialization.

ID	Name	Language	Term offered	Credits
Elective Modules: Software Engineering and Compiler Construction (Elective: between 15 and 73 credits)				
M-INFO-106966	Compiler Design	**EN**	**Irreg.**	**9 CP**
M-INFO-107685	Empirical Software Engineering ***First usage possible from Apr 01, 2026.***	**EN**	**Irreg.**	**4 CP**
M-INFO-106626	Engineering Self-Adaptive Systems	**EN**	**WT**	**3 CP**
M-INFO-107906	Logic Programming neu ***First usage possible from Oct 01, 2026.***	**EN**	**Irreg.**	**6 CP**
M-INFO-106102	Logical Foundations of Cyber-Physical Systems	**EN**	**WT**	**6 CP**
M-INFO-106931	Model-Driven Software Development	**EN**	**WT**	**3 CP**
M-INFO-107739	Practical Course: Advanced Software Development Tools neu ***First usage possible from Apr 01, 2026.***	**EN**	**WT+ST**	**6 CP**
M-INFO-107677	Practical Course: Continuous Software Engineering ***First usage possible from Apr 01, 2026.***	**EN**	**WT+ST**	**6 CP**
M-INFO-107678	Practical Course: Engineering Approaches to Software Development ***First usage possible from Apr 01, 2026.***	**EN**	**WT+ST**	**6 CP**
M-INFO-106932	Practical Course: Model-Driven Software Development	**EN**	**ST**	**6 CP**
M-INFO-107865	Practical Course: Performance Engineering in C++ and Rust neu ***First usage possible from Oct 01, 2026.***	**EN**	**Irreg.**	**6 CP**
M-INFO-108020	Practical Course: Programming Language Design and Implementation neu	**EN**	**Irreg.**	**6 CP**
M-INFO-107831	Practice of Research (Project, 1st Semester) neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT+ST**	**10 CP**
M-INFO-107832	Practice of Research (Project, 2nd Semester) neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT+ST**	**10 CP**
M-INFO-105309	Seminar: Continuous Software Engineering	**EN**	**ST**	**4 CP**
M-INFO-107236	Seminar: Software Architecture, Security and Privacy	**EN**	**Irreg.**	**4 CP**
M-INFO-107625	Seminar: Type Systems and Static Program Analysis ***First usage possible from Oct 01, 2025.***	**EN**	**WT**	**4 CP**
M-INFO-107237	Software Architecture and Quality	**EN**	**WT**	**3 CP**
M-INFO-107235	Software Engineering II	**EN**	**ST**	**6 CP**
M-INFO-107212	Software Product Line Engineering	**EN**	**ST**	**3 CP**
M-INFO-106344	Software Security Engineering	**EN**	**ST**	**3 CP**
M-INFO-100719	Software-Evolution ***First usage possible from Jan 16, 2026.***	**EN**	**WT**	**3 CP**
M-INFO-107239	Software Test and Quality Management (SQM)	**EN**	**WT**	**5 CP**
M-INFO-107664	Type Systems and Program Analysis	**EN**	**Irreg.**	**6 CP**

3.9 Area of Specialization: Telematics

Credits
15-73

Specialization Coordinators: Prof. S. Abeck, Prof. H. Hartenstein, Prof. M. Ziterbart

Election notes
Students must choose at least 8 CP of lectures (no practical courses, no seminars, no advanced mandatory courses). In total students must choose at least 15 CP in each specialization.

ID	Name	Language	Term offered	Credits
Elective Modules: Telematics (Elective: between 15 and 73 credits)				
M-INFO-106303	Access Control Systems: Models and Technology	**EN**	**ST**	**5 CP**
M-INFO-106655	Data Science and Artificial Intelligence for Energy Systems	**EN**	**ST**	**6 CP**
M-INFO-105334	Decentralized Systems: Fundamentals, Modeling, and Applications	**EN**	**ST**	**6 CP**
M-INFO-107215	Distributed Computing	**EN**	**WT**	**4 CP**
M-INFO-107166	Human Computer Interaction	**EN**	**ST**	**6 CP**
M-INFO-100800	Internet of Everything ***First usage possible until Mar 31, 2027.***	**EN**	**WT**	**4 CP**
M-INFO-107245	Mobile Communication	**EN**	**WT**	**4 CP**
M-INFO-107218	Network Security: Architectures and Protocols	**EN**	**ST**	**4 CP**
M-INFO-100784	Next Generation Internet	**EN**	**ST**	**4 CP**
M-INFO-105870	Practical Course: Advanced Topics in High Performance Computing, Data Management and Analytics	**EN**	**Irreg.**	**6 CP**
M-INFO-107836	Practical Course: Decentralized Learning Lab neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT**	**3 CP**
M-INFO-107919	Practical Course: Designing and Conducting Experimental Studies neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT+ST**	**6 CP**
M-INFO-105453	Practical Course: Security, Usability and Society	**EN**	**Irreg.**	**4 CP**
M-INFO-105955	Practical Course: Smart Energy System	**EN**	**WT+ST**	**6 CP**
M-INFO-107831	Practice of Research (Project, 1st Semester) neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT+ST**	**10 CP**
M-INFO-107832	Practice of Research (Project, 2nd Semester) neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT+ST**	**10 CP**
M-INFO-105452	Privacy Enhancing Technologies	**EN**	**ST**	**6 CP**
M-INFO-106654	Research Focus Class: Blockchain & Cryptocurrencies	**EN**	**Irreg.**	**6 CP**
M-INFO-105591	Resilient Networking	**EN**	**WT**	**6 CP**
M-INFO-105780	Scientific Methods to Design and Analyze Secure Decentralized Systems	**EN**	**WT**	**6 CP**
M-INFO-106490	Seminar: Artificial Intelligence for Energy Systems	**EN**	**WT**	**4 CP**
M-INFO-104891	Seminar: Hot Topics in Decentralized Systems	**EN**	**Irreg.**	**3 CP**
M-INFO-107243	Telematics ***First usage possible until Mar 31, 2027.***	**EN**	**WT**	**6 CP**
M-INFO-107161	Ubiquitous Computing	**EN**	**Irreg.**	**5 CP**

3.10 Area of Specialization: Theoretical Foundations

Credits
15-73

Specialization Coordinators: Prof. P. Sanders, Prof. S. Erdweg

Election notes
Students must choose at least 10 CP of lectures (no practical courses, no seminars, no advanced mandatory courses). In total students must choose at least 15 CP in each specialization.

ID	Name	Language	Term offered	Credits
Elective Modules: Theoretical Foundations (Elective: between 15 and 73 credits)				
M-INFO-107200	Advanced Data Structures	**EN**	**ST**	**5 CP**
M-INFO-106960	Algorithmic Graph Theory	**EN**	**Irreg.**	**5 CP**
M-INFO-106961	Algorithms for Visualization of Graphs	**EN**	**Irreg.**	**5 CP**
M-INFO-107201	Algorithms II	**EN**	**WT**	**6 CP**
M-INFO-104447	Automated Planning and Scheduling	**EN**	**Irreg.**	**5 CP**
M-INFO-107599	Beating the Worst-Case in Practice: Unexpectedly Efficient Algorithms	**EN**	**Irreg.**	**6 CP**
M-INFO-107228	Computational Geometry	**EN**	**Irreg.**	**6 CP**
M-INFO-106256	Constructive Logic	**EN**	**ST**	**5 CP**
M-INFO-106644	Fine-Grained Complexity Theory & Algorithms	**EN**	**Irreg.**	**6 CP**
M-INFO-107211	Graph Partitioning and Graph Clustering in Theory and Practice	**EN**	**Irreg.**	**5 CP**
M-INFO-107906	Logic Programming neu ***First usage possible from Oct 01, 2026.***	**EN**	**Irreg.**	**6 CP**
M-INFO-106102	Logical Foundations of Cyber-Physical Systems	**EN**	**WT**	**6 CP**
M-INFO-107167	Parameterized Algorithms	**EN**	**Irreg.**	**6 CP**
M-INFO-106784	Practical Course: Fine-grained Algorithm Design and Engineering	**EN**	**Irreg.**	**6 CP**
M-INFO-107494	Practical Course: Interactive Theorem Proving	**EN**	**Irreg.**	**3 CP**
M-INFO-107845	Practical Course: Machine Learning and Intelligent Systems neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT+ST**	**8 CP**
M-INFO-107238	Practical SAT Solving	**EN**	**Irreg.**	**5 CP**
M-INFO-107831	Practice of Research (Project, 1st Semester) neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT+ST**	**10 CP**
M-INFO-107832	Practice of Research (Project, 2nd Semester) neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT+ST**	**10 CP**
M-INFO-107168	Probability and Computing	**EN**	**Irreg.**	**5 CP**
M-INFO-107209	Seminar: Advanced Topics on SAT Solving	**EN**	**WT**	**3 CP**
M-INFO-106086	Seminar: Algorithm Engineering	**EN**	**Irreg.**	**4 CP**
M-INFO-107027	Seminar: Current Trends in Theoretical Computer Science	**EN**	**Irreg.**	**4 CP**
M-INFO-106645	Seminar: Fine-Grained Complexity Theory & Algorithms	**EN**	**Irreg.**	**4 CP**
M-INFO-103306	Seminar: Proofs from THE BOOK	**EN**	**Irreg.**	**3 CP**
M-INFO-107172	Seminar: Recent Highlights in Algorithms	**EN**	**Irreg.**	**4 CP**
M-INFO-107625	Seminar: Type Systems and Static Program Analysis ***First usage possible from Oct 01, 2025.***	**EN**	**WT**	**4 CP**
M-INFO-107639	Theory of Satisfiability Algorithms ***First usage possible from Apr 01, 2026.***	**EN**	**Irreg.**	**4 CP**
M-INFO-107664	Type Systems and Program Analysis	**EN**	**Irreg.**	**6 CP**
M-INFO-107846	Seminar for Practical Course: Machine Learning and Intelligent Systems neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT+ST**	**3 CP**

3.11 Elective Studies in Informatics

Credits
6-49

ID	Name	Language	Term offered	Credits
Elective Studies (Elective: between 6 and 49 credits)				
M-INFO-106303	Access Control Systems: Models and Technology	**EN**	**ST**	**5 CP**
M-INFO-106812	Advanced Bayesian Data Analysis	**EN**	**WT**	**5 CP**
M-INFO-107863	Advanced Competitive Programming neu ***First usage possible from Oct 01, 2026.***	**EN**	**Irreg.**	**6 CP**
M-INFO-107200	Advanced Data Structures	**EN**	**ST**	**5 CP**
M-INFO-100795	Algorithm Engineering	**EN**	**ST**	**5 CP**
M-INFO-106960	Algorithmic Graph Theory	**EN**	**Irreg.**	**5 CP**
M-INFO-106961	Algorithms for Visualization of Graphs	**EN**	**Irreg.**	**5 CP**
M-INFO-107201	Algorithms II	**EN**	**WT**	**6 CP**
M-INFO-106810	Artificial Intelligence & IT-Security	**EN**	**WT**	**6 CP**
M-INFO-104447	Automated Planning and Scheduling	**EN**	**Irreg.**	**5 CP**
M-INFO-106608	Autonomous Learning for Intelligent Robot Perception	**EN**	**WT**	**4 CP**
M-INFO-107599	Beating the Worst-Case in Practice: Unexpectedly Efficient Algorithms	**EN**	**Irreg.**	**6 CP**
M-INFO-106966	Compiler Design	**EN**	**Irreg.**	**9 CP**
M-INFO-107228	Computational Geometry	**EN**	**Irreg.**	**6 CP**
M-INFO-106190	Computational Imaging	**EN**	**WT**	**5 CP**
M-INFO-106256	Constructive Logic	**EN**	**ST**	**5 CP**
M-INFO-107435	Cryptographic Protocols II: Universal Composability	**EN**	**WT**	**3 CP**
M-INFO-106655	Data Science and Artificial Intelligence for Energy Systems	**EN**	**ST**	**6 CP**
M-INFO-105334	Decentralized Systems: Fundamentals, Modeling, and Applications	**EN**	**ST**	**6 CP**
M-INFO-107197	Deep Learning and Neural Networks	**EN**	**ST**	**6 CP**
M-INFO-107843	Deep Learning for Computer Vision: Advanced Topics neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT**	**3 CP**
M-INFO-107230	Design and Architectures of Embedded Systems (ESII)	**EN**	**WT**	**3 CP**
M-INFO-107215	Distributed Computing	**EN**	**WT**	**4 CP**
M-INFO-107234	Edge-AI in Software and Sensor Applications	**EN**	**WT+ST**	**3 CP**
M-INFO-105775	Embedded Machine Learning Lab	**EN**	**WT+ST**	**4 CP**
M-INFO-107685	Empirical Software Engineering ***First usage possible from Apr 01, 2026.***	**EN**	**Irreg.**	**4 CP**
M-INFO-106626	Engineering Self-Adaptive Systems	**EN**	**WT**	**3 CP**
M-INFO-106302	Explainable Artificial Intelligence	**EN**	**ST**	**3 CP**
M-INFO-106644	Fine-Grained Complexity Theory & Algorithms	**EN**	**Irreg.**	**6 CP**
M-INFO-106237	Geometric Deep Learning	**EN**	**WT**	**6 CP**
M-INFO-107211	Graph Partitioning and Graph Clustering in Theory and Practice	**EN**	**Irreg.**	**5 CP**
M-INFO-107448	Hardware-efficient Artificial Intelligence	**EN**	**WT**	**3 CP**
M-INFO-106650	HRI and Social Robotics	**EN**	**ST**	**6 CP**
M-INFO-107166	Human Computer Interaction	**EN**	**ST**	**6 CP**
M-INFO-106649	Humanoid Robots - Locomotion and Whole-Body Control	**EN**	**ST**	**6 CP**
M-INFO-107152	Humanoid Robots - Seminar	**EN**	**WT**	**3 CP**
M-INFO-100800	Internet of Everything ***First usage possible until Mar 31, 2027.***	**EN**	**WT**	**4 CP**
M-INFO-100749	Introduction to Bioinformatics for Computer Scientists	**EN**	**WT**	**3 CP**
M-INFO-106998	IT Security	**EN**	**WT**	**6 CP**
M-INFO-107176	Lab Project: Speech Translation	**EN**	**WT**	**6 CP**
M-INFO-107821	Introduction to Quantum Machine Learning neu ***First usage possible from Oct 01, 2026.***	**EN**	**ST**	**3 CP**
M-INFO-107663	Localization of Mobile Agents ***First usage possible from Apr 01, 2026.***	**EN**	**ST**	**6 CP**
M-INFO-107906	Logic Programming neu ***First usage possible from Oct 01, 2026.***	**EN**	**Irreg.**	**6 CP**

ID	Name	Language	Term offered	Credits
M-INFO-106102	Logical Foundations of Cyber-Physical Systems	**EN**	**WT**	**6 CP**
M-INFO-100807	Low Power Design	**EN**	**ST**	**3 CP**
M-INFO-107169	Machine Learning - Foundations and Algorithms	**EN**	**ST**	**6 CP**
M-INFO-106959	Machine Learning for Natural Sciences	**EN**	**ST**	**6 CP**
M-INFO-106470	Machine Learning in Climate and Environmental Sciences	**EN**	**ST**	**6 CP**
M-INFO-107245	Mobile Communication	**EN**	**WT**	**4 CP**
M-INFO-106931	Model-Driven Software Development	**EN**	**WT**	**3 CP**
M-INFO-107676	Multimodal Artificial Intelligence ***First usage possible from Apr 01, 2026.***	**EN**	**ST**	**6 CP**
M-INFO-107178	Natural Language Processing	**EN**	**WT**	**6 CP**
M-INFO-107233	Natural Language Processing and Software Engineering	**EN**	**WT**	**3 CP**
M-INFO-107218	Network Security: Architectures and Protocols	**EN**	**ST**	**4 CP**
M-INFO-100784	Next Generation Internet	**EN**	**ST**	**4 CP**
M-INFO-107229	Optimization and Synthesis of Embedded Systems (ESI)	**EN**	**WT**	**3 CP**
M-INFO-105329	Optimization Methods for Machine Learning and Engineering	**EN**	**WT**	**5 CP**
M-INFO-107199	Parallel Algorithms	**EN**	**WT**	**5 CP**
M-INFO-107167	Parameterized Algorithms	**EN**	**Irreg.**	**6 CP**
M-INFO-107170	Participatory Technology Design	**EN**	**WT**	**6 CP**
M-INFO-107817	Photorealistic Rendering neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT**	**5 CP**
M-INFO-107642	Post-quantum Cryptography from Lattices ***First usage possible from Apr 01, 2026.***	**EN**	**Irreg.**	**3 CP**
M-INFO-103706	Practical Course: Internet of Things (IoT)	**EN**	**WT+ST**	**4 CP**
M-INFO-107739	Practical Course: Advanced Software Development Tools neu ***First usage possible from Apr 01, 2026.***	**EN**	**WT+ST**	**6 CP**
M-INFO-105870	Practical Course: Advanced Topics in High Performance Computing, Data Management and Analytics	**EN**	**Irreg.**	**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**	**WT+ST**	**4 CP**
M-INFO-106867	Practical Course: Artificial Intelligence & Security Lab (AISEC-Lab)	**EN**	**ST**	**4 CP**
M-INFO-107412	Practical Course: Building PETs	**EN**	**WT**	**4 CP**
M-INFO-107265	Practical Course: Chip Design I	**EN**	**WT+ST**	**3 CP**
M-INFO-107266	Practical Course: Chip Design II	**EN**	**WT+ST**	**3 CP**
M-INFO-107677	Practical Course: Continuous Software Engineering ***First usage possible from Apr 01, 2026.***	**EN**	**WT+ST**	**6 CP**
M-INFO-107897	Practical Course: Customized Embedded Processor Design neu ***First usage possible from Jul 13, 2026.***	**EN**	**ST**	**4 CP**
M-INFO-107836	Practical Course: Decentralized Learning Lab neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT**	**3 CP**
M-INFO-107919	Practical Course: Designing and Conducting Experimental Studies neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT+ST**	**6 CP**
M-INFO-107678	Practical Course: Engineering Approaches to Software Development ***First usage possible from Apr 01, 2026.***	**EN**	**WT+ST**	**6 CP**
M-INFO-106784	Practical Course: Fine-grained Algorithm Design and Engineering	**EN**	**Irreg.**	**6 CP**
M-INFO-102661	Practical Course: FPGA Programming	**EN**	**WT+ST**	**3 CP**
M-INFO-100724	Practical Course: General-Purpose Computation on Graphics Processing Units	**EN**	**WT+ST**	**3 CP**
M-INFO-106646	Practical Course: Human-Centred Robotics ***First usage possible from Oct 01, 2025.***	**EN**	**WT+ST**	**6 CP**
M-INFO-107494	Practical Course: Interactive Theorem Proving	**EN**	**Irreg.**	**3 CP**
M-INFO-104031	Practical Course: Low Power Design and Embedded Systems	**EN**	**ST**	**4 CP**

ID	Name	Language	Term offered	Credits
M-INFO-107845	Practical Course: Machine Learning and Intelligent Systems neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT+ST**	**8 CP**
M-INFO-107609	Practical Course: Mathematical and Computational Methods in Robotics and AI ***First usage possible from Oct 01, 2025.***	**EN**	**WT+ST**	**6 CP**
M-INFO-106932	Practical Course: Model-Driven Software Development	**EN**	**ST**	**6 CP**
M-INFO-106648	Practical Course: Movement and Technology	**EN**	**ST**	**6 CP**
M-INFO-107177	Practical Course: Natural Language Dialog Systems	**EN**	**Irreg.**	**6 CP**
M-INFO-106503	Practical Course: Neural Network Acceleration on FPGAs neu ***First usage possible from Apr 01, 2026.***	**EN**	**WT+ST**	**3 CP**
M-INFO-107865	Practical Course: Performance Engineering in C++ and Rust neu ***First usage possible from Oct 01, 2026.***	**EN**	**Irreg.**	**6 CP**
M-INFO-108020	Practical Course: Programming Language Design and Implementation neu	**EN**	**Irreg.**	**6 CP**
M-INFO-106627	Practical Course: Real-world Vulnerability Discovery and Exploits	**EN**	**WT+ST**	**4 CP**
M-INFO-107600	Practical Course: Route Planning	**EN**	**Irreg.**	**6 CP**
M-INFO-105453	Practical Course: Security, Usability and Society	**EN**	**Irreg.**	**4 CP**
M-INFO-105955	Practical Course: Smart Energy System	**EN**	**WT+ST**	**6 CP**
M-INFO-101567	Practical Course: Visual Computing	**EN**	**WT+ST**	**6 CP**
M-INFO-107241	Practical Introduction to Hardware Security	**EN**	**WT+ST**	**6 CP**
M-INFO-107238	Practical SAT Solving	**EN**	**Irreg.**	**5 CP**
M-INFO-105452	Privacy Enhancing Technologies	**EN**	**ST**	**6 CP**
M-INFO-107168	Probability and Computing	**EN**	**Irreg.**	**5 CP**
M-INFO-105623	Reinforcement Learning	**EN**	**WT**	**6 CP**
M-INFO-100850	Reliable Computing I	**EN**	**Irreg.**	**3 CP**
M-INFO-106654	Research Focus Class: Blockchain & Cryptocurrencies	**EN**	**Irreg.**	**6 CP**
M-INFO-107728	Research Practical Course on Behavior Foundation Models neu ***First usage possible from Apr 01, 2026.***	**EN**	**ST**	**6 CP**
M-INFO-106866	Research Practical Course: Artificial Intelligence & Security	**EN**	**WT+ST**	**6 CP**
M-INFO-106495	Research Practical Course: Explainable Artificial Intelligence ***First usage possible from Apr 01, 2026.***	**EN**	**WT**	**6 CP**
M-INFO-107174	Research Project Deep Learning for Robotics	**EN**	**WT**	**6 CP**
M-INFO-107163	Research Project: Generative AI for Autonomous Agents	**EN**	**ST**	**6 CP**
M-INFO-105591	Resilient Networking	**EN**	**WT**	**6 CP**
M-INFO-107155	Robotics - Practical Course	**EN**	**ST**	**6 CP**
M-INFO-107162	Robotics I - Introduction to Robotics	**EN**	**WT**	**6 CP**
M-INFO-107123	Robotics II - Humanoid Robotics	**EN**	**ST**	**3 CP**
M-INFO-107130	Robotics III - Sensors and Perception in Robotics	**EN**	**ST**	**3 CP**
M-INFO-107598	Robotics Institute Germany - Lecture Series	**EN**	**WT**	**3 CP**
M-INFO-107090	Sampling Methods for Machine Learning	**EN**	**ST**	**6 CP**
M-INFO-107867	Scalable Graph and Sparse Matrix Algorithms for Learning neu	**EN**	**Irreg.**	**5 CP**
M-INFO-105780	Scientific Methods to Design and Analyze Secure Decentralized Systems	**EN**	**WT**	**6 CP**
M-INFO-102662	Seminar Dependable Computing	**EN**	**WT+ST**	**3 CP**
M-INFO-107846	Seminar for Practical Course: Machine Learning and Intelligent Systems neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT+ST**	**3 CP**
M-INFO-107242	Seminar in Privacy	**EN**	**ST**	**4 CP**
M-INFO-107729	Seminar on Behavior Foundation Models neu ***First usage possible from Apr 01, 2026.***	**EN**	**ST**	**3 CP**
M-INFO-107353	Seminar: Advanced Topics in Natural Language Processing ***First usage possible from Oct 01, 2025.***	**EN**	**WT+ST**	**3 CP**

ID	Name	Language	Term offered	Credits
M-INFO-107209	Seminar: Advanced Topics on SAT Solving	**EN**	**WT**	**3 CP**
M-INFO-106086	Seminar: Algorithm Engineering	**EN**	**Irreg.**	**4 CP**
M-INFO-106490	Seminar: Artificial Intelligence for Energy Systems	**EN**	**WT**	**4 CP**
M-INFO-105309	Seminar: Continuous Software Engineering	**EN**	**ST**	**4 CP**
M-INFO-106958	Seminar: Critical Topics in AI	**EN**	**ST**	**3 CP**
M-INFO-107027	Seminar: Current Trends in Theoretical Computer Science	**EN**	**Irreg.**	**4 CP**
M-INFO-107175	Seminar: Deep Learning for Robotics	**EN**	**WT**	**3 CP**
M-INFO-107231	Seminar: Embedded Systems I	**EN**	**WT+ST**	**3 CP**
M-INFO-107232	Seminar: Embedded Systems II	**EN**	**WT+ST**	**3 CP**
M-INFO-106927	Seminar: Exoskeletons & Motion Capture ***First usage possible from Oct 01, 2025.***	**EN**	**WT**	**3 CP**
M-INFO-106497	Seminar: Explainable Artificial Intelligence	**EN**	**WT**	**3 CP**
M-INFO-106651	Seminar: Exploring Robotics - Insights from Science Fiction, Research and Society	**EN**	**ST**	**3 CP**
M-INFO-107436	Seminar: Failing Forward: Robotics, Critical Reading and the Making of Good Research	**EN**	**WT**	**3 CP**
M-INFO-106645	Seminar: Fine-Grained Complexity Theory & Algorithms	**EN**	**Irreg.**	**4 CP**
M-INFO-106868	Seminar: Hot Topics in Artificial Intelligence & Security 1	**EN**	**WT**	**4 CP**
M-INFO-106869	Seminar: Hot Topics in Artificial Intelligence & Security 2	**EN**	**ST**	**4 CP**
M-INFO-100750	Seminar: Hot Topics in Bioinformatics	**EN**	**ST**	**3 CP**
M-INFO-104891	Seminar: Hot Topics in Decentralized Systems	**EN**	**Irreg.**	**3 CP**
M-INFO-106392	Seminar: Hot Topics in Explainable Artificial Intelligence (XAI)	**EN**	**ST**	**4 CP**
M-INFO-107686	Seminar: Information Systems ***First usage possible from Apr 01, 2026.***	**EN**	**WT+ST**	**3 CP**
M-INFO-107217	Seminar: Interpretability and Causality in Machine Learning	**EN**	**ST**	**3 CP**
M-INFO-106719	Seminar: Machine Learning in Climate and Environmental Sciences	**EN**	**Irreg.**	**3 CP**
M-INFO-107816	Seminar: Neural Networks and Artificial Intelligence neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT**	**3 CP**
M-INFO-107205	Seminar: Operating Systems	**EN**	**Irreg.**	**3 CP**
M-INFO-105585	Seminar: Post-Quantum Cryptography	**EN**	**Irreg.**	**3 CP**
M-INFO-107264	Seminar: Practical Graph Algorithms	**EN**	**Irreg.**	**4 CP**
M-INFO-107216	Seminar: Privacy and Security	**EN**	**WT**	**4 CP**
M-INFO-103306	Seminar: Proofs from THE BOOK	**EN**	**Irreg.**	**3 CP**
M-INFO-105408	Seminar: Quantum Information Theory	**EN**	**Irreg.**	**3 CP**
M-INFO-107172	Seminar: Recent Highlights in Algorithms	**EN**	**Irreg.**	**4 CP**
M-INFO-107926	Seminar: Robot Reinforcement Learning neu ***First usage possible from Jul 29, 2026.***	**EN**	**Irreg.**	**3 CP**
M-INFO-105761	Seminar: Secure Multiparty Computation	**EN**	**Irreg.**	**3 CP**
M-INFO-107236	Seminar: Software Architecture, Security and Privacy	**EN**	**Irreg.**	**4 CP**
M-INFO-107179	Seminar: Speech-to-Speech Translation	**EN**	**ST**	**3 CP**
M-INFO-107625	Seminar: Type Systems and Static Program Analysis ***First usage possible from Oct 01, 2025.***	**EN**	**WT**	**4 CP**
M-INFO-106504	Simulation and Optimization in Robotics and Biomechanics	**EN**	**WT**	**6 CP**
M-INFO-107237	Software Architecture and Quality	**EN**	**WT**	**3 CP**
M-INFO-107235	Software Engineering II	**EN**	**ST**	**6 CP**
M-INFO-107212	Software Product Line Engineering	**EN**	**ST**	**3 CP**
M-INFO-106344	Software Security Engineering	**EN**	**ST**	**3 CP**
M-INFO-100719	Software-Evolution	**EN**	**WT**	**3 CP**
M-INFO-107239	Software Test and Quality Management (SQM)	**EN**	**WT**	**5 CP**
M-INFO-107847	Stochastic Information Processing neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT**	**6 CP**
M-INFO-107243	Telematics ***First usage possible until Mar 31, 2027.***	**EN**	**WT**	**6 CP**

ID	Name	Language	Term offered	Credits
M-INFO-100851	Testing Digital Systems I	**EN**	**Irreg.**	**3 CP**
M-INFO-102962	Testing Digital Systems II	**EN**	**Irreg.**	**3 CP**
M-INFO-107202	Text Indexing	**EN**	**WT**	**5 CP**
M-INFO-107639	Theory of Satisfiability Algorithms ***First usage possible from Apr 01, 2026.***	**EN**	**Irreg.**	**4 CP**
M-INFO-107664	Type Systems and Program Analysis	**EN**	**Irreg.**	**6 CP**
M-INFO-107161	Ubiquitous Computing	**EN**	**Irreg.**	**5 CP**
M-INFO-107834	User Studies in Human-Robot Interaction neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT**	**6 CP**
M-INFO-107113	Wearable Robotic Technologies	**EN**	**ST**	**4 CP**

3.12 Minor Studies: Biologically Inspired Robotics

Credits
9-18

Note regarding usage
First usage possible from Apr 01, 2026.

ID	Name	Language	Term offered	Credits
Elective Modules (Elective: between 9 and 18 credits)				
M-MACH-107806	Autonomous Driving in Practice neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT**	**6 CP**
M-MACH-106903	Biologically Inspired Robots	**EN**	**ST**	**3 CP**
M-MACH-106905	CAD Engineering Project for Intelligent Systems	**EN**	**WT+ST**	**6 CP**
M-MACH-106904	Practical Course: Software Development and Application of Mobile, Bio-Inspired Robots	**EN**	**WT**	**6 CP**
M-MACH-107621	Robotic Intelligence: Navigation and Mobile Manipulation ***First usage possible from Apr 01, 2026.***	**EN**	**ST**	**6 CP**
M-MACH-107558	Robotic Intelligence: Perception and Scene Understanding ***First usage possible from Apr 01, 2026.***	**EN**	**WT**	**6 CP**
M-MACH-106902	Seminar: Bionic Algorithms and Robot Technologies	**EN**	**WT+ST**	**3 CP**

3.13 Minor Studies: Electrical Engineering

Credits
9-18

ID	Name	Language	Term offered	Credits
Elective Modules (Elective: between 9 and 18 credits)				
M-ETIT-101834	Business Innovation in Optics and Photonics ***First usage possible from Oct 01, 2025.***	**EN**	**WT**	**4 CP**
M-ETIT-105616	Channel Coding: Algebraic Methods for Communications and Storage	**EN**	**ST**	**3 CP**
M-ETIT-105617	Channel Coding: Graph-Based Codes	**EN**	**WT**	**6 CP**
M-ETIT-100449	Hardware Modeling and Simulation	**EN**	**WT**	**4 CP**
M-ETIT-106963	Hardware Synthesis and Optimization	**EN**	**ST**	**6 CP**
M-ETIT-105971	Mobile Communications	**EN**	**WT**	**4 CP**
M-ETIT-105604	Nano- and Quantum Electronics	**EN**	**ST**	**6 CP**
M-ETIT-100456	Optical Engineering	**EN**	**WT**	**4 CP**
M-ETIT-107839	Seminar Radiation Protection in Medicine neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT**	**3 CP**
M-ETIT-105073	Student Innovation Lab	**EN**	**WT+ST**	**15 CP**
M-ETIT-100537	Systems and Software Engineering	**EN**	**WT**	**6 CP**
M-ETIT-100462	Systems Engineering for Automotive Electronics	**EN**	**ST**	**4 CP**

3.14 Minor Studies: Mathematics

Credits
9-18

ID	Name	Language	Term offered	Credits
Elective Modules (Elective: between 9 and 18 credits)				
M-MATH-101336	Graph Theory	**EN**	**see notes**	**9 CP**
M-MATH-102950	Combinatorics	**EN**	**see notes**	**9 CP**
M-MATH-106957	Modern Methods in Combinatorics	**EN**	**Irreg.**	**6 CP**

3.15 Minor Studies: Economics

Credits
9-18

ID	Name	Language	Term offered	Credits
Elective Modules (Elective: between 9 and 18 credits)				
M-WIWI-105659	Advanced Machine Learning and Data Science	**EN**	**WT+ST**	**9 CP**
M-WIWI-106258	Digital Marketing	**EN**	**WT+ST**	**9 CP**
M-WIWI-101503	Service Design Thinking	**EN**	**Irreg.**	**9 CP**

3.16 Minor Studies: Law

Credits
9-18

ID	Name	Language	Term offered	Credits
Elective Modules (Elective: between 9 and 18 credits)				
M-INFO-107030	EU Data Protection Law	**EN**	**WT**	**3 CP**
M-INFO-107029	Public International Law with an Economic Law Focus	**EN**	**ST**	**3 CP**
M-INFO-107028	Seminar: Law and Legal Studies	**EN**	**WT+ST**	**3 CP**
M-INFO-108019	EU-Law neu	**EN**	**WT**	**3 CP**

3.17 Interdisciplinary Qualifications

Credits
2-6

All courses from the House of Competence (HoC), FORUM Science and Society (except computer science or minor studies courses) and from the Language Center (SpZ), but also special courses of the informatics department, can be validated in this area. The courses are not listed in the module handbook, but can be found on the webpages of these institutions. In order to be accepted, English language certificates must demonstrate a level above B2.

Election notes
All courses from the House of Competence (HoC), FORUM Science and Society (except computer science or minor studies courses) and from the Language Center (SpZ), but also special courses of the informatics department, can be validated in this area. The courses are not listed in the module handbook, but can be found on the webpages of these institutions. In order to be accepted, English language certificates must demonstrate a level above B2.

ID	Name	Language	Term offered	Credits
Interdisciplinary Qualifications (Elective: between 2 and 6 credits)				
M-INFO-107254	Interdisciplinary Qualifications	**EN**	**WT+ST**	**6 CP**
M-INFO-107829	Practice of Research (Methods, 1st Semester) neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT+ST**	**2 CP**
M-INFO-107830	Practice of Research (Methods, 2nd Semester) neu ***First usage possible from Oct 01, 2026.***	**EN**	**WT+ST**	**2 CP**

4 Modules

M 4.1 Module: Access Control Systems: Models and Technology [M-INFO-106303]

Coordinators: Prof. Dr. Hannes Hartenstein
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Cryptography and Security
Area of Specialization: Telematics
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-112775	Access Control Systems: Models and Technology	**ST**	**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 4.2 Module: Advanced Bayesian Data Analysis [M-INFO-106812]

Coordinators: Prof. Dr. Nadja Klein
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Data Science
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113673	Advanced Bayesian Data Analysis	**WT**	**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
Lecture with 2 SWS + 1 SWS exercise
5 ECTS corresponds to approx. 150 hours
approx. 30 hours lecture attendance,
approx. 15 hours exercise attendance,
approx. 80 hours post-processing (self-study)
approx. 25 hours exam preparation (self-study)

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

M 4.3 Module: Advanced Competitive Programming [M-INFO-107863]

Coordinators: TT-Prof. Dr. Thomas Bläsius
Prof. Dr.-Ing. Marvin Künnemann-Goos

Organisation: KIT Department of Informatics

Part of: Area of Specialization: Algorithm Engineering (Usage from 10/1/2026)
Elective Studies in Informatics (Usage from 10/1/2026)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-115279	Advanced Competitive Programming	**Irreg.**	**6 CP**	**Bläsius, Künnemann-Goos**

Assessment
See Partial Achievements (Teilleistung).

Prerequisites
See Partial Achievements (Teilleistung).

Competence Goal
After completion of the module, students are able to:

- efficiently implement problem-specific algorithms using basic and advanced algorithmic techniques in at least one programming language
- estimate running times (in seconds) of algorithms and implementations based on the input size
- recognize applications of existing algorithms
- adapt and combine algorithmic methods to develop new algorithms

Content
The lectures present algorithms and data structures that are useful in practical settings (e.g., programming contests) due to their efficiency and comparably short implementations. For each presented topic (including: string algorithms, number theory, graphs, tree data structures, etc.), the students solve practical programming assignments. In addition, the students participate in contests simulating conditions of popular competitive programming contests.

Among others, the course provides an ideal preparation to participate in collegiate programming contests. Attending this course is especially recommended for students who might be interested in participating in the ACM ICPC Northwestern Europe Regional Contest (NWERC).

Workload
6 CP corresponds to a workload of roughly 180 hours, distributed as follows:

- attendance of lectures: 30 h
- preparation and review of lecture materials: 30 h
- programming assignments: 100 h
- preparation of exam contest: 20 h

Recommendations
The course assumes basic knowledge of algorithms and data structures (e.g., lectures Algorithms 1 and 2) and coding in C++.

We strongly recommend successful participation in “Basispraktikum zum ICPC Programmierwettbewerb”, a similar course or basic experience with competitive programming contests.

M 4.4 Module: Advanced Data Structures [M-INFO-107200]

Coordinators: Prof. Dr. Peter Sanders
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Theoretical Foundations
Area of Specialization: Algorithm Engineering
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114223	Advanced Data Structures	**ST**	**4 CP**	**Sanders**
T-INFO-114224	Advanced Data Structures Project/Experiment	**ST**	**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 4.5 Module: Advanced Machine Learning and Data Science [M-WIWI-105659]

Coordinators: Prof. Dr. Maxim Ulrich
Organisation: KIT Department of Business and Economics
Part of: Minor Studies: Economics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-WIWI-111305	Advanced Machine Learning and Data Science	**WT+ST**	**9 CP**	**Ulrich**

Assessment
The assessment is carried out as a single examination of another type. It includes the interim presentations during the project, the quality of the implementation, the written final paper, and the final presentation. All components are integrated into a single overall assessment, and the resulting grade reflects the overall impression of the combined performance.

Prerequisites
None

Competence Goal
After a successful project, the students can:

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

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

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

Recommendations
None

Teaching and Learning Methods
Project

M 4.6 Module: Algorithm Engineering [M-INFO-100795]

Coordinators: Prof. Dr. Peter Sanders
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Algorithm Engineering
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-101332	Algorithm Engineering	**ST**	**4 CP**	**Sanders**
T-INFO-111856	Algorithm Engineering Pass	**ST**	**1 CP**	**Sanders**

Assessment
See partial achievements (Teilleistung)

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

Prerequisites
See partial achievements (Teilleistung)

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

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

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

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

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

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

Workload
Lecture and exercise with a combined 3 semester hours, 5 ECTS
5 ECTS correspond to about 150h of work, split into
about 45h visiting lectures and exercise or block seminar
about 25h preparation and follow-up on lectures
about 40h solving exercise tasks (programming, preparing presentation for mini seminar, etc)
about 40h exam preparation

M 4.7 Module: Algorithmic Graph Theory [M-INFO-106960]

Coordinators: Dr. rer. nat. Torsten Ueckerdt
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Theoretical Foundations
Area of Specialization: Algorithm Engineering
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113918	Algorithmic Graph Theory	**Irreg.**	**5 CP**	**Ueckerdt**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

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

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

Workload
Lecture with 3SWS, 5CP

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

approx. 45h lecture attendance

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

approx. 45h exam preparation

Recommendations
See partial achievements (Teilleistung)

M 4.8 Module: Algorithms for Visualization of Graphs [M-INFO-106961]

Coordinators: Dr. rer. nat. Torsten Ueckerdt
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Theoretical Foundations
Area of Specialization: Algorithm Engineering
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113919	Algorithms for Visualization of Graphs	**Irreg.**	**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 4.9 Module: Algorithms II [M-INFO-107201]

Coordinators: Prof. Dr. Peter Sanders
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Theoretical Foundations
Area of Specialization: Algorithm Engineering
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114225	Algorithms II	**WT**	**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 4.10 Module: Artificial Intelligence & IT-Security [M-INFO-106810]

Coordinators: Prof. Dr. Christian Wressnegger
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Cryptography and Security
Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113668	Artificial Intelligence & IT-Security	**WT**	**6 CP**	**Wressnegger**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

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

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

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

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

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

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

M 4.11 Module: Automated Planning and Scheduling [M-INFO-104447]

Coordinators: Prof. Dr. Peter Sanders
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Theoretical Foundations
Area of Specialization: Algorithm Engineering
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-109085	Automated Planning and Scheduling	**Irreg.**	**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 4.12 Module: Autonomous Driving in Practice [M-MACH-107806]

Coordinators: Dr.-Ing. Martin Gießler
Kevin Simon
Organisation: KIT Department of Mechanical Engineering
Part of: Minor Studies: Biologically Inspired Robotics (Usage from 10/1/2026)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-MACH-115202	Autonomous Driving in Practice	**WT**	**6 CP**	**Simon**

Assessment
The final grade is based on: 2 written exams (duration about 30 minutes) and the final presentation of the practical task (duration 30 minutes max.), including the final report (2-3 pages). Submission of the homework is mandatory.

The overall impression will be evaluated.

Prerequisites
none

Competence Goal
- Students can configure sensors on the test vehicle, record data and check the quality of the recorded sensor data.
- Students can annotate and segment sensor data and recognize and classify objects using suitable algorithms.
- Students can plan paths and trajectories for driving maneuvers, generate behavioral strategies and evaluate their feasibility.
- Students can implement driving maneuvers using suitable control strategies and control the actuators of the test vehicle.
- Students can implement the entire pipeline - from environmental perception to planning and execution - and test it in a real test vehicle.

Content
The main objective of the event is the practical implementation of the pipeline required for automated/autonomous driving functions with a real test vehicle. This includes recording the environment using various sensors, processing the recorded sensor data (perception), planning driving maneuver and the final execution of the maneuver by the actuators.

- Sensor data acquisition: Setup and data recording of the sensors on the test vehicle
- Perception: data annotation, segmentation of sensor data, object detection
- Maneuver planning: path and trajectory planning, behaviour generation, etc.
- Maneuver execution: vehicle control, implementation of the driving maneuver in the real test vehicle using actuators

Module Grade Calculation
The module grade results of the assessment of the written exams, the presentation, and the final report. Details will be given during the lecture.

Additional Information
Due to capacity limitations, the lecture is limited to 16 students. If necessary, a selection process will be conducted. Places will be allocated based on the students' academic progress (semester level and subject-specific programming skills).

Workload
The workload includes:

1. Attendance time in lectures: 60 h
2. Work on the project: 120 h

Total: 180 h

M 4.13 Module: Autonomous Learning for Intelligent Robot Perception [M-INFO-106608]

Coordinators: Prof. Dr. Rudolph Triebel
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Robotics and Automation
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113327	Autonomous Learning for Intelligent Robot Perception	**WT**	**4 CP**	**Triebel**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Students are capable of describing the details of different methods for autonomous learning, and they can place them in the context of intelligent robot perception. They are able to derive mathematical principles of these algorithms and they can name and describe relevant applications.

Content
This lecture conveys the main principles of Intelligent Robot Perception, where the major focus is on machine learning techniques that are particularly useful for robot vision applications. The most important design criteria for these methods are run-time and data efficiency, safety, and autonomy, where the latter refers to independence of human interactions and the ability to take decisions during learning (aka. active learning). In the lecture, we will analyse modern learning techniques that meet these criteria, and we will show concrete applications of these in robotic perception tasks such as object detection and pose estimation, grasp detection and semantic mapping.

Workload
120h

Recommendations
A basic understanding of probability theory and linear algebra is required

M 4.14 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: Area of Specialization: Theoretical Foundations
Area of Specialization: Algorithm Engineering
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114898	Beating the Worst-Case in Practice: Unexpectedly Efficient Algorithms	**Irreg.**	**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 4.15 Module: Biologically Inspired Robots [M-MACH-106903]

Coordinators: Prof. Dr.-Ing. Arne Rönnau
Organisation: KIT Department of Mechanical Engineering
Part of: Minor Studies: Biologically Inspired Robotics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-MACH-113856	Biologically Inspired Robots	**ST**	**3 CP**	**Rönnau**

Assessment
See partial achievement

Prerequisites
None

Competence Goal
Students are familiar with various design principles of the "bionics" method in robotics and can analyze and evaluate models for kinematics, mechanics, control, perception and cognition.

Students understand the lightweight construction concepts and material properties of natural models. They are familiar with the concepts and methods of lightweight robotics and can describe the resulting effects on the energy efficiency of mobile robot systems.

Students can distinguish between different natural muscle types and how they function. They also know the corresponding artificial muscle systems and can derive the underlying muscle model.

Students know the most important human senses and the associated stimulus processing and information coding. They can derive technological sensors that perform the same function in robotics.

Students can differentiate the function of a central pattern generator (CPG) from a reflex. They can theoretically derive neuro-oscillators and explain how they control the movement of a robot. Furthermore, they can generate walking patterns for six-legged robots based on the "Cruse rules".

Students can distinguish between different types of locomotion and suitable stability criteria for walking movements. They know the most important walking patterns for multi-legged walking robots and can represent these in a gait diagram.

Students know the most important algorithms for machine learning methods and can explain their advantages and disadvantages in robotics.

Students know the subsumption system architecture and can evaluate the advantages of a reactive system architecture. They can combine "behaviors" for biologically inspired robots into behavior networks.

Students can apply Mendel's laws and explain the differences between meitosis and mitosis. They can also explain the basic genetic algorithm.

Students can identify the greatest challenges in the development of innovative, humanoid robot systems and are familiar with possible solutions and successful implementations.

Content
The lecture biologically inspired robots deals intensively with robots whose mechanical design, sensor concepts or control architecture were inspired by nature. In detail, we will look at solutions from nature (e.g. lightweight construction concepts using honeycomb structures, human muscles) and then at robot technologies that utilize these principles to solve similar tasks (lightweight 3D printed parts or artificial muscles in robotics).

After discussing these biologically inspired technologies, concrete robotic systems and applications from current research that successfully utilize these technologies will be presented. In particular, multi-legged walking robots, snake-like and humanoid robots are presented and their sensor and drive concepts are discussed.

The lecture focuses on the concepts of control and system architectures (e.g. behavior-based systems) of these robotic systems, with locomotion being the main focus. The lecture ends with an outlook on future developments and the development of commercial applications for these robots.

Workload
90 working hours, of which approx:

- 30h for attendance time in lectures
- 30h for preparation and follow-up time
- 30h for exam preparation and participation in the oral exam

M 4.16 Module: Business Innovation in Optics and Photonics [M-ETIT-101834]

Coordinators: Prof. Dr. Werner Nahm
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Minor Studies: Electrical Engineering (Usage from 10/1/2025)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-ETIT-104572	Business Innovation in Optics and Photonics	**WT**	**4 CP**	**Nahm**

Assessment
Type of Examination: examination of another type

Duration of Examination: 4 group presentations à 20 minutes (approx.)

Modality of Exam: The exam consists of four group presentations. 2nd day: Technology Presentation. 3rd day: Development plan presentation. 4th day: Business Canvas presentation. Final presentation: Business pitch. The overall impression is rated.

Prerequisites
none

Competence Goal
The student has an understanding how innovative concepts for optical and photonics products are transferred into a successful business development. The student knows about and makes first The student develops practical experience of how to analyse, develop, and pitch innovative business ideas based on optics & photonics technologies, specifically in the field of spectroscopy and hyperspectral imaging. Through a series of short lectures followed by extensive group work over the first week of the block course the student acquires hands-on experience of business development as lived in a technology start-up environment. The students are given a basic introduction to spectroscopy and are challenged to propose innovative businesses enabled by evolving technology and market needs. To assist in this process the students are introduced to the innovation methodology “Deep Tech Exploration” and primed on themes from intellectual property management to effective pitching.

The students organize themselves into teams, and work cooperatively within the team to develop and deliver the complete business pitch.

In summary the students:

- learn innovation methodologies to assess and optimize the desirability, viability, and feasibility of business ideas.
- are introduced to methods to assess and generate relevant intellectual property.
- get to apply the knowledge gained with extensive group work developing their own business idea and pitch.

Content
This course is instructed by ZEISS employees, active within the ZEISS corporate innovation ecosystem.

Monday: Introduction into spectroscopy and the deep tech exploration method
• Technology introduction, state-of-the-art
• Scenario Introduction: Found your own start-up
• Overview Deep Tech Exploration methodology / Select your use case

Tuesday: Deep dive – deep tech exploration
• Methods and ideation techniques
• Fundamental principles in Innovation / Value Proposition
• Define your tech product

Wednesday: Business case development
• How to protect your business idea with IP?
• Develop your business idea with the help of the Business Model Canvas
• Writing a Business plan

Thursday: Storytelling and pitching
• Entrepreneurial fincance: tech product problem sizing / ballparking
• Storytelling
• Preparing an elevator pitch

Friday-Thursday of second week: Final pitch preparation
• Self-organized by groups

Friday of second week: Final pitch

Module Grade Calculation
The module grade results of the assessment of the presentations. Details will be given during the lecture.

Workload
Total 120 h, thereof 34 h contact hours and 86 h preparation, homework, and self-studies

Recommendations
Good knowledge in optics & photonics. Personal motivation and interest for getting deeper into business development aspects, methods and tools. Commitment to active, regular and coninuous participation in the group work.

M 4.17 Module: CAD Engineering Project for Intelligent Systems [M-MACH-106905]

Coordinators: Prof. Dr.-Ing. Arne Rönnau
Organisation: KIT Department of Mechanical Engineering
Part of: Minor Studies: Biologically Inspired Robotics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-MACH-113857	CAD Engineering Project for Intelligent Systems	**WT+ST**	**6 CP**	**Rönnau**

Assessment
See module component

Prerequisites
None

Content
The module *CAD Engineering Project for Intelligent Systems* is a project-based master's-level course that offers students the opportunity to gain and to deepen engineering competencies in the development of intelligent mechatronic systems through practical application. Working in interdisciplinary teams, students conceive, design, and realize a robotic prototype across a complete development cycle.

Starting from a defined problem statement, students develop a technical concept and implement it as a detailed mechanical design using CAD software (Autodesk Fusion 360). Particular emphasis is placed on the basics of rapid prototyping, function-oriented component design, correct parametrization, consideration of manufacturing constraints, and the integration of mechanical and electronic components as well as their software interfacing.

The designed components are predominantly manufactured using additive manufacturing methods (in particular 3D printing) and are supplemented by basic conventional manufacturing techniques. In parallel, students integrate suitable sensors, actuators, and additional electronic components into the system and develop the necessary software for control and regulation of the robotic prototype.

Finally, the developed system is assembled, commissioned, and tested and evaluated under realistic conditions. The results are subsequently documented and presented. In addition to technical expertise, the module particularly promotes project management skills, teamwork, interdisciplinary thinking, and a systematic, solution-oriented approach, as required for the development of intelligent technical systems in research and industry.

Prerequisites:
Basic knowledge of common CAD software solutions, ideally Fusion 360.

Students must hand in a small application, detailing motivation and prior experience. The application is done via Ilias (ilias.studium.kit.edu) - **Deadline: 16.04.2026 .**

Module Grade Calculation
The module grade results of the assessment of the design project, the written assignments and the presentation. Further details will be provided at the beginning of the course.

Additional Information
For further notes see here teaching.imi.kit.edu

Workload
1. Attendance time internship: 60 h (4 SWS*15 h)
2. Work on the project, self-study time incl. exam preparation: 120 h
   Total: 180 h

Division of content:

- Initial design / idea of a (biologically inspired) mechatronic component: 20h
- Construction using CAD system and overall system design: 60h
- 3D printing, assembly, integration of electronics and functional tests: 80h
- Documentation and report: 10h
- Meetings: Kickoff, interim and final presentation and discussions as well as meetings with supervisors: 10h

M 4.18 Module: Channel Coding: Algebraic Methods for Communications and Storage [M-ETIT-105616]

Coordinators: Prof. Dr.-Ing. Laurent Schmalen
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Minor Studies: Electrical Engineering

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-ETIT-111244	Channel Coding: Algebraic Methods for Communications and Storage	**ST**	**3 CP**	**Schmalen**

Assessment
The exam is held as an oral exam of approx. 20 min.

The module grade of the module corresponds to the grade of the oral exam.

Competence Goal
The students are able to analyse and assess problems of algebraic channel coding. They can apply methods of algebraic coding theory in the context of communication systems for data transmission and data storage and are able to assess their implementation.Additionally, they will get knowledge to current research topics and research results.

Content
This course focuses on the formal and mathematical basics for the design of coding schemes in digital communication systems. These include schemes for data transmission, data storage and networking. The course starts by introducing he necessary fundamentals of algebra which are then used to derive codes for different applications. Besides codes that are important for data transmission appliations, e.g., BCH and Reed-Solomon-Codes, we also investigate codes for the efficient storage and reconstruction of data in distributed systems (locally repairable codes) and codes that increase the throughput in computer networks (network codes). Real applications are always given to discuss practical aspects and implementations of these coding schemes. Many of these applications are illustrated by example code in software (python/MATLAB).

Module Grade Calculation
The module grade of the module corresponds to the grade of the oral exam.

Workload
1. Attendance to the lecture: 15 * 2 h = 30 h
2. Preparation and review: 15 * 4 h = 60 h
3. Preparation for the exam: included in preparation and review
4. In total: 90 h = 3 LP

Recommendations
Knowledge of basic engineering as well as basic knowledge of communications engineering.

Previous attendance of the lectures "Communication Engineering I" and "Probability Theory" is recommended.

M 4.19 Module: Channel Coding: Graph-Based Codes [M-ETIT-105617]

Coordinators: Prof. Dr.-Ing. Laurent Schmalen
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Minor Studies: Electrical Engineering

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-ETIT-111245	Channel Coding: Graph-Based Codes	**WT**	**6 CP**	**Schmalen**

Assessment
The success control takes place in the form of an oral examination lasting approx. 25 minutes. Before the examination, there is a preparation phase of 30 minutes in which preparatory tasks are solved.

Prerequisites
none

Competence Goal
Students will be able to understand and apply advanced and modern methods of channel coding. They get to know various tools of modern coding theory for the analysis and optimization of coding schemes, conceptual design approaches of error correction building blocks as well as applications in digital communications (for example, 5G). Additionally, they will get knowledge to current research topics and research results.

Content
The course expands on the topics dealt with in the lecture “Verfahren der Kanalcodierung”. The focus is on modern methods that have been brought into practice in the past few years and that achieve the capacity limits postulated by Shannon. For this purpose, known techniques have to be extended and new methods have to be learnt additionally. The lecture introduces the theoretical limits very quickly and follows with a discussion on the basic concepts of channel coding, including block codes. Based on this, modern error correction methods like LDPC codes, spatially coupled codes, and Polar codes are treated in depth. The lecture ends with a view on the application of channel coding in classical and distributed storage scenarios and in computer networks. Many of the applications are illustrated with example implementations in software (python/MATLAB).

Module Grade Calculation
The modul grade is the grade of the oral exam.

Workload
- Lecture attendance time: 15 * 3 h = 45 h
- Presence time Exercise: 15 * 1 h = 15 h
- Lecture preparation / revision: 15 * 3 h = 45 h
- Exercise: 15 * 1 h = 15 h
- Exam preparation and attendance: 60 h

Total workload: approx. 180 h = 6 LP

Recommendations
Previous attendance of the lectures "Communication Engineering I" and "Probability Theory" is recommended. Knowledge from the lecture "Applied Information Theory" can be helpful. Previous attendance of the lecture “Verfahren der Kanalcodierung” can be helpful, but is not necessary.

M 4.20 Module: Combinatorics [M-MATH-102950]

Coordinators: Prof. Dr. Maria Aksenovich
Organisation: KIT Department of Mathematics
Part of: Minor Studies: Mathematics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-MATH-105916	Combinatorics	**Irreg.**	**9 CP**	**Aksenovich**

Assessment
The final grade is given based on the written final exam (2h).

By successfully working on the problem sets, a bonus can be obtained. To obtain the bonus, one has to achieve 50% of the points on the solutions of the exercise sheets 1-6 and also of the exercise sheets 7-12. If the grade in the final written exam is between 4,0 and 1,3, then the bonus improves the grade by one step (0,3 or 0,4).

Prerequisites
none

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

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

Module Grade Calculation
The grade of the module ist the grade of the written exam.

Additional Information
- Course is held in English
- This course is one of the nine core courses in the subject area Algebra and Geometry, from which at least six courses are offered within every two years (at least four different ones).

Workload
Total workload: 240 hours

Attendance time: 90 hours

- Course including module examination during the course of study

Self-study: 150 hours

- Deepening the study content by working on the lecture content at home
- Completion of exercises
- In-depth study of the course content using suitable literature and internet research
- Preparation for the module examination during the course of study

Recommendations
Knowledge of the modules Linear Algebra 1 and 2 and Analysis 1 and 2 is recommended.

Teaching and Learning Methods
Lecture + Tutorial (4+2 weekly contact hours)

M 4.21 Module: Compiler Design [M-INFO-106966]

Coordinators: Prof. Dr. André Platzer
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Software Engineering and Compiler Construction
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113925	Compiler Design	**Irreg.**	**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 4.22 Module: Computational Geometry [M-INFO-107228]

Coordinators: TT-Prof. Dr. Thomas Bläsius
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Theoretical Foundations
Area of Specialization: Algorithm Engineering
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114251	Computational Geometry	**Irreg.**	**6 CP**	**Bläsius**
T-INFO-114252	Computational Geometry - Pass	**Irreg.**	**0 CP**	**Bläsius**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

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

* explain concepts, structures, and fundamental problem definitions presented in the lectures

* execute geometric algorithms, analyze them mathematically, and prove their properties

* select appropriate algorithms and data structures for solving a given geometric problem and adapt them to specific problem scenarios if necessary

* analyze unfamiliar geometric problems, reduce them to their algorithmic core, and create an abstract model; based on the concepts and techniques learned in the lecture, design their own solutions within this model, analyze them, and prove their properties

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

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

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

M 4.23 Module: Computational Imaging [M-INFO-106190]

Coordinators: Prof. Dr.-Ing. Jürgen Beyerer
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Robotics and Automation
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-112573	Computational Imaging	**WT**	**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 4.24 Module: Constructive Logic [M-INFO-106256]

Coordinators: Prof. Dr. André Platzer
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Theoretical Foundations
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-112704	Constructive Logic	**ST**	**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 4.25 Module: Cryptographic Protocols II: Universal Composability [M-INFO-107435]

Coordinators: Prof. Dr. Jörn Müller-Quade
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Cryptography and Security
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114602	Cryptographic Protocols II: Universal Composability	**WT**	**3 CP**	**Müller-Quade**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

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

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

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

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

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

Workload
90 h
Lectures: 24 h
Self-study during semester: 31 h
Preparation for the exam: 35 h

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

M 4.26 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: Area of Specialization: Telematics
Area of Specialization: Human-centred Machine Intelligence
Area of Specialization: Data Science
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113402	Data Science and Artificial Intelligence for Energy Systems	**ST**	**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 4.27 Module: Decentralized Systems: Fundamentals, Modeling, and Applications [M-INFO-105334]

Coordinators: Prof. Dr. Hannes Hartenstein
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Cryptography and Security
Area of Specialization: Telematics
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-110820	Decentralized Systems: Fundamentals, Modeling, and Applications	**ST**	**6 CP**	**Hartenstein**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Fundamentals & Modeling

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

Applications

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

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

- Fundamentals
  - Peer-to-Peer Overlay Networks, Sybil and Eclipse Attacks
  - Formalization of decentralized systems, including models for their computation, communication, faults, and timing.
  - Leader election and broadcast in decentralized systems, based on different models for identities and timing.
  - Byzantine consensus in synchronous and asynchronous settings, including Bracha's fundamental algorithm for reliable broadcast, practical Byzantine fault tolerant consensus, and fundamental limits.
  - Consistency models and protocols, including conflict-free replicated data types.

- Applications
  - Decentralized storage systems, at the example of IPFS
  - Decentralized communication systems, at the example of Matrix for instant messaging
  - Distributed ledgers and blockchains, at the examples of Bitcoin and Ethereum, in particular Proof-of-Work and Proof-of-Stake consensus
  - Scaling techniques for distributed ledgers, at the example of payment channel networks and rollups
  - Decentralized, federated machine learning systems

Workload
1. Attendance time (Course, exercise, etc.)
Lecture: 3 SWS: 3,0h x 15 = 45h
Exercise: 1 SWS: 1,0h x 15 = 15h
2. Self-study (e.g. independent review of course material, work on homework assignments)
Weekly preparation and follow-up of the lecture: 15 x 1h x 3 = 45h
Weekly preparation and follow-up of the exercise: 15 x 2h = 30h
3. Preparation for the exam: 45 h
Σ = 180h = 6 ECTS

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

M 4.28 Module: Deep Learning and Neural Networks [M-INFO-107197]

Coordinators: Prof. Dr. Jan Niehues
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114219	Deep Learning and Neural Networks	**ST**	**6 CP**	**Niehues**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

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

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

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

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

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

Workload
Lecture with 4 SWS, 6 CP.
6 LP corresponds to approx. 180 hours, of which
approx. 60 hours lecture attendance
approx. 90 hours post-processing (self-study)
approx. 30 hours exam preparation (self-study)

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

M 4.29 Module: Deep Learning for Computer Vision: Advanced Topics [M-INFO-107843]

Coordinators: Prof. Dr.-Ing. Rainer Stiefelhagen
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Human-centred Machine Intelligence (Usage from 10/1/2026)
Elective Studies in Informatics (Usage from 10/1/2026)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-115257	Deep Learning for Computer Vision: Advanced Topics	**WT**	**3 CP**	**Stiefelhagen**

Assessment
See partial achievements.

Prerequisites
See partial achievements.

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

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

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

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

Module Grade Calculation
See partial achievements.

Workload
Attendance of the lectures: approx. 20 hours

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

Exam preparation: approx. 40 hours

Total: approx. 90 hours

Recommendations
Knowledge of deep learning basics is strongly recommended.

M 4.30 Module: Design and Architectures of Embedded Systems (ESII) [M-INFO-107230]

Coordinators: Prof. Dr.-Ing. Jörg Henkel
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Design of Embedded Systems and Computer Architectures
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114254	Design and Architectures of Embedded Systems (ESII)	**WT**	**3 CP**	**Henkel**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

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

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

Workload
90 hours:
30 hours of lectures (15 weeks*2 hours)
30 hours of self study (15 weeks*2 hours)
15 hours of deepening (coding low level C and embedded C) to grasp the theory with practical
15 hours exam preparation

M 4.31 Module: Digital Marketing [M-WIWI-106258]

Coordinators: Prof. Dr. Ann-Kristin Kupfer
Organisation: KIT Department of Business and Economics
Part of: Minor Studies: Economics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-WIWI-112693	Digital Marketing	**ST**	**4,5 CP**	**Kupfer**
Supplementary Courses (Elective: 4,5 credits)				
T-WIWI-114174	Economic Decision Making	**WT**	**4,5 CP**	**Scheibehenne**
T-WIWI-114893	International Entrepreneurship and Brand Development	**see notes**	**6 CP**	**Kupfer, Terzidis**
T-WIWI-115326	AI- and Data-Driven B2B Sales	**ST**	**1,5 CP**	**Klarmann, Konhäuser**
T-WIWI-107720	Market Research	**ST**	**4,5 CP**	**Klarmann**
T-WIWI-112711	Media Management	**see notes**	**4,5 CP**	**Kupfer**
T-WIWI-111848	Online Concepts for Karlsruhe City Retailers	**ST**	**3 CP**	**Kupfer**

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

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

Prerequisites
None

Competence Goal
Students

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

Content

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

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

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

Workload

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

M 4.32 Module: Distributed Computing [M-INFO-107215]

Coordinators: Prof. Dr. Achim Streit
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Telematics
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114235	Distributed Computing	**WT**	**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 4.33 Module: Edge-AI in Software and Sensor Applications [M-INFO-107234]

Coordinators: Dr. Victor Pankratius
Organisation: KIT Department of Informatics
Part of: Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114258	Edge-AI in Software and Sensor Applications	**WT+ST**	**3 CP**	**Pankratius**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Qualification goals

After completing the module, students have the following skills. They...

- can name and explain the theoretical and practical aspects of software and sensor technology in the context of edge and fog computing
- can name and use techniques of software engineering and algorithm development for sensor applications
- can name and use methods of artificial intelligence in the context of resource constraints and fault tolerance
- can weigh the characteristic properties of the methods and tools presented, their advantages and disadvantages against each other and can select a suitable tool for a given application scenario.

Learning objectives

Students can name the relevant elements of a technical system and their tasks in edge/fog computing. Students are able to name resource constraints of different types (CPU, memory, communication, energy) and describe their effects on software and algorithm design. Students can describe functional principles of sensors of different types (e.g. microelectromechanical systems - MEMS), describe their functional principles in accelerators, gyroscopes, pressure/humidity sensors, particle detection, etc., explain applications and their context (e.g. gesture recognition in mobile phones/"wearables"/"hearables", localization & navigation, environmental measurements). Students are able to design software systems for edge and fog applications and to develop complex edge and fog software projects in an engineering manner. The problems and requirements of different application areas can be recognized, processed and transferred to a new context. Problems in recognizing patterns in sensor data, classification and prediction can be solved using model-based algorithms or machine learning approaches. Problems in deriving instructions for action can be solved using inference techniques.

Content
Edge computing comprises applications, data and services that are relocated to the outer edges of networks. Such systems typically require local data processing with limited resources such as energy consumption, CPUs, memory or connectivity. Fog computing also combines these aspects with cloud architectures. The importance of these approaches is growing today for modern sensor applications and ranges from industrial applications to Internet-of-Things, ubiquitous computing, consumer applications in cell phones, wearables & hearables (e.g. health & fitness applications), drones or applications in augmented reality. At the same time, the proportion of hardware-related software is also growing in all sensor applications, which opens up new possibilities. In this context, artificial intelligence methods are becoming increasingly important in order to realize learning systems with improved autonomy and immediate feedback. This module presents the current status as well as research work and open problems.

Workload
2 SWS: (2 SWS + 1.5 x 2 SWS) x 15 + 15 h exam preparation = 90 h = 3 ECTS

Recommendations
Knowledge of e.g. cognitive systems, software engineering, algorithms, computer networks & structures, low-power design is helpful.

M 4.34 Module: Embedded Machine Learning Lab [M-INFO-105775]

Coordinators: Prof. Dr.-Ing. Jörg Henkel
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Design of Embedded Systems and Computer Architectures
Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-111549	Embedded Machine Learning Lab	**WT+ST**	**4 CP**	**Henkel**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
The student will understand the main concept of machine learning (ML) on embedded systems, the constraints present on such platforms, and the design objectives for ML algorithms on such platforms. The student will be able to understand various concepts of compression of neural networks. The student will gain hands-on experience with current state-of-the-art ML frameworks, parameter tuning of algorithms, and will develop software programs for implementing the concepts. The student will be able to compare and analyze the current state-of-the-art algorithms regarding their flexibility and performance on embedded devices.

Content
IoT devices more and more rely on ML models to perform their operations. They thereby also generate lots of data that should be used to improve these ML models through on-device learning. Devices need to perform the training with this data locally due to privacy constraints or communication limitations. However, the inference of neural networks, and especially the training, requires too many resources (computations, memory, energy, etc.) — unless the available resources are considered in the design.

This lab provides insights into deploying machine learning algorithms to embedded devices.

Since embedded devices operate with significantly lower resources than the commonly-employed high-end GPUs, making neural networks run fast without sacrificing much accuracy on embedded devices is a challenging task. The lab covers training and inference on resource-constrained devices, introducing state-of-the-art methodologies like pruning and quantization.

The students will learn about neural networks beyond theory, working with popular frameworks like TensorFlow, the effects of hyperparameters, and how they influence the network. Furthermore, the student will learn about resource and accuracy trade-offs in neural networks and design custom networks to achieve given resource or accuracy requirements.

This lab requires basic (theoretic) knowledge about neural networks and training. Further knowledge of Linux environments and Python is strongly advised since they will be intensively used in the lab and are the de-facto industry standard for machine learning research.

The students will meet every week. Exact dates and times will be fixed in the first kick-off meeting. Depending on the number of participants, students will work together in groups of 2-3 students.

Workload
(2 SWS +1.5*2 SWS)*10

+55 h final project

+15 h presentation & report

= 120 h = 4 ECTS

Recommendations
This lab requires a basic (theoretic) knowledge about neural networks and training. Further knowledge of Linux environments and Python is strongly advised since they will be intensively used in the lab and are the de-facto industry standard for machine learning research.

M 4.35 Module: Empirical Software Engineering [M-INFO-107685]

Coordinators: Prof. Dr.-Ing. Anne Koziolek
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Software Engineering and Compiler Construction (Usage from 4/1/2026)
Elective Studies in Informatics (Usage from 4/1/2026)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-115054	Empirical Software Engineering	**WT+ST**	**4 CP**	**Dehghani**

Assessment
See Partial Achievements (Teilleistung).

Prerequisites
See Partial Achievements (Teilleistung).

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

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

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

M 4.36 Module: Engineering Self-Adaptive Systems [M-INFO-106626]

Coordinators: Prof. Dr. Raffaela Mirandola
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Software Engineering and Compiler Construction
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113349	Engineering Self-Adaptive Systems	**WT**	**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 4.37 Module: EU Data Protection Law [M-INFO-107030]

Coordinators: Gustavo Gil Gasiola
Organisation: KIT Department of Informatics
Part of: Minor Studies: Law

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113887	EU Data Protection Law	**WT**	**3 CP**	**Gil Gasiola**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
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

M 4.38 Module: EU-Law [M-INFO-108019]

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

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-115479	EU-Law	**WT**	**3 CP**	**Zufall**

Assessment
See Partial Achievements (Teilleistung).

Prerequisites
See Partial Achievements (Teilleistung).

Competence Goal
Students will gain a general understanding of the European Union, EU law and its interplay with the law of the Member States. Moreover, they will be able to distinguish between the different actors and sources of law. Students will also become familiar with the European single market and the fundamental freedoms of the European Union as well as European human rights. After the lecture, students should be able to identify and solve issues of EU law.

Content
The lecture is designed to provide students with a general understanding of the European Union, EU law and its interplay with the law of the Member States. The lecture will introduce students to the institutional structure of the European Union, including the main actors (European Commission, Council of the European Union, European Parliament and Court of Justice of the European Union). Moreover, an overview over the legislative process of the European Union and the different sources of law (in particular regulations, directives and decisions) will be provided.
Another focus of the lecture will be the European single market and the fundamental freedoms. The lecture will also discuss European human rights (in particular the Charter of Fundamental Rights).
Furthermore, the lecture will deal with the relationship between EU law and the law of the Member States as well as the application of EU law by national authorities and the relationship between national courts and the courts of the European Union.

Workload
The course workload is 90 h, including 22,5 h attendance time.

Recommendations
Students are advised to have the EU Treaties and other relevant legal texts at hand (e.g. Blackstone's EU Treaties & Legislation or online at https://eur-lex.europa.eu/collection/eu-law/treaties/treaties-force.html).

M 4.39 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: Area of Specialization: Human-centred Machine Intelligence
Area of Specialization: Data Science (Usage from 10/1/2025)
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-112774	Explainable Artificial Intelligence	**ST**	**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 4.40 Module: Fine-Grained Complexity Theory & Algorithms [M-INFO-106644]

Coordinators: Prof. Dr.-Ing. Marvin Künnemann-Goos
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Theoretical Foundations
Area of Specialization: Algorithm Engineering
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113391	Fine-Grained Complexity Theory & Algorithms	**Irreg.**	**6 CP**	**Künnemann-Goos**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Students know the foundations of fundamental algorithmic barriers in the polynomial-time and exponential-time regimes. They are able to use fine-grained reductions to relate the time complexity of different problems. They can derive conditional lower bounds from such reductions, based on established hardness assumptions.
Furthermore, they know about the techniques underlying the fastest known algorithms for central problems in the field.

Content
- fine-grained reductions:
  -- conditional lower bounds
  -- main techniques for obtaining such reductions
- central hardness assumptions and their applications:
  -- (Strong) Exponential Time Hypothesis
  -- Orthogonal Vectors Hypothesis
  -- 3SUM Hypothesis
  -- APSP Hypothesis
- conditional lower bounds for string problems, algorithmic graph theory, geometry
- algorithmic techniques:
  -- fastest known algorithms for central problems (SAT, Orthogonal Vectors, 3SUM, APSP)
  -- polynomial method
  -- applications of fast matrix multiplication
  -- Fast Fourier Transform/polynomial multiplication

Workload
Lecture with exercises, 4 SWS, 6 CP
6 CP amounts to 180 h, distributed as follows:
- about 60 h attendance of lectures and exercise sessions
- about 30 h of preparation and reviewing course material
- about 60 h solving exercise sheets
- about 30 h exam preparation

Recommendations
Basic knowledge of theoretical computer science and algorithm design is recommended.

M 4.41 Module: Geometric Deep Learning [M-INFO-106237]

Coordinators: Jun.-Prof. Dr. Jan Stühmer
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-112662	Geometric Deep Learning	**WT**	**6 CP**	**Stühmer**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Students gain a theoretical and methodical approach to modern Deep Learning as well as knowledge and experience about the application of Deep Learning methods on networks and graphs

Students are able to apply this knowledge for understanding existing state-of-the-art Deep Learning architectures and for deriving novel architectures from first principles

Content
- This module provides students with both theoretical and practical insights into modern Deep Learning
- In particular, we focus on a novel approach for understanding deep neural networks with mathematical tools from geometry and group theory
- This enables a methodical approach to Deep Learning: starting from first principles of symmetry and invariance, we derive different network architectures for analyzing unstructured sets, grids, graphs, and manifolds
- Topics of the course include: group theory, graph neural networks, convolutional neural networks, applications of geometric deep learning in diverse fields such as geometry processing, molecular dynamics, social networks, game playing (computer Go), processing of text and speech, as well as applications in medicine

Workload
Lecture with 2 SWS + 2 SWS Tutorial, 6 LP
6 LP corresponds to 180 hours, including

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: 75h (self-study)

Recommendations
Knowledge about the foundations of machine learning, group theory and linear algebra useful but not required.

M 4.42 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: Area of Specialization: Theoretical Foundations
Area of Specialization: Algorithm Engineering
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114232	Graph Partitioning and Graph Clustering in Theory and Practice	**Irreg.**	**4 CP**	**Sanders, Ueckerdt**
T-INFO-114233	Graph Partitioning and Graph Clustering in Theory and Practice - Practical	**Irreg.**	**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 4.43 Module: Graph Theory [M-MATH-101336]

Coordinators: Prof. Dr. Maria Aksenovich
Organisation: KIT Department of Mathematics
Part of: Minor Studies: Mathematics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-MATH-102273	Graph Theory	**Irreg.**	**9 CP**	**Aksenovich**

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

By successfully working on the problem sets, a bonus can be obtained. To obtain the bonus, one has to achieve 50% of the points on the solutions of the exercise sheets 1-6 and also of the exercise sheets 7-12. If the grade in the final written exam is between 4,0 and 1,3, then the bonus improves the grade by one step (0,3 or 0,4).

Prerequisites
None.

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

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

Additional Information
- Course is held in English
- This course is one of the nine core courses in the subject area Algebra and Geometry, from which at least six courses are offered within every two years (at least four different ones).

Workload
Total workload: 240 hours

Attendance time: 90 hours

- Course including module examination during the course of study

Self-study: 150 hours

- Deepening the study content by working on the lecture content at home
- Completion of exercises
- In-depth study of the course content using suitable literature and internet research
- Preparation for the module examination during the course of study

Teaching and Learning Methods
Lecture + Tutorial (4+2 weekly contact hours)

M 4.44 Module: Hands-on Bioinformatics Practical [M-INFO-101573]

Coordinators: Prof. Dr. Alexandros Stamatakis
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Algorithm Engineering

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-103009	Hands-on Bioinformatics Practical	**Irreg.**	**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 4.45 Module: Hardware Modeling and Simulation [M-ETIT-100449]

Coordinators: Dr.-Ing. Jens Becker
Prof. Dr.-Ing. Jürgen Becker
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Minor Studies: Electrical Engineering

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-ETIT-100672	Hardware Modeling and Simulation	**WT**	**4 CP**	**Becker, Becker**

Assessment
Achievement is examined in the form of a written examination lasting 120 minutes.

Prerequisites
none

Competence Goal
After completing this module, students will be familiar with different hardware description languages and their applications in various abstraction levels. They will gain knowledge of the SPICE Hardware Description Language and become proficient in building and deriving the analog matrix for spice simulation. In the realm of digital design, they will develop a comprehensive understanding of the hardware description language VHDL, encompassing the VHDL Standard and its extensions, such as VHDL 2008, the 9-valued logic, and the VHDL-AMS standard. Furthermore, students will achieve a profound comprehension of simulator principles, particularly the delta cycle model. They will also grasp the fundamentals of fault simulations for testing fabricated circuits and learn to derive test vectors. Additionally, students will acquire an understanding of higher-level hardware construction languages like Chisel and SystemC.

Content
In order to address the complexity of modern chips during development, it is essential to utilize modern hardware description languages. This course offers insights into the various levels of abstraction in these languages. It starts by covering the fundamentals of analog description using SPICE and then progresses through VHDL, VHDL-AMS, and Verilog. Additionally, the course introduces more abstract languages like Chisel and SystemC.

Topics covered in the course are:

- Design Process
- Basics of Modeling and Simulation
- Low Level Modeling
- VHDL
  - VHDL-AMS
  - 9-valued logic
  - Delta cycle simulation
  - Fault simulation
- Verilog
- Chisel
- SystemC

Module Grade Calculation
The module grade results from the grade of the written examination.

Workload
The workload is covered by:

1. Participating in lectures and tutorials: 33h
2. Preparing and wrap up of the above named units: 66h
3. Exam preparation and presence: 21h

Sum: 120h = 4 LP

M 4.46 Module: Hardware Synthesis and Optimization [M-ETIT-106963]

Coordinators: Prof. Dr.-Ing. Jürgen Becker
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Minor Studies: Electrical Engineering

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-ETIT-113922	Hardware Synthesis and Optimization	**ST**	**6 CP**	**Becker**

Assessment
The examination takes place within the framework of an oral overall examination (approx. 30 minutes)

Prerequisites
none

Competence Goal
Students know the basic steps required for the automated design of optimized digital circuits. They are able to classify them in the Y-chart and assess their complexity.

They will be able to name and explain the most important approaches for these design steps and evaluate them with regard to optimality and computational effort. This includes the ability to use algorithms for these approaches, e.g. selected graph algorithms, metaheuristics such as simulated annealing. The students are also able to determine their respective runtime complexities.

In addition, they can solve given problems from the field of design automation by selecting a suitable approach based on certain optimization criteria and applying it to the respective problem.

Content
The module focuses on teaching the formal and methodological foundations for the automated design of optimized electronic systems. The relevant scientific and methodological properties of the methods used are discussed and their implementation in industrial practice is also taught.

The following topics are covered:

- Graph Algorithms and Complexity
- High-Level Synthesis
- Algorithms for Scheduling, Allocation and Binding Problems
- Register-Transfer-Level Synthesis
- Retiming Algorithms
- Logic Optimization
- Technology Mapping for Standard Cells and FPGAs
- Physical Design
- Placement of Standard Cells with ILP and Simulated Annealing
- Global and Detailed Routing

Module Grade Calculation
The module grade is the grade of the oral exam.

Workload
The workload includes (4 SWS):

1. attendance in lectures and exercises: 60 h
2. preparation / follow-up: 60 h
3. preparation of and attendance in examination: 60 h

A total of 180 h = 6 CR

Recommendations
Basic knowledge in the field of digital circuits, e.g. as taught in the course “Digital Technology” (2311615) is helpful.

M 4.47 Module: Hardware-efficient Artificial Intelligence [M-INFO-107448]

Coordinators: Prof. Dr.-Ing. Jörg Henkel
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Design of Embedded Systems and Computer Architectures
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114628	Hardware-efficient Artificial Intelligence	**WT**	**3 CP**	**Henkel, Rapp**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Upon successful completion of the course, participants will be able to:

1. Understand and analyze the challenges of efficiently deploying deep learning models on hardware platforms.
2. Apply optimization techniques to improve the hardware efficiency of deep learning models, specifically to reduce latency, energy consumption, and memory usage.
3. Explain and implement the following methods in practical scenarios:
- Knowledge Distillation
- Neural Architecture Search (NAS)
- Pruning
- Quantization
4. Evaluate and adapt the use of these techniques for both cloud-based and embedded systems.
5. Perform model optimizations while maintaining high task performance.

Content
Deep learning models are ubiquitous in modern applications, from computer vision to natural language processing. However, deploying these models efficiently on hardware platforms remains a significant challenge, leading to increased latency, energy consumption, memory usage, and cost. As deep learning models become larger and more complex, the need for optimization techniques to improve their performance on hardware is more critical than ever. This course discusses the principles and techniques for optimizing deep learning models for hardware deployment, focusing on both cloud and embedded systems.

The course covers various optimization techniques to improve model efficiency, reduce latency, and minimize memory usage while maintaining a high task performance. Precisely, the covered topics include
- Knowledge distillation
- Neural architecture search (NAS)
- Pruning
- Quantization

A basic understanding of deep learning concepts and neural networks is recommended. Furthermore, familiarity with hardware architectures and embedded systems is beneficial but not mandatory.

Workload
lecture time: 24h
self study: 24h
exam preparation: 42h

total: 90h = 3 ECTS

Recommendations
A basic understanding of deep learning concepts and neural networks is expected; familiarity with hardware architectures and embedded systems is helpful but not required.

M 4.48 Module: HRI and Social Robotics [M-INFO-106650]

Coordinators: TT-Prof. Dr. Barbara Bruno
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Robotics and Automation
Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113396	HRI and Social Robotics	**ST**	**4 CP**	**Bruno**
T-INFO-113397	HRI and Social Robotics - Pass	**ST**	**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 4.49 Module: Human Computer Interaction [M-INFO-107166]

Coordinators: Prof. Dr.-Ing. Michael Beigl
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Telematics
Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114192	Human-Computer-Interaction	**ST**	**6 CP**	**Beigl**
T-INFO-114193	Human-Computer-Interaction Pass	**ST**	**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 4.50 Module: Humanoid Robots - Locomotion and Whole-Body Control [M-INFO-106649]

Coordinators: Prof. Dr. Katja Mombaur
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Robotics and Automation
Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113395	Humanoid Robots - Locomotion and Whole-Body Control	**WT+ST**	**6 CP**	**Mombaur**
T-INFO-114282	Humanoid Robots - Locomotion and Whole-Body Control -Pass	**WT+ST**	**0 CP**	**Mombaur**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

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

Content
This course introduces fundamentals and recent developments in the field of humanoid robotics with a focus on locomotion and whole-body motions. We will cover kinematic and dynamic modeling of anthropomorphic systems, basic concepts of bipedal walking control, stability aspects, gait generation in different terrains, humanoid balance and push recovery, motion primitives and optimal control-based approaches, motion imitation and learning. The course will also give some insights in basic principles of passive dynamic walking, human motion generation and control and human motion modeling. Students will work with different robotics tools and perform a graduate level research project related to a whole-body humanoid robot.
This module is complementary to the course “4.290 Robotik II - Humanoide Robotik” which focuses on upper body motions and cognitive architectures while this course focuses on the specific aspects of legged humanoids and whole-body motions. The modules can be taken at the same time.

Module Grade Calculation
See partial achievements (Teilleistung)

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

Workload
Estimated effort for this module is 180 hours:
60h - Lecture and exercises (2+2 SWS)
40h - Repetition of lecture contents, preparation of assignments
80h – Work on final project, documentation and presentation

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

M 4.51 Module: Humanoid Robots - Seminar [M-INFO-107152]

Coordinators: Prof. Dr.-Ing. Tamim Asfour
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Robotics and Automation
Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114170	Humanoid Robots - Seminar	**WT**	**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 4.52 Module: Interdisciplinary Qualifications [M-INFO-107254]

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

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

ID	Name	Term offered	Credits	Lecturers
KC_Master (Elective: between 1 and 6 credits)				
T-INFO-102051	Reading Group	**WT+ST**	**1 CP**	**Reussner**
T-INFO-111474	Self-Booking-HOC-SPZ-FORUM-PEBA-Graded	**WT+ST**	**1 CP**	**Coerdt**
T-INFO-111475	Self-Booking-HOC-SPZ-FORUM-PEBA-Graded	**WT+ST**	**2 CP**	**Coerdt**
T-INFO-111476	Self-Booking-HOC-SPZ-FORUM-PEBA-Graded	**WT+ST**	**3 CP**	**Coerdt**
T-INFO-111477	Self-Booking-HOC-SPZ-FORUM-PEBA-Ungraded	**WT+ST**	**1 CP**	**Coerdt**
T-INFO-111478	Self-Booking-HOC-SPZ-FORUM-PEBA-Ungraded	**WT+ST**	**2 CP**	**Coerdt**
T-INFO-111479	Self-Booking-HOC-SPZ-FORUM-PEBA-ungraded	**WT+ST**	**3 CP**	**Coerdt**
T-INFO-111839	Information, Science and Responsibility - Current Ethical Challenges of IT	**ST**	**1 CP**	**Kaplan**
T-INFO-112148	Information, Science and Responsibility - Current Ethical Challenges in IT	**ST**	**2 CP**	**Kaplan**
T-INFO-115027	Self-Booking-HOC-SPZ-FORUM-PEBA-Graded	**WT+ST**	**2 CP**	**Coerdt**
T-INFO-115028	Self-Booking-HOC-SPZ-FORUM-PEBA-Graded	**WT+ST**	**1 CP**	**Coerdt**
T-INFO-115029	Self-Booking-HOC-SPZ-FORUM-PEBA-ungraded	**WT+ST**	**2 CP**	**Coerdt**
T-INFO-115030	Self-Booking-HOC-SPZ-FORUM-PEBA-ungraded	**WT+ST**	**1 CP**	**Coerdt**
T-INFO-115077	Self-Booking-HOC-SPZ-FORUM-PEBA-ungraded	**WT+ST**	**4 CP**	**Coerdt**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Learning objectives can be divided into three main categories, which complement each other:

1. Orientation knowledge
   - Students become aware of the cultural imprint of their position and are able to consider the views and interests of others (across disciplinary, cultural and linguistic boundaries).
   - They expand their ability to participate in academic or public discussions in an appropriate and relevant manner.
2. practical orientation
   - Students gain insight into the routines of professional action.
   - They further develop their learning skills.
   - They expand their ability to act by improving their foreign language skills.
   - They can link basic business and legal issues to their field of experience.
3. basic skills
   - Students can acquire new knowledge independently in a planned, targeted and methodologically sound manner and apply this knowledge to solve tasks and problems.
   - They can evaluate their own work.
   - They have efficient working techniques, can set priorities, make decisions and take responsibility.

Content
The House of Competence (HoC) is the central, research-based institution in the field of interdisciplinary competence development at KIT and offers students of all disciplines a broad learning portfolio. The HoC seminar program is divided into focus areas that aim to develop interdisciplinary skills for studies and careers. The three HoC laboratories are mainly responsible for the focus areas: the Methods LAB, Learning LAB and Writing LAB.

The courses in the HoC program can be credited in the areas of "Key Qualifications" (SQ), "Additional Professional Qualifications" (BOZ) and in the "Personal Competence Module" for student teachers (MPK). The requirements for the respective degree programs can be found in the applicable examination and study regulations. The current seminar program, which is published each semester, can be found on the HoC homepage at www.hoc.kit.edu.

Additional Information
German courses and/or language courses in the native language are not recognized as key qualifications.

Only those examination and study achievements can be credited,
which cannot be taken in the computer science or supplementary subjects.
Certificates of attendance are not accepted.

Workload
Each credit point corresponds to approx. 25-30 hours of work (by the student). This is based on the average student who achieves an average performance. The workload includes (for a lecture)
1. Attendance time in lectures, exercises
2. Preparation and follow-up of the same
3. Exam preparation and attendance in the same.

M 4.53 Module: Internet of Everything [M-INFO-100800]

Coordinators: Prof. Dr. Martina Zitterbart
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Telematics (Usage until 3/31/2027)
Elective Studies in Informatics (Usage until 3/31/2027)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-101337	Internet of Everything	**WT**	**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.

Additional Information
Offered for the last time in WS 26/27!!!!!

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 4.54 Module: Introduction to Bioinformatics for Computer Scientists [M-INFO-100749]

Coordinators: Prof. Dr. Alexandros Stamatakis
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Algorithm Engineering
Elective Studies in Informatics
Prerequisite for: T-INFO-101287 - Seminar: Hot Topics in Bioinformatics
T-INFO-103009 - Hands-on Bioinformatics Practical

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-101286	Introduction to Bioinformatics for Computer Scientists	**WT**	**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 4.55 Module: IT Security [M-INFO-106998]

Coordinators: Prof. Dr. Jörn Müller-Quade
Prof. Dr. Christian Wressnegger
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Cryptography and Security
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113960	IT Security	**WT**	**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 4.56 Module: Lab Project: Speech Translation [M-INFO-107176]

Coordinators: Prof. Dr. Jan Niehues
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114205	Lab Project: Speech Translation	**WT**	**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 4.57 Module: Introduction to Quantum Machine Learning [M-INFO-107821]

Coordinators: Prof. Dr. Achim Streit
Organisation: KIT Department of Informatics
Part of: Elective Studies in Informatics (Usage from 10/1/2026)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-115215	Introduction to Quantum Machine Learning	**ST**	**3 CP**	**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 "Introduction to Quantum Computing" is recommended
- Knowledge of linear algebra is recommended
- Programming skills in Python are helpful

M 4.58 Module: Localization of Mobile Agents [M-INFO-107663]

Coordinators: Prof. Dr.-Ing. Uwe Hanebeck
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Robotics and Automation (Usage from 4/1/2026)
Area of Specialization: Human-centred Machine Intelligence (Usage from 4/1/2026)
Elective Studies in Informatics (Usage from 4/1/2026)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-115014	Localization of Mobile Agents	**ST**	**6 CP**	**Hanebeck**
T-INFO-115015	Localization of Mobile Agents - Pass	**ST**	**0 CP**	**Hanebeck**

Assessment
See Partial Achievements (Teilleistung).

Prerequisites
See Partial Achievements (Teilleistung).

Competence Goal
Participants in this course will gain a broad overview of probabilistic machine learning tools and learn how to creatively combine them to solve a wide variety of problems.

Content
This module provides a systematic introduction to the field of localization methods. To facilitate entry, the module is divided into four central topics. Dead reckoning (1) deals with the step-by-step determination of a vehicle's position from dynamic parameters such as speed or steering angle, as well as intertial measurement unit (IMU) data. Localization with the aid of measurements to external, known landmarks is part of static localization (2). Specifically, signal times of arrival (multilateration and GPS), distance measurements, and angle measurements (bearings) are covered. In addition to closed-form solutions for special measurements, the method of least squares for fusing arbitrary measurements is introduced. This also includes nonlinear optimization methods and certifiable global optimization. Dynamic localization (3) deals with the combination of dead reckoning and static localization using the Kalman filter, which is used in virtually all object tracking scenarios and other state estimation problems. General estimator properties are also discussed. The course concludes with simultaneous localization and mapping (SLAM) (4), which allows localization even when the location of landmarks is partially unknown. Thereby the measurement association problem is also addressed.

Workload
Per week:
2 SWS Presence
2h Follow-up
6h Digital exercise with computation tasks
2h exam preparation
= 12h/week und 180h/semester

Recommendations
Knowledge of a higher-level programming language with mature libraries for scientific and numerical computing (e.g., Julia, Matlab, Python) is an advantage.

M 4.59 Module: Logic Programming [M-INFO-107906]

Organisation: KIT Department of Informatics

Part of: Area of Specialization: Theoretical Foundations (Usage from 10/1/2026)
Area of Specialization: Software Engineering and Compiler Construction (Usage from 10/1/2026)
Elective Studies in Informatics (Usage from 10/1/2026)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-115318	Logic Programming	**Irreg.**	**6 CP**	**Erdweg**

Competence Goal
- Students understand the foundations of logic programming.
- Students can explain the semantics and evaluation of logic programs.
- Students can develop programs in Datalog and Prolog.
- Students can assess logic programming techniques for different application domains.

Content
Logic programs consist of logical implications that are executed to derive complex conclusions from initial knowledge. Logic programming has applications in many different areas such as network modeling, symbolic artificial intelligence, and source-code analysis. This course introduces foundational and advanced topics of logic programming, including: logical foundations, unification, denotational and operational semantics, evaluation strategies, negation as failure, Datalog, Prolog, and incremental resolution.

Workload
1. Attendance time 4 h x 15 weeks = 60 h
2. Self-study 7 h x 15 weeks = 105 h
3. Preparation for the exam 15 h

Recommendations
- Knowledge of programming semantics is helpful but not required.
- Knowledge of logic inference systems is helpful but not required

M 4.60 Module: Logical Foundations of Cyber-Physical Systems [M-INFO-106102]

Coordinators: Prof. Dr. André Platzer
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Theoretical Foundations
Area of Specialization: Software Engineering and Compiler Construction
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-112360	Logical Foundations of Cyber-Physical Systems	**WT**	**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 4.61 Module: Low Power Design [M-INFO-100807]

Coordinators: Prof. Dr.-Ing. Jörg Henkel
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Design of Embedded Systems and Computer Architectures
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-101344	Low Power Design	**ST**	**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 4.62 Module: Machine Learning - Foundations and Algorithms [M-INFO-107169]

Coordinators: Prof. Dr. Gerhard Neumann
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114197	Machine Learning - Foundations and Algorithms	**ST**	**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 4.63 Module: Machine Learning for Natural Sciences [M-INFO-106959]

Coordinators: Prof. Dr. Pascal Friederich
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Robotics and Automation
Area of Specialization: Human-centred Machine Intelligence
Area of Specialization: Data Science
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113916	Machine Learning for Natural Sciences	**ST**	**3 CP**	**Friederich**
T-INFO-113917	Machine Learning for Natural Sciences - Pass	**ST**	**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 4.64 Module: Machine Learning in Climate and Environmental Sciences [M-INFO-106470]

Coordinators: TT-Prof. Dr. Peer Nowack
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Human-centred Machine Intelligence
Area of Specialization: Data Science
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113083	Machine Learning in Climate and Environmental Sciences	**ST**	**6 CP**	**Nowack**
T-INFO-113085	Machine Learning in Climate and Environmental Sciences - Pass	**ST**	**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 4.65 Module: Master's Thesis [M-INFO-106828]

Coordinators: Prof. Dr.-Ing. Anne Koziolek
Organisation: KIT Department of Informatics
Part of: Master‘s Thesis

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113697	Master's Thesis	**WT+ST**	**30 CP**	**Koziolek**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Modeled Prerequisites
The following conditions have to be fulfilled:

1. You need to have earned at least 60 credits in the following fields:
   - Area of Specialization: Algorithm Engineering
   - Area of Specialization: Computer Graphics and Geometry Processing
   - Area of Specialization: Cryptography and Security
   - Area of Specialization: Data Science
   - Area of Specialization: Design of Embedded Systems and Computer Architectures
   - Area of Specialization: Human-centred Machine Intelligence
   - Area of Specialization: Parallel Computing
   - Area of Specialization: Robotics and Automation
   - Area of Specialization: Software Engineering and Compiler Construction
   - Area of Specialization: System Architecture
   - Area of Specialization: Telematics
   - Area of Specialization: Theoretical Foundations
   - Elective Studies in Informatics
   - Interdisciplinary Qualifications
   - Minor Studies: Biologically Inspired Robotics
   - Minor Studies: Economics
   - Minor Studies: Electrical Engineering
   - Minor Studies: Law
   - Minor Studies: Mathematics
   - Minor Studies: Mechanical Engineering
2. You need to have earned at least 15 credits in the following fields:
   - Area of Specialization: Algorithm Engineering
   - Area of Specialization: Computer Graphics and Geometry Processing
   - Area of Specialization: Cryptography and Security
   - Area of Specialization: Data Science
   - Area of Specialization: Design of Embedded Systems and Computer Architectures
   - Area of Specialization: Human-centred Machine Intelligence
   - Area of Specialization: Parallel Computing
   - Area of Specialization: Robotics and Automation
   - Area of Specialization: Software Engineering and Compiler Construction
   - Area of Specialization: System Architecture
   - Area of Specialization: Telematics
   - Area of Specialization: Theoretical Foundations

Competence Goal
- In the Master's thesis, students work independently on a topic in computer science in line with the current state of research.
- Students demonstrate a comprehensive understanding of the scientific methods and procedures relating to the topic.
- Students select suitable methods and apply them correctly. If necessary, they adapt them accordingly or develop them further.
- Students critically compare their results with other approaches and evaluate their results.
- Students form a scientific opinion and are able to present and defend this and their results in discussions.

Content
- The Master's thesis should demonstrate that students are able to work on a problem from their subject independently and within a limited period of time using scientific methods that reflect the current state of research.
- The completion period is six months. Upon justified request by the student, the Examination Board may extend the completion time by a maximum of three months. The Master's thesis can also be written in English in agreement with the supervisor.
- If the Master's thesis is to be written outside the faculty, this requires the approval of the Examination Board.
- The Master's thesis may also be approved in the form of a group thesis if the contribution of the individual students to be assessed as examination performance is clearly distinguishable.
- When submitting the Master's thesis, students must confirm in writing that they have written the thesis independently and have not used any sources or aids other than those specified by them, that they have identified the passages taken verbatim or in terms of content as such and that they have observed the statutes of the Karlsruhe Institute of Technology (KIT) for ensuring good scientific practice in the currently valid version.
- The date of issue of the topic and the date of submission of the Master's thesis must be recorded.

Workload
The workload for the module is approximatly 900 hours.

M 4.66 Module: Mobile Communication [M-INFO-107245]

Coordinators: Prof. Dr. Oliver Waldhorst
Prof. Dr. Martina Zitterbart
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Telematics
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114271	Mobile Communication	**WT**	**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 4.67 Module: Mobile Communications [M-ETIT-105971]

Coordinators: Prof. Dr.-Ing. Peter Rost
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Minor Studies: Electrical Engineering

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-ETIT-112127	Mobile Communications	**WT**	**4 CP**	**Rost**

Assessment
The success control takes place in the form of an oral examination lasting approx. 25 minutes. Before the examination, there is a preparation phase of 15 minutes in which preparatory tasks are solved.

Prerequisites
none

Competence Goal
Students are enabled to analyze and assess functionalities of mobile communication systems. They learn how to apply and implement fundamental methods of the lecture “Communications Engineering I” in mobile radio networks. Furthermore, students will be enabled to understand requirements and limitations of mobile applications.

Content
At the beginning, this course describes exemplary applications of mobile communications and elaborates on resulting requirements. Based on a solid understanding of those requirements, selected approaches and techniques will be presented that are solving the respective challenges in mobile communication systems. To this end, algorithms as well as system architectures are discussed in order to acquire solid knowledge on the radio network, the core network and the integration with applications and services.

Module Grade Calculation
Grade of the module corresponds to the grade of the oral exam.

Workload
1. Attendance time in lectures: 15 * 2 h = 30 h
2. Preparation and follow-up of lectures: 15 * 2 h = 30 h
3. Attendance time in excercises: 15 * 1 h = 15 h
4. Preparation and follow-up of excercises: 15 * 1 h = 15 h
5. Preparation for the oral exam: 30 h

In total: 120 h = 4 LP

Recommendations
Knowledge of basic engineering as well as basic knowledge of communications engineering and Previous attendance of the lecture "Communication Engineering I" is recommended. Sound English language skills are required.

M 4.68 Module: Model-Driven Software Development [M-INFO-106931]

Coordinators: Prof. Dr. Ralf Reussner
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Software Engineering and Compiler Construction
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113896	Model-Driven Software Development	**WT**	**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 4.69 Module: Modern Methods in Combinatorics [M-MATH-106957]

Coordinators: Prof. Dr. Maria Aksenovich
Organisation: KIT Department of Mathematics
Part of: Minor Studies: Mathematics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-MATH-113911	Modern Methods in Combinatorics	**Irreg.**	**6 CP**	**Aksenovich**

Assessment
The module examination takes the form of an oral examination (approx. 30 min).

Prerequisites
None

Competence Goal
Students are able to name, explain, and apply modern methods of combinatorics. In particular, they are capable of applying probabilistic techniques, the polynomial method, the container method, and regularization techniques to combinatorial problems. Furthermore, students are able to communicate using technical English

Content
The course is concerned with modern methods in Combinatorics including probabilistic or algebraic ones. Every presented method is illustrated with several applications.

The probabilistic part includes the following topics: random graphs, linearity of expectation, second moment method, and Lovasz Local Lemma. The algebraic part includes: polynomial methods, spectral methods, and linear algebraic techniques.

Module Grade Calculation
The module grade is the grade of the oral examination.

Workload
Total workload: 180 hours

Attendance time: 60 hours

- Course including module examination during the course of study

Self-study: 120 hours

- Deepening the study content by working on the lecture content at home
- completion of exercises
- In-depth study of the course content using suitable literature and internet research
- Preparation for the module examination during the course of study

Recommendations
Some knowledge of linear algebra and probability theory is strongly recommended. The courses *Graph Theory* and *Combinatorics* are recommended but not required.

Teaching and Learning Methods
Lecture + Tutorial (3+1 weekly contact hours)

M 4.70 Module: Motion in Human and Machine - Seminar [M-INFO-102555]

Coordinators: Prof. Dr.-Ing. Tamim Asfour
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Human-centred Machine Intelligence

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-105140	Motion in Human and Machine - Seminar	**ST**	**3 CP**	**Asfour**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Students understand methods for modeling, processing, and analyzing human motions. They can explain approaches for capturing biological motion and biomechanical simulation.

Students can describe methods for learning motion primitives from human demonstrations and understand how human motion is mapped to robots with different kinematics and dynamics. They can apply these methods in new contexts.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

Content
This interdisciplinary block seminar addresses methods for modeling, generating, and controlling movements in human and robot systems. Students gain insight into this interdisciplinary field, learning fundamentals of capturing biological motion, biomechanical simulation, robotics, and machine learning.

The seminar begins with the generation of human movement as an effect of muscle contraction. It covers how observed movement patterns can be identified and categorized. Methods for learning movement primitives from human demonstrations are presented, including approaches for reproducing these patterns on humanoid robots. The seminar addresses the challenge of mapping human motion to robots with different kinematics and dynamics. Students learn how motion primitives enable transfer of human movements to robotic systems and their application to motion generation in humanoid robots.

Students work in small groups on collaborative projects that apply the learned methods. These projects allow students to deepen their understanding through practical application of the methods.

Additional Information
This interdisciplinary seminar is conducted in cooperation with the University of Stuttgart and the University of Tübingen.

Workload
Seminar with 3 SWS, 3 LP
3 LP corresponds to 90 hours, including
30 hours attendance time
15 hours group work
20 hours literature research
20 hours manuscript preparation
5 hours video creation

Recommendations
Programming experience in C++, Python or Matlab is recommended.
Attending the lectures Robotics I – Introduction to Robotics, Robotics II: Humanoid Robotics, Robotics III - Sensors and Perception in Robotics, Mechano-Informatics and Robotics and Wearable Robotic Technologies is recommended.

M 4.71 Module: Multimodal Artificial Intelligence [M-INFO-107676]

Coordinators: Prof. Dr. Jan Niehues
Prof. Dr.-Ing. Rainer Stiefelhagen

Organisation: KIT Department of Informatics

Part of: Area of Specialization: Human-centred Machine Intelligence (Usage from 4/1/2026)
Elective Studies in Informatics (Usage from 4/1/2026)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-115041	Multimodal Artificial Intelligence	**ST**	**6 CP**	**Niehues, Stiefelhagen**

Assessment
See Partial Achievements (Teilleistung).

Prerequisites
See Partial Achievements (Teilleistung).

Competence Goal
- The students know the relevant elements of a multimodal AI .
- The students understand the algorithms and methods of multimodal AI.
- The students are able to understand the different sub-components to develop and analyze a system .
- The students can transfer this knowledge to new applications, as well as analyze and compare different methods.

Content
Due to the successes in research, multimodal AI systems are increasingly integrated into our everyday lives. These are, for example, systems that can understand and generate language and speech or analyze images and videos. Furthermore, advanced video and image generation AI shows leads to new applications

Based on the knowledge of the lecture “Introduction to AI”, the students learn to understand, develop and evaluate multimodal AI Systems.
In order to bring this knowledge closer to the students, the lecture is divided into 5 parts. First, the lecture investigates method of speech and language perception followed by a part about visual perception. The second part deals speech and language generation followed by a part about video processing. Finally, multimodal AI methods are presented.

Workload
Lecture with 3 SWS + 1 SWS exercise , 6 CP.
6 LP corresponds to approx. 180 hours, of which
approx. 45 hours lecture attendance
approx. 15 hours exercise visit
approx. 90 hours post-processing and processing of the exercise sheets (self-study)
approx. 30 hours exam preparation (self-study)

Recommendations
See Partial Achievements (Teilleistung).

M 4.72 Module: Nano- and Quantum Electronics [M-ETIT-105604]

Coordinators: Prof. Dr. Sebastian Kempf
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Minor Studies: Electrical Engineering

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-ETIT-111232	Nano- and Quantum Electronics	**ST**	**6 CP**	**Kempf**

Assessment
The assessment of success takes place in the form of a written examination lasting 120min. The grade corresponds to the result of the written examination.

Prerequisites
none

Competence Goal
Students will understand the physical limits of CMOS scaling and will be able to analyze the function of conventional nanoelectronic devices. Students will also understand the operation of novel nanoelectronic and quantum electronic devices and will be able to design this kind of devices that are based on quantum mechanical effects. They develop the ability to design nanoelectronic sensors and devices and can understand and analyze the fabrication methods for nano- and quantum electronic devices.

Content
Nanoelectronics deals with integrated circuits whose typical length scale is well below 100nm. In this regime, physical effects, in particular of quantum mechanical origin, occur and strongly influence the scaling of classical microelectronic devices. This ultimately leads to a new form of electronic components as well as novel operation principles. A special form of nanoelectronics is quantum electronics in which quantum mechanical effects are exploited on purpose to build an entirely new class of devices whose performance reaches far beyond any other microelectronics devices. Well-known examples are superconducting digital electronics which enables to build, for example, microprocessors with clock rates exceeding several 100GHz, or the quantum computer, which will lead to a change of paradigms in the field of information processing.

Within this context, the module "Nano- and quantum electronics" intends to give students an overview of the theoretical and practical aspects of nano- and quantum electronics. In particular, it discusses the following topics:

- Limitations of conventional CMOS technology
- Quantum mechanical effects in the field of nano- and quantum electronics (quantized conductance, Coulomb blockade, tunnel effect, etc.)
- Hot-electron effect
- Nano- and quantum-technological manufacturing and analysis methods
- Nanostructure field-effect transistors
- Quantum dots
- Carbon nanotube field-effect transistor
- Resonant tunnel diodes
- Unipolar resonant tunnel transistor
- Single Electron Transistor (SET)
- Josephson junction based analog and digital electronics
- Quantum bits, quantum computers and quantum computing

The tutorial is closely linked to the lecture and deals with special aspects concerning the development of nano- and quantum electronics. In particular, the development and system integration of such devices for various applications is discussed by means of exercises.

Module Grade Calculation
The module grade is the grade of the written examination.

Workload
A workload of approx. 175h is required for the successful completion of the module. This is composed as follows:

- Attendance time in lectures and exercises: 18*1.5h + 6*1.5h = 36h
- Preparation and follow-up of lectures: 21*3h= 54h
- Preparation and follow-up of tutorials: 7*5h= 35h
- Preparation for the exam: 50h

Recommendations
Successful completion of the modules "Superconductivity for Engineers" and „Einführung in die Quantentheorie für Elektrotechniker“ is recommended.

M 4.73 Module: Natural Language Processing [M-INFO-107178]

Coordinators: Prof. Dr. Jan Niehues
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114207	Natural Language Processing	**WT**	**6 CP**	**Niehues**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
- To familiarise the student with the problems that exist in natural language processing
- The student should be introduced to the basic techniques for solving the problems.
- The student should gain an insight into current research in the field of natural language processing and be able to use the language processing and can use the acquired knowledge to work on current research topics

Content
Summarise today's lecture? When were neural networks invented? Artificial intelligence that can answer these questions has long been a dream of mankind. And today we are seeing the first programmes that can solve these problems. In this lecture we will provide the skills and knowledge to develop solutions to these problems of natural language processing using state-of-the-art methods.
After an introduction to the challenges of natural language processing, the different tasks in natural language processing are discussed. One focus of the course is on methods from the field of deep learning. Firstly, sequence classification tasks such as sentiment analysis are covered. Next, methods of sequence labelling are discussed, such as those used in the recognition of proper names or the determination of part-of-speech tags. The lecture will then discuss sequence-to-sequence methods. These models are used in many natural language processing tasks, such as machine translation, automatic summarisation and automatic question answering.
In this course, the important challenges in the development of systems will be addressed: The representation of words, neural architectures to model language, methods to train complex models, and finding the most likely output.

Workload
180hLecture with 4 SWS, 6 CP.
6 LP corresponds to approx. 180 hours, of which
approx. 60 hours lecture attendance
approx. 90 hours post-processing (self-study)
approx. 30 hours exam preparation (self-study)

M 4.74 Module: Natural Language Processing and Software Engineering [M-INFO-107233]

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

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114257	Natural Language Processing and Software Engineering	**WT**	**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 4.75 Module: Network Security: Architectures and Protocols [M-INFO-107218]

Coordinators: Prof. Dr. Martina Zitterbart
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Cryptography and Security (Usage from 4/1/2025)
Area of Specialization: Telematics
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114238	Network Security: Architectures and Protocols	**ST**	**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 4.76 Module: Next Generation Internet [M-INFO-100784]

Coordinators: Dr.-Ing. Roland Bless
Prof. Dr. Martina Zitterbart
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Telematics
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-101321	Next Generation Internet	**ST**	**4 CP**	**Bless, Zitterbart**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Students

- know the basic properties and architectural concepts of the Internet as well as its limitations- know newer transport protocols and current approaches to increase the flexibility of Internet-based communication and can apply this knowledge in practice.are familiar with concepts for quality of service support and group communications and can apply mechanisms for their implementation on the Internethave the ability to analyze and evaluate peer-to-peer systems and advanced routing protocolsare 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 ofcommunication networks (e.g. network virtualization, software-defined networking, service function chaining) andan analyze, explain, and apply technical procedures for their implementation.

- Moreover, students know properties of satellite and quantum networks and their corresponding challenges.

Content
The lecture focuses on current developments in Internet-based network technologies. First, architectural principles of today's Internet are presented and discussed, subsequently nowadays and future challenges are motivated.
The lecture also discusses approaches and paradigms beyond the current Internet architecture, methods for quality-of-service support, newer transport protocols and congestion control approaches as well as group communication support. Deployments of the presented technologies in IP-based networks are discussed. The lecture presents advanced approaches such as programmable networks, network virtualization as well as newer approaches and protocols for routing, satellite networking, and peer-to-peer networks. A brief introduction to
the technology of a future quantum Internet is provided as well.

Workload
Lecture with 2 SWS plus follow-up/exam preparation, 4 CP.

4 CP corresponds to approx. 120 working hours, of which

approx. 30 hours lecture attendance

approx. 60 hours preparation/follow-up work

approx. 30 hours exam preparation

Literature
J.F. Kurose, K.W. Ross; Computer Networking: A Top-Down Approach. Pearson, 2022, 8th Edition, ISBN 978-1292405469

M 4.77 Module: Optical Engineering [M-ETIT-100456]

Coordinators: Prof. Dr. Wilhelm Stork
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Minor Studies: Electrical Engineering

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-ETIT-100676	Optical Engineering	**WT**	**4 CP**	**Stork**

Assessment
Achievement will be examined in an oral examination (approx. 20 minutes).

Prerequisites
none

Competence Goal
The students from different backgrounds refresh and elaborate their knowledge of engineering optics and photonics. They will get to know the basic principles of optical designs. They will connect these principles with real-world applications and learn about their problems and how to solve them. The students will know about the human view ability and the eye system. After the module they will be able to judge the basic qualities of an optical system by its quantitative data.

After the course, students will:

- understand fundamental optical phenomena and apply it to solve optical engineering problems;
- work with the basic tools of optical engineering, i.e. ray-tracing by abcd-matrices;
- get a broad knowledge on real-world applications of optical engineering;
- learn about the potential of optical design for industrial, medical and day-to-day applications;
- know up-to-date optical engineering problems and its solutions.

Content
The course "Optical Engineering" teaches the practical aspects of designing optical components and instruments such as lenses, microscopes, optical sensors and measurement systems, and optical disc systems (e.g. CD, DVD, HVD). The course explains the layout of modern optical systems and gives an overview over available technology, materials, costs, design methods, as well as optical design software. The lectures will be given in the form of presentations and accompanied by individual and group exercises. The topics of the lectures include:

I. Introduction (Optical Phenomena)

II. Ray Optics (thin/thick lenses, principal planes, ABCD-matrices, chief rays, examples: Eye, IOL)

III. Popular Applications (Magnifying glass, microscope, telescope, Time-of-flight)

IV. Wave Optics (Interference, Diffraction, Spectrometers, LDV)

V. Aberrations I (Coma, defocus, astigmatism, spherical aberration)

VI. Fourier Optics (Periodical patterns, FFT spectrum, airy-patterns)

VII. Aberration II (Seidel and Zernike Aberrations, MTF, PSF, Example: Eye)

VIII. Fourier Optics II (Kirchhoff + Fresnel, contrast, example: Hubble-telescope)

IX. Diffractive Optics Applications (Gratings, holography, IOL, CD/DVD/Blu-Ray-Player)

X. Interference (Coherence, OCT)

XI. Filters and Mirrors (Filters, antireflection, polarization, micro mirrors, DLPs)

XII. Laser and Laser Safety (Laser principle, laser types, laser safety aspects)

XIII. Displays (Pico projectors, LCD, LED, OLED, properties of displays)

Module Grade Calculation
The module grade is the grade of the oral exam.

Workload
total 120 h, hereof 45 h contact hours (30 h lecture, 15 h problem class), and 75 h homework and selfstudies

Recommendations
Solid mathematical background.

Literature
E. Hecht: Optics

J.W. Goodmann: Introduction to Fourier optics

K.K. Sharma: Optics - Principles and Applications

M 4.78 Module: Optimization and Synthesis of Embedded Systems (ESI) [M-INFO-107229]

Coordinators: Prof. Dr.-Ing. Jörg Henkel
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Design of Embedded Systems and Computer Architectures
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114253	Optimization and Synthesis of Embedded Systems (ESI)	**WT**	**3 CP**	**Henkel**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
The student can develop embedded systems. They can specify, synthesize and optimize their own hardware. They learn the hardware description language and are familiar with the special boundary conditions of the design of embedded systems.

Content
The cost-effective and error-free development of embedded systems represents a challenge that should not be underestimated and which is having an ever greater influence on the added value of the overall system. In Europe in particular, the design of embedded systems is playing an increasingly important economic role in many sectors of the economy, such as the automotive industry, so that a number of well-known companies are already involved in the development of embedded systems.

The lecture deals comprehensively with all aspects of the development of embedded systems at hardware, software and system level. This includes diverse areas such as modelling, optimization and synthesis of systems.

Workload
90 hours:
30 hours of lectures (15 weeks*2 hours)
30 hours of self study (15 weeks*2 hours)
15 hours of deepening (coding RTL) to grasp the theory with practical
15 hours exam preparation

M 4.79 Module: Optimization Methods for Machine Learning and Engineering [M-INFO-105329]

Coordinators: Prof. Dr.-Ing. Jürgen Beyerer
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-110809	Optimization Methods for Machine Learning and Engineering	**WT**	**5 CP**	**Beyerer, Pfrommer**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Students are able to formulate practical tasks as optimisation problems and solve them using suitable algorithmic methods.
Learning objectives: The students know
- The most important categories of (convex) optimisation problems and their mathematical foundations
- The associated algorithmic solution methods and their runtime complexity
- Techniques for modelling practical tasks as optimisation problems (machine learning, engineering, finance)
- Methods for transforming and approximating optimisation problems for the use of resource-efficient methods

Content
The term optimization refers to techniques for the identification of the best solution in a complex problem setting. Many applications from machine learning and engineering are based on solving an optimization problem. This lecture introduces the major theoretical and algorithmic tools for solving of convex optimization problems. Practical problems for machine learning, engineering and further application domains are used as illustration. The students apply their knowledge to practical optimization problems in tutorial exercises.

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

Literature

- Boyd, Stephen, and Lieven Vandenberghe. Convex optimization. Cambridge university press, 2004.
- Luenberger, David G. Optimization by vector space methods. John Wiley & Sons, 1969.
- Sra, Suvrit, Sebastian Nowozin, and Stephen J. Wright, eds. Optimization for machine learning. MIT Press, 2012.

M 4.80 Module: Parallel Algorithms [M-INFO-107199]

Coordinators: Prof. Dr. Peter Sanders
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Algorithm Engineering
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114221	Parallel Algorithms	**WT**	**4 CP**	**Sanders**
T-INFO-114222	Parallel Algorithms Pass	**WT**	**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
See partial achievements (Teilleistung)

M 4.81 Module: Parameterized Algorithms [M-INFO-107167]

Coordinators: TT-Prof. Dr. Thomas Bläsius
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Theoretical Foundations
Area of Specialization: Algorithm Engineering
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114194	Parameterized Algorithms	**Irreg.**	**6 CP**	**Bläsius**
T-INFO-114195	Parameterized Algorithms - Pass	**Irreg.**	**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 4.82 Module: Participatory Technology Design [M-INFO-107170]

Coordinators: Prof. Dr. Kathrin Gerling
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114199	Participatory Technology Design	**WT**	**6 CP**	**Gerling**
T-INFO-114200	Participatory Technology Design - Pass	**WT**	**0 CP**	**Gerling**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
After completing the course, students will be able to reproduce basic and advanced theoretical concepts from human-machine interaction and participatory technology design. Furthermore, they will be able to apply relevant methods for participatory design and evaluation to given problems, taking into account the needs of users and ethical aspects, and derive concrete design recommendations from the results. Finally, students are able to recognise and critically reflect on the connections between participation, design, implementation and evaluation of technologies.

Content
In human-machine interaction, the participatory development of new technologies - i.e. the direct and equal involvement of users in the development process - is becoming increasingly important. It is used, for example, in the development of body-centred and wearable systems, or contributes to the design of solutions in the field of smart and assisted living and personal robotics. Participation is often realised through interviews, focus groups and design workshops; new technologies are also regularly evaluated as part of user studies. The direct involvement of users is intended to ensure that the resulting technologies are better adapted to people's needs and that their benefits and relevance for individuals and society can be increased as a result.
The lecture deals with current research approaches to the participatory design of new technologies and covers the following topics in particular, while continuously taking ethical aspects into account:

- Design approaches, in particular theory-driven design, ethical approaches such as value-sensitive design, and future-oriented approaches such as speculative design and design fiction
- Typical methods of participation in the design and development of technologies, and reflection on the associated challenges and opportunities
- Participatory and user-centred evaluation of technologies and implications for society, research and development

In the associated exercise, students actively develop relevant concepts and reflect on theoretical aspects in their application in the context of practical examples. In addition, current research publications are analysed as part of the exercise.

Workload
The total workload for this course is approx. 180 hours (6 credits).
Approximately...
28h for attending the lecture,
24 hours for attending the exercises,
40h for preparation and follow-up of the lecture,
40h for preparation and follow-up of the exercise,
48h for exam preparation.

Recommendations
Knowledge of the basics of human-machine interaction is helpful.

M 4.83 Module: Photorealistic Rendering [M-INFO-107817]

Coordinators: Prof. Dr.-Ing. Carsten Dachsbacher
Organisation: KIT Department of Informatics
Part of: Elective Studies in Informatics (Usage from 10/1/2026)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-115210	Photorealistic Rendering	**ST**	**5 CP**	**Dachsbacher**

Assessment
See Partial Achievements (Teilleistung)

Prerequisites
See Partial Achievements (Teilleistung)

Competence Goal
Students understand algorithms and techniques for generating realistic images (e.g., reflection models, light transport simulation, Monte Carlo methods), can analyze and evaluate them, and can select and implement appropriate rendering techniques for a given application.

Content
Algorithms and techniques in computer graphics for generating photorealistic images. Topics include: global illumination and light transport phenomena, path tracing, photon mapping, radiometry, BRDFs, radiosity, Monte Carlo methods, and importance sampling.

Workload
60 hours = 1. attendance, time of attendance, face-to-face teaching (Studierende), 2. core working hours (Arbeitnehmer); 3. contact hours (in Modulbeschreibung)

70 hours = preparation/follow-up

20 hours = Exam preparation

Recommendations
See Partial Achievements (Teilleistung)

M 4.84 Module: Post-quantum Cryptography from Lattices [M-INFO-107642]

Coordinators: Prof. Dr. Jörn Müller-Quade
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Cryptography and Security (Usage from 4/1/2026)
Elective Studies in Informatics (Usage from 4/1/2026)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114987	Post-quantum Cryptography from Lattices	**Irreg.**	**3 CP**	**Müller-Quade**

Assessment
See Partial Achievements (Teilleistung).

Prerequisites
See Partial Achievements (Teilleistung).

Competence Goal
The student
- knows the assumptions and framework underlying lattice-based cryptography.
- understands and is able to explain the common tools of the area.
- knows and understands the protocols and proofs presented in the lecture and can reproduce them.
- can apply the contents of the lecture to construct new (simple) schemes or analyze the security of given (simple) schemes.

Content
The lecture “Post-Quantum (Lattice-based) Cryptography” introduces the framework of lattice-based cryptography, its common tools and concepts, and important constructions of advanced cryptographic primitives. The central hardness assumptions underlying lattice-based cryptography are believed to be intractable even for quantum algorithms, and as such provide a foundation for post-quantum security. Beyond that, lattice-based cryptography enables a wealth of constructions of theoretical and practical interest.

Workload
90 h
Lectures: 24 h
Self-study during semester: 31 h
Preparation for the exam: 35 h

Recommendations
See Partial Achievements (Teilleistung).

M 4.85 Module: Practical Course: Advanced Software Development Tools [M-INFO-107739]

Coordinators: Prof. Dr.-Ing. Ina Schaefer
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Software Engineering and Compiler Construction (Usage from 4/1/2026)
Elective Studies in Informatics (Usage from 4/1/2026)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-115130	Practical Course: Advanced Software Development Tools	**WT+ST**	**6 CP**	**Schaefer**

Competence Goal
Students will be able to:
· Understand academically driven problems and, in collaboration with advisors, define requirements for the software to be developed or enhanced.
· Create medium-sized programs using current development environments, or familiarize themselves with medium- to large-scale programs and further develop them.
· Present project progress to advisors at regular meetings and identify potential obstacles.
· Evaluate third-party programs during code reviews, identify potential vulnerabilities, and discuss them.
· Present a (further) developed program in a short presentation.
· Document a (further) developed program.

Content
The requirements to modern software are becoming increasingly stringent and complex. As a result, new software development techniques are constantly being introduced to meet these demands. This often requires researchers to implement new development environments and tools that support these advanced development techniques.
In this module, participants will use and expand advanced software development tools from both industry and research. The goal is either to extend the functionality of the tool or to improve its non- functional properties.
Practical work is graded individually, and group work is required. The practical course is integrated into the department's current research projects and offers ample opportunity for creativity. The assignments are practice-oriented and prepare students for real-world tasks in research and industry.

Additional Information
The module can also be offered in German by arrangement.

Workload
20 h familiarization + 120 h development work + 20 h weekly meetings and their follow-up + 10 h preparation and code review + 10 h preparation and holding of the final presentation = 180 h

M 4.86 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: Area of Specialization: Telematics
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-111803	Practical Course: Advanced Topics in High Performance Computing, Data Management and Analytics	**Irreg.**	**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 COBalD/TARDIS)
• Authentication and authorization infrastructure (e.g., OpenID, SAML)

Students are individually supervised by scientific staff of the Scientific Centre for Computing and can apply their skills in a practical and research-oriented way by being involved in current research tasks (e.g., Helmholtz program, BMBF and EU projects).

Workload
3 SWS = 150 h per semester
• 12 h in meetings during the semester (kick-off, regular meetings with the supervisor, final meeting including presentation)
• 18 h preparation of meetings
• 120 h working on the topic and preparation of the exam

Recommendations
Knowledge in the area of databases, data management, data analytics, parallel computing is helpful.

M 4.87 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: Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113659	Practical Course: AI for Climate and Weather Predictions	**Irreg.**	**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 4.88 Module: Practical Course: Application Security [M-INFO-106996]

Coordinators: Prof. Dr. Jörn Müller-Quade
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Cryptography and Security
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113958	Practical Course: Application Security	**WT+ST**	**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 4.89 Module: Practical Course: Artificial Intelligence & Security Lab (AISEC-Lab) [M-INFO-106867]

Coordinators: Prof. Dr. Christian Wressnegger
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Cryptography and Security
Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113760	Practical Course: Artificial Intelligence & Security Lab (AISEC-Lab)	**ST**	**4 CP**	**Wressnegger**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Students know how to apply basic concepts of artificial intelligence and machine learning, and are able to evaluate the performance of such systems on real-world data from computer security research.

- Students know and understand concepts of machine learning for computer security.
- Students are able independently design, implement, and evaluate learning-based systems.
- Students understand limits of learning-based approaches.

Content
In this practical course, the students develop learning-based systems for different computer security tasks, thereby intensifying their knowledge gained in the corresponding lectures. The students have the unique opportunity to design, implement, and evaluate systems based on real-world data used in computer security research.

The module is composed of multiple units with several individual tasks/challenges covering different topics from classical computer security research to security of artificial intelligence. In each unit, the students develop an approach, train and validate it on known data, and submit their solution to the course platform, where the approach is tested against unknown data.

Workload
- 30h attendance time
- 70h Time to complete the exercises
- 15h Preparation of final presentation
- 5h attendance time (final event)

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

M 4.90 Module: Practical Course: Building PETs [M-INFO-107412]

Coordinators: Prof. Dr. Thorsten Strufe
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Cryptography and Security
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114550	Practical Course: Building PETs	**WT**	**4 CP**	**Schadt, Strufe**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Students are able to implement basic methods to handle data in a privacy-preserving manner.

Content
This practical course teaches students the basics of Privacy Enhancing Technology implementations. The methods consist of data privacy notions (k-anonymity and Differential Privacy), private information retrieval and anonymous communication. Students must implement those methods in small example programs in a programming language of their choice.

Additional Information
Participation slots are limited. The sign-up modality can be found on the institute website.

Workload
Attendance time: 9h
Practical work: 100h
Lecture preparations/follow-up: 11h

Recommendations
Familiarity with a programming language and a HTTP library

M 4.91 Module: Practical Course: Chip Design I [M-INFO-107265]

Coordinators: Prof. Dr. Mehdi Baradaran Tahoori
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Design of Embedded Systems and Computer Architectures
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114298	Practical Course: Chip Design I	**WT+ST**	**3 CP**	**Tahoori**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Hands-on, practical learning by working on hardware-related projects

Content
The Project Lab is a unique opportunity for students to engage in hands-on, practical learning by working on hardware-related projects from various fields, including
- Hardware-based Neural-Networks implementation
- Neuromorphic computing
- Printed Electronics
- Computation in Memory
- Open-source electronic design automation (EDA) tools extension
- Field Programmable Gate Arrays (FPGA)
- Risc-V architecture
- Hardware Security
- Reliability and Test
- other Emerging Technologies

Students can work individually or in groups of 2-4, collaborating to tackle challenges based on a selected topic. The lab accepts a limited number of participants each term based on the number of offered projects, ensuring a focused and immersive experience for everyone involved.
Project topics are carefully defined and curated each term to align with active research initiatives within the Chair of Dependable Nano Computing (CDNC). Participants not only contribute to these projects but also have the potential to co-author research papers and make tangible contributions to the academic community.
The lab emphasizes practical skills, especially in hardware-related fields, offering students access to state-of-the-art tools and technologies. It provides an invaluable opportunity to bridge the gap between theory and practice while preparing for a future in research, development, or industry.

Workload
4 SWS of practical workload including meetings with the supervisor. 90h

M 4.92 Module: Practical Course: Chip Design II [M-INFO-107266]

Coordinators: Prof. Dr. Mehdi Baradaran Tahoori
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Design of Embedded Systems and Computer Architectures
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114299	Practical Course: Chip Design II	**WT+ST**	**3 CP**	**Tahoori**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Hands-on, practical learning by working on hardware-related projects

Content
The Project Lab is a unique opportunity for students to engage in hands-on, practical learning by working on hardware-related projects from various fields, including
- Hardware-based Neural-Networks implementation
- Neuromorphic computing
- Printed Electronics
- Computation in Memory
- Open-source electronic design automation (EDA) tools extension
- Field Programmable Gate Arrays (FPGA)
- Risc-V architecture
- Hardware Security
- Reliability and Test
- other Emerging Technologies

Students can work individually or in groups of 2-4, collaborating to tackle challenges based on a selected topic. The lab accepts a limited number of participants each term based on the number of offered projects, ensuring a focused and immersive experience for everyone involved.
Project topics are carefully defined and curated each term to align with active research initiatives within the Chair of Dependable Nano Computing (CDNC). Participants not only contribute to these projects but also have the potential to co-author research papers and make tangible contributions to the academic community.
The lab emphasizes practical skills, especially in hardware-related fields, offering students access to state-of-the-art tools and technologies. It provides an invaluable opportunity to bridge the gap between theory and practice while preparing for a future in research, development, or industry.

Workload
4 SWS of practical workload including meetings with the supervisor. 90h

M 4.93 Module: Practical Course: Continuous Software Engineering [M-INFO-107677]

Coordinators: Prof. Dr.-Ing. Anne Koziolek
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Software Engineering and Compiler Construction (Usage from 4/1/2026)
Elective Studies in Informatics (Usage from 4/1/2026)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-115043	Practical Course: Continuous Software Engineering	**WT+ST**	**6 CP**	**Koziolek**

Assessment
See Partial Achievements (Teilleistung)

Prerequisites
See Partial Achievements (Teilleistung)

Competence Goal
Students are able to
· understand scientifically motivated problem statements and, in cooperation with supervisors, derive requirements for the software to be developed or extended.
· develop medium-sized programs using current development environments, or familiarize themselves with medium- to large-scale software systems and further develop them.
· present project progress to supervisors in regular meetings and identify and communicate potential obstacles.
· evaluate third-party code in the context of code reviews, identify potential weaknesses, and discuss them.
· present a (further) developed software system in a short presentation.
· document a (further) developed software system

Content
Agile software development methods refer to a class of iterative and incremental development approaches that place particular emphasis on executable software, early feedback from stakeholders, and embracing necessary changes. In these approaches, efforts that are not directly related to producing running software are viewed critically.

In this lab course, participants use and extend state-of-the-art tools from both practice and research to support agile software development. The following types of tools are considered:

- tools that leverage large language models (LLMs) to support agile software development methods, e.g., creating trace links from existing software engineering artifacts and models
- tools for semi-automatically deriving models from source code and runtime information, in particular performance data
- tools for simpler, domain-specific modeling
- tools for automatically maintaining consistency between development artifacts and models

Depending on the chosen topic, different technologies and programming languages are used, including:

- LLMs
- Java, Python, Java/TypeScript
- Spring Boot, React, Maven, EMF (Eclipse Modeling Framework)
- development of VS Code extensions or language servers
- Vitruvius
- Palladio Simulator
- ARDoCo
- JPlag

Course assessment is graded individually; group work is intended. The lab is embedded in the chair’s ongoing research and offers plenty room for creativity. The assignments are practice-oriented and prepare students for realistic tasks in both research and industry.

The lab can be completed entirely in English. If preferred, supervision and presentations in German are also possible.

Additional Information
In earlier semesters, this course was named „Praktikum: Werkzeuge für agile Modellierung “.

Workload
Course workload:
20 hours of work for onboarding,
120 hours of work for development,
20 hours of work for weekly meetings and follow-up,
10 hours for preparing and conducting a code review,
10 hours for preparing and delivering the final presentation.

Recommendations
See Partial Achievements (Teilleistung)

M 4.94 Module: Practical Course: Customized Embedded Processor Design [M-INFO-107897]

Coordinators: Prof. Dr.-Ing. Jörg Henkel
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Design of Embedded Systems and Computer Architectures (Usage from 7/13/2026)
Elective Studies in Informatics (Usage from 7/13/2026)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-115314	Practical Course: Customized Embedded Processor Design	**ST**	**4 CP**	**Henkel**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
The student will be able to adapt a processor to specific applications with the help of suitable tools so that it is particularly efficient in terms of performance and power consumption. The student will be able to synthesize and simulate the design.

Content
The design of embedded processors has made rapid progress in recent years. This development has been and continues to be characterized by the increasing demand for application-specific solutions in order to meet the diverse and sometimes contradictory requirements for low power consumption, high performance, low costs and, above all, a fast time-to-market.

This is where the internship comes in. The use of an embedded processor tool suite is practiced. Specifically, application-specific processors are developed for embedded applications, whereby the main focus is on adapting the application-specific instruction set. The description of the customized

processor is then evaluated for functional correctness and efficiency, e.g. performance/power consumption, performance/chip area, etc., on an FPGA platform after various simulation and synthesis steps. If necessary, some or all design steps are iterated several times in order to find an optimal solution. One learning objective is to see that optimizations at a high level of abstraction are particularly effective.

Workload
1. attendance time in the internship: 36 h
2. Preparation/follow-up of the same: 24

M 4.95 Module: Practical Course: Decentralized Learning Lab [M-INFO-107836]

Coordinators: Prof. Dr. Hannes Hartenstein
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Cryptography and Security (Usage from 10/1/2026)
Area of Specialization: Telematics (Usage from 10/1/2026)
Area of Specialization: Human-centred Machine Intelligence (Usage from 10/1/2026)
Elective Studies in Informatics (Usage from 10/1/2026)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-115246	Practical Course: Decentralized Learning Lab	**WT**	**3 CP**	**Hartenstein**

Assessment
See partial achivements (Teilleitung)

Prerequisites
See partial achivements (Teilleitung)

Competence Goal
Students know the foundations of Federated and Decentralized Learning. They know and can apply techniques in these fields. They can identify and explain important trade-offs, attacks and defenses in this field. Students are able to independently implement various algorithms and identify fitting solutions for several important application scenarios.

Content
This lab introduces students to the principles and practice of federated and decentralized machine learning. In the first phase, participants implement standard federated learning across a range of application scenarios, gaining hands-on experience with distributed training and aggregation. The course then transitions to decentralized federated learning, removing the central coordinator and exploring peer-to-peer collaboration.
Students will analyze and implement common attack vectors, such as poisoning and inference attacks, and evaluate corresponding defense mechanisms. A common theme throughout the lab is the privacy-robustness-efficiency-trilemma, examining the fundamental trade-offs between protecting user data, ensuring model integrity, and maintaining system performance. By the end, students will be equipped to design and critically assess secure and efficient decentralized learning systems.

Workload
In class: 45 h (meetings, reviews, presentation, etc.)
Independent work: 45 h
Sum: 90 h = 3 ECTS

Recommendations
Basic knowledge of Machine Learning and Decentralized Systems is helpful.

M 4.96 Module: Practical Course: Designing and Conducting Experimental Studies [M-INFO-107919]

Coordinators: Prof. Dr.-Ing. Michael Beigl
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Telematics (Usage from 10/1/2026)
Elective Studies in Informatics (Usage from 10/1/2026)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-115341	Practical Course: Designing and Conducting Experimental Studies	**WT+ST**	**6 CP**	**Beigl**

Competence Goal
Planning and conducting a study on a current research topic in the areas of Human–Computer Interaction, Ubiquitous Systems, and Context-Aware Systems.
Upon successful completion of the seminar, students will be able to:
independently search for, identify, analyze, and critically evaluate relevant scientific literature;
derive the framework conditions and parameters for user studies and experiments from the literature;
design, conduct, and evaluate a study addressing a given research question;
present scientific findings in a structured manner and communicate them to a specialist audience in the form of a short presentation;
apply the principles and techniques of scientific writing to prepare a scientific paper describing the planning, execution, and results of the study.
Students are familiar with the German Research Foundation (DFG) Code of Conduct *Guidelines for Safeguarding Good Research Practice* and successfully apply these guidelines in the preparation of their scientific work.

Content
The practical course focuses on investigating specific research questions through the design and execution of a user study.

Particular emphasis is placed on designing a user study to address a defined research question, followed by conducting the study and analyzing the collected data. Depending on the research question, the workload associated with the individual components may vary.

The lecture part provides both theoretical and practical knowledge on the planning, execution, and evaluation of user studies. It is intended to serve as valuable preparation for the Master's thesis.

Additional Information
Upon consultation, proof of performance may also be provided in German.

Workload
- Contact hours: group presentations and discussions (15 × 45 min): 11 h 15 min
- Common Lectures (4x1,5h): 6h
- Individual review of feedback and project work (15 × 30 min): 7h 30 min
- Practical group work on the assigned tasks (15 × 8 h): 120h
- Documentation of results and preparation of presentations (15 × 45 min) 11h 15
- Final report 24h

Total: 180h

Recommendations
Recommendation: The student should be familiar with the content of the course “Human Computer Interaction” or similar.

M 4.97 Module: Practical Course: Engineering Approaches to Software Development [M-INFO-107678]

Coordinators: Prof. Dr. Ralf Reussner
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Software Engineering and Compiler Construction (Usage from 4/1/2026)
Elective Studies in Informatics (Usage from 4/1/2026)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-115044	Practical Course: Engineering Approaches to Software Development	**WT+ST**	**6 CP**	**Reussner**

Assessment
See Partial Achievements (Teilleistung).

Prerequisites
See Partial Achievements (Teilleistung).

Competence Goal
Students are able to
- understand scientifically motivated problem statements and, in cooperation with supervisors, derive requirements for the software to be developed or extended.
- develop medium-sized programs using current development environments, or familiarize themselves with medium- to large-scale software systems and further develop them.
- present project progress to supervisors in regular meetings and identify and communicate potential obstacles.
- evaluate third-party code in the context of code reviews, identify potential weaknesses, and discuss them.
- present a (further) developed software system in a short presentation.

Content
The engineering-oriented development of software is an indispensable prerequisite for building large systems. Accordingly, software engineers must systematically analyze the system's quality already during software design and, where possible, also predict it.

In this practical course, participants use and extend state-of-the-art tools from both practice and research to evaluate and predict the performance of software systems. These tools provide solutions for the following tasks:

- assessing the scalability of software depending on the execution environment
- maintaining consistency across different development artifacts

The development tasks are drawn from the following areas:

- MDSD (Model-Driven Software Development)
- plugin development
- benchmarking
- reverse engineering

The technologies used include:

- Java, Python, Java/TypeScript
- Spring Boot, React, Maven, EMF (Eclipse Modeling Framework)
- Development of VS Code extensions or language servers
- Vitruvius
- Palladio Simulator

Course assessment is graded individually; group work is intended. The lab is embedded in the chair's ongoing research and offers plenty room for creativity. The assignments are practice-oriented and prepare students for realistic tasks in both research and industry.

The lab can be completed entirely in English. If preferred, supervision and presentations in German are also possible.

Additional Information
In earlier semesters, this course was named „Praktikum Ingenieursmäßige Software-Entwicklung"

Workload
Course workload:
20 hours of work for onboarding,
120 hours of work for development,
20 hours of work for weekly meetings and follow-up,
10 hours for preparing and conducting a code review,
10 hours for preparing and delivering the final presentation.

In total, this amounts to 180 hours of work.

Recommendations
See Partial Achievements (Teilleistung).

M 4.98 Module: Practical Course: Fine-grained Algorithm Design and Engineering [M-INFO-106784]

Coordinators: Prof. Dr.-Ing. Marvin Künnemann-Goos
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Theoretical Foundations
Area of Specialization: Algorithm Engineering
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113635	Practical Course: Fine-grained Algorithm Design and Engineering	**Irreg.**	**6 CP**	**Künnemann-Goos**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Students should be able to apply knowledge in the specializations “Algorithmtechnik” and “Theoretische Grundlagen” to derive fast algorithms and their implementations for a given algorithmic problem.

This includes:
– modeling a given problem of interest as a well-defined algorithmic problem as well as identifying reasonable relaxations
– performing a literature search to identify algorithmic ideas previously proposed for a given problem
– researching a given algorithmic or conditional lower bound technique and investigating its applicability on a given problem
– implementing resulting algorithms efficiently
– creating reasonable benchmark data sets (generated randomly, via reductions or from real-world data sources)
– evaluating an implementation on benchmark data and gaining insights on possible improvements of the model, algorithm or implementation.

Furthermore, the students can constructively engage in a team setting and are able to clearly communicate their ideas and results.

Content
Each group of students will receive a topic among a list of possible algorithmic problems with relevance for fine-grained and parameterized complexity (usually from the fields of graph theory, computational geometry or string problems). In some cases, the proposed topic is the subject of an ongoing algorithmic contest (e.g., the PACE challenge), providing an opportunity of participation as part of the practical course.

Under supervision, each group will:
– research the theoretical state-of-the-art for their algorithmic problem and/or design a novel algorithm,
– implement one or more algorithmic approaches
– evaluate and improve them using appropriate benchmark data sets.

The course aims to investigate the connections between worst-case upper & conditional lower bounds and fast practical implementations.

Workload
6 CP correspond to ~ 180 h, distributed roughly as follows:
~ 40 h meetings, literature review, etc.
~ 100 h implementation and evaluation
~ 40 h preparation of presentation and report

Recommendations
- Basic knowledge of algorithms and data structures is assumed.
- Knowledge of fine-grained complexity is helpful, but not required.

M 4.99 Module: Practical Course: FPGA Programming [M-INFO-102661]

Coordinators: Prof. Dr. Mehdi Baradaran Tahoori
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Design of Embedded Systems and Computer Architectures
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-105576	Practical Course: FPGA Programming	**WT+ST**	**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 4.100 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: Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-109914	Practical Course: General-Purpose Computation on Graphics Processing Units	**WT+ST**	**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 4.101 Module: Practical Course: Human-Centred Robotics [M-INFO-106646]

Coordinators: Prof. Dr. Katja Mombaur
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Robotics and Automation (Usage from 10/1/2025)
Area of Specialization: Human-centred Machine Intelligence (Usage from 10/1/2025)
Elective Studies in Informatics (Usage from 10/1/2025)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113393	Practical Course: Human-Centred Robotics	**WT+ST**	**6 CP**	**Mombaur**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Students learn to understand and scrutinize complex scientific topics and to reproduce and verify published results. They gain in-depth knowledge and practical experience in the field of motion generation and control of human-centered robots while working on a specific project task. They also learn how to plan, work together and communicate in a team. Students will be able to present their project results in a scientific presentation, demonstrate the practical results and answer detailed questions. They can also summarize their project results in writing using Latex in the style of a scientific paper and place them in a scientific context.

Content
Human-centered robots are robots that directly interact with humans or support humans in their motions. This includes humanoid robots, but also wearable robots (exoskeletons and prostheses) or external physical assistive devices. In this practical course, students learn how to implement theoretical knowledge about human-centered robots and use it to solve a given task based on a individual project with robot hardware. Projects can either focus on code development for a given hardware or on the development or modification of robot hardware along with the basic code. Students learn about the challenges of working with real robot hardware vs model computations, and about working principles and practical implementation of sensors and actuators.

Additional Information
For capacity reasons (supervision of practical projects and workspace) , the practical course is limited in terms of projects and number of students. Specific project topics will be different each term and will be announced in a presentation during the first semester week.
Subsequently, a selection and topic assignment will be carried out, taking into account the students' subject and topic specific skills.

Workload
Estimated effort for this module is 180 hours:
20h – In person events (kickoff meeting, individual meetings with supervisor, presentations)
130h – Individual project work
30h - Writing report and preparing presentation

Recommendations
Knowledge in Robotics (e.g. from the class Robotics 1 and follow-ups) are very helpful.

M 4.102 Module: Practical Course: Interactive Theorem Proving [M-INFO-107494]

Coordinators: Prof. Dr. Bernhard Beckert
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Theoretical Foundations
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114691	Practical Course: Interactive Theorem Proving	**Irreg.**	**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 4.103 Module: Practical Course: Internet of Things (IoT) [M-INFO-103706]

Coordinators: Prof. Dr.-Ing. Jörg Henkel
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Design of Embedded Systems and Computer Architectures
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-107493	Practical Course: Internet of Things (IoT)	**WT+ST**	**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 4.104 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: Area of Specialization: Design of Embedded Systems and Computer Architectures
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-108323	Practical Course: Low Power Design and Embedded Systems	**ST**	**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 4.105 Module: Practical Course: Machine Learning and Intelligent Systems [M-INFO-107845]

Coordinators: Prof. Dr.-Ing. Uwe Hanebeck
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Theoretical Foundations (Usage from 10/1/2026)
Area of Specialization: Robotics and Automation (Usage from 10/1/2026)
Area of Specialization: Human-centred Machine Intelligence (Usage from 10/1/2026)
Elective Studies in Informatics (Usage from 10/1/2026)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-115259	Practical Course: Machine Learning and Intelligent Systems	**WT+ST**	**8 CP**	**Hanebeck**

Assessment
See Partial Achievements (Teilleistung).

Prerequisites
See Partial Achievements (Teilleistung).

Competence Goal
Students are able to:

- Plan and conduct a research project collaboratively in small groups
- Organize and structure their work and create a project plan
- Apply scientific methods to investigate a research question and evaluate results
- Present their work and results in oral presentations and a written report

Content
This course offers the opportunity to work on research-related topics in the areas of extended reality, robotics, state estimation, and measurement and control systems. The specific tasks in each semester are based on current research work at ISAS and are published on the lab's website. The tasks are worked on by small groups of up to three students, by designing, implementing, and testing suitable hardware and/or software components. Each group is supported by a designated supervisor regularly giving personal feedback and advice. The main goal of the course is the implementation of theoretical methods in real-world applications. An initial familiarization and brainstorming phase is followed by an extensive practical phase in which, in addition to the implementation work, project and time management skills are trained. In parallel, results are documented in the form of presentations and a final report.

http://isas.iar.kit.edu

Workload

- Attendance time: 20h
- Individual project work: 170h
- Preparation of report and presentations: 50h

M 4.106 Module: Practical Course: Mathematical and Computational Methods in Robotics and AI [M-INFO-107609]

Coordinators: Prof. Dr. Katja Mombaur
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Robotics and Automation (Usage from 10/1/2025)
Area of Specialization: Human-centred Machine Intelligence (Usage from 10/1/2025)
Elective Studies in Informatics (Usage from 10/1/2025)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114911	Practical Course: Mathematical and Computational Methods in Robotics and AI	**WT+ST**	**6 CP**	**Mombaur**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Students learn to understand scientific topics. They will learn how to address specific project tasks and solve them in a structured way. They will obtain deepened knowledge about fundamental mathematical and computational methods, including their potential, strengths and limitations and in which areas they are suited to be applied. Students learn to present their results to a an audience, as well as suitably documenting their results in form or in addition to a scientific paper and being capable of assessing the advantages and disadvantages of the methods used.

Content
Efficient mathematical and computational methods are an irreplaceable cornerstone of modern research and industrial applications in forms such as numerical simulation, optimization or inference, ranging from the generation of task-specific trajectories for robotic systems over stabilization of existing robots to data-driven prediction and inference as well as AI-applications.
In this practical course, students learn, on the basis of an individual programming project, how to implement and apply fundamental mathematical and computational methods to solve an existing task in a robotics application or related fields and gain experience leveraging methods from this area in said real-world context.

Additional Information
Limited number of projects and participants. Specific project topics will be different each term and will be announced in a presentation during the first semester week or can be indivdually agreed upon with people supervising the practical. Students can propose topics on their own as well.

Workload
Estimated effort for this module is 180 hours:
20h – In person events (kickoff meeting, individual meetings with supervisor, presentations)
130h – Individual project work
30h - Writing report and preparing presentation

Recommendations
Basic mathematical knowledge will be helpful, depending on topic. For Projects in the context of robotics, knowledge of robotics is recommended, but not strictly necessary.

M 4.107 Module: Practical Course: Model-Driven Software Development [M-INFO-106932]

Coordinators: Prof. Dr. Ralf Reussner
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Software Engineering and Compiler Construction
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113897	Practical Course: Model-Driven Software Development	**ST**	**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 4.108 Module: Practical Course: Movement and Technology [M-INFO-106648]

Coordinators: Prof. Dr. Katja Mombaur
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Robotics and Automation
Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113394	Practical Course: Movement and Technology	**ST**	**6 CP**	**Mombaur**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Students learn to analyze and understand complex scientific topics in the area of human motion capture and motion analysis. They gain in-depth knowledge and practical experience with motion capture technology, experiment planning, and analysis. They also learn how to plan, work together and communicate in an interdisciplinary team. Students will be able to present their project results in a scientific presentation, demonstrate the practical results and answer detailed questions. They can also summarize their project results in writing using Latex and place them in a scientific context.

Content
In this joint course between Informatics and Sports Science, and in the sense of research-oriented teaching, students learn about current research projects of the BioRobotics Lab (Informatics) and the BioMotion Center (Sports Science) at the interface of motor control and biomechanics of human movement. This research involves the use of latest motion capture technology, advanced analysis tools, and partly also assistive robotics technology. Students work in in teams (interdisciplinary teams between students from different study programs are highly encouraged) to carry out motion capture experiments, analyze the data and present the results in written and oral form. Depending on the specific project, these motion capture studies are either stand-alone studies just for this course or part of a larger research project at one of the organizing research groups.

Additional Information
Limited number of projects and participants. Specific project topics will be different each term and will be announced in a presentation during the first semester week.

Workload
Estimated effort for this module is 180 hours:
20h – In person events (kickoff meeting, individual meetings with supervisor, presentations)
120h – Individual project work
40h - Writing report and preparing presentation

Recommendations
Knowledge in Robotics (e.g. from the class Robotics 1 and follow-ups) are very helpful.

Programming skills.

M 4.109 Module: Practical Course: Natural Language Dialog Systems [M-INFO-107177]

Coordinators: Prof. Dr. Jan Niehues
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114206	Practical Course: Natural Language Dialog Systems	**Irreg.**	**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 4.110 Module: Practical Course: Neural Network Acceleration on FPGAs [M-INFO-106503]

Coordinators: Prof. Dr. Mehdi Baradaran Tahoori
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Design of Embedded Systems and Computer Architectures (Usage from 4/1/2026)
Elective Studies in Informatics (Usage from 4/1/2026)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113122	Practical Course: Neural Network Acceleration on FPGAs	**WT+ST**	**3 CP**	**Gnad, Tahoori**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
After the lab is finished, the students will have acquired the following skills and expertise:

- Be able to implement a neural network accelerator based on established benchmark data, generating an ONNX model and finishing with a dedicated FPGA design, based on the open source FINN framework for AMD FPGAs.
- Understand the implications of using quantization and other resource-constraining methods.
- Be able to understand the distinctive advantages (or disadvantages) of FPGAs versus other implementations.

Content
Neural networks are applied in a variety of domains, even critical application scenarios in transportation and medicine. Important aspects of accelerating neural networks in various application domains are performance, latency, reliability, and energy footprint. Dedicated hardware can have advantages in all of these domains over a traditional CPU and also GPU implementations. In this regard, Field-Programmable Gate Arrays (FPGAs; reconfigurable hardware) have shown to be an efficient and versatile solution for accelerating quantized neural networks, which are compact representations of neural network models. Their benefits are proven by the use in Microsoft Azure ML, Amazon AWS and other cloud platforms.
This module will teach students how to implement neural networks on reconfigurable hardware using an established framework, and also looks into relevant practical details when optimizing the network for hardware deployment.

Workload
(2 SWS + 2 x 2 SWS) x 15 = 90h = 3 ECTS

M 4.111 Module: Practical Course: Performance Engineering in C++ and Rust [M-INFO-107865]

Coordinators: Prof. Dr. Peter Sanders
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Algorithm Engineering (Usage from 10/1/2026)
Area of Specialization: Software Engineering and Compiler Construction (Usage from 10/1/2026)
Elective Studies in Informatics (Usage from 10/1/2026)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-115280	Practical Course: Performance Engineering in C++ and Rust	**Irreg.**	**6 CP**	**Groot Koerkamp, Maas**

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++ or Rust.
- recognize factors that lead to inefficient code and can, if possible, replace them with more efficient constructions.
- understand how the presented techniques can be used to optimize
  CPU-bound code using SIMD instructions and multi-threading and to optimize memory-bound code using cache-efficient data structures.
- know the features of the standard library and are able to use them selectively.
- can test, profile, and benchmark the generated code 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++ or Rust. 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 are used, such as SIMD, multi-threading, and prefetching.

Additional Information
This course used to be called "Efficient Parallel C++".

Workload
~ 15h attendance time
~ 25h presentation/discussion/assessment of the solutions (with preparation)
~ 140h working on the tasks (implementation and evaluation)

Recommendations
At least basic knowledge of the C++ language *or* Rust language is necessary for
participation in the course. Students should be able to implement given
algorithms.

M 4.112 Module: Practical Course: Programming Language Design and Implementation [M-INFO-108020]

Coordinators: Prof. Dr. Sebastian Erdweg
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Software Engineering and Compiler Construction
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-115486	Practical Course: Programming Language Design and Implementation	**Irreg.**	**6 CP**	**Erdweg**

Assessment
See Partial Achievements (Teilleistung)

Prerequisites
See Partial Achievements (Teilleistung)

Competence Goal
Upon completion of this practical course, students will be able to:
· Name and describe the different parts of a language implementation.
· Distinguish and compare alternative implementation techniques for programming languages.
Contribute to and adapt parts of a language implementation.

Content
In the first few weeks of this course, students are introduced to the different parts and techniques for implementing programming languages. This may include for example: language design, frontend, type checking and inference, static analysis, macros and metaprogramming, code generation, optimization, run-time systems, memory management, and debugging.

After the introductory sessions, students will work in independent groups to develop a new language implementation or extend an existing one. Project topics will be set after the introductory part of the course.

Workload
6 CP equate to approximately 180 SWS. These are distributed as follows:
· approx. 30 h in-person meetings (introductory lectures, individual meetings with project supervisors, presentations)
· approx. 40 h self-study of existing language implementations
· approx. 100 h work on the independent project and its presentation
· approx. 10 h write a project summary

Recommendations
Very good programming skills.

M 4.113 Module: Practical Course: Real-world Vulnerability Discovery and Exploits [M-INFO-106627]

Coordinators: Prof. Dr. Christian Wressnegger
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Cryptography and Security
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113350	Practical Course: Real-world Vulnerability Discovery and Exploits	**WT+ST**	**4 CP**	**Wressnegger**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
← Students know and understand exploitation techniques.
← Students are able to independently research software vulnerabilities.
← Students are comfortable engaging with software vendors in vulnerability disclosure.

Content
Students understand modern exploitation techniques and can apply them. Furthermore, they get familiar with the vulnerability disclosure process of prominent software vendors, reporting their findings.

Workload
- 2h attendance time/ week (lectures)
- 5h project work/ week
- 10h preparation for final presentation
- 5h attendance time (final event)

Total 120h

Recommendations
Application security internship

M 4.114 Module: Practical Course: Route Planning [M-INFO-107600]

Coordinators: TT-Prof. Dr. Thomas Bläsius
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Algorithm Engineering
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114899	Practical Course: Route Planning	**Irreg.**	**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 4.115 Module: Practical Course: Security, Usability and Society [M-INFO-105453]

Coordinators: Prof. Dr. Thorsten Strufe
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Cryptography and Security
Area of Specialization: Telematics
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-110990	Practical Course: Security, Usability and Society	**Irreg.**	**4 CP**	**Strufe**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Students know established security and data protection programs, can implement them in apps and can carry out user studies.

Learning objectives:

- Students know and understand the methods for developing privacy-friendly apps and can apply them.
- Students are able to implement various applicable security measures in programs.
- Students can set up and conduct user studies.
- Students are able to prepare and present a report of their work.

Content
The internship "Security, Usability and Society" covers topics such as usable security and privacy programs as well as conducting user studies.
Topics include:

- Privacy-friendly apps
- Programming usable security measures
- Conducting usable security user studies

Workload
Attendance time: 15 h
Solving the tasks: 75
Preparation of presentation and report: 30

M 4.116 Module: Practical Course: Smart Energy System [M-INFO-105955]

Coordinators: Prof. Dr. Veit Hagenmeyer
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Telematics
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-112030	Practical Course: Smart Energy System	**WT+ST**	**6 CP**	**Jumar**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
After successfully completing the course, students will be able to

- explain and categorize a set of current research issues in modern energy systems
- explain structure and objectives of the KIT Energy Lab and its role in smart grid research
- conduct selected research activities in the field of innovative, application-oriented information, automation and system technology for sustainable energy systems
- isolate a research activity / hypothesis suitable for evaluation in the Smart Energy System Simulation and Control Center
- plan, organize and manage their laboratory / experimental work to fit a given time-frame
- concisely present and defend their research activity and results in front of a peer audience
- structure and writeup their work in research-paper-style
- work in team

Content
As part of the two-week lab course, students work in teams of two on a project topic derived from current research questions of the Smart Energy System Simulation and Control Centre of the Energy Lab (https://www.iai.kit.edu/RPE.php). A list of topics is made available in advance via the Campus Plus Portal. Interested students should indicate their preferences based on which the topics will be assigned.

The group of students typically goes through the following phases: Concept development/experiment preparation, implementation/experiment execution, evaluation/experiment analysis, presentation of results and write-up. The teams will work independently on the assigned project - supervision is provided by research assistants.

The course begins with a joint kick-off event. This includes an organizational introduction, a tour of the Energy Lab and a brief presentation of all project topics. For the following preparation phase students are provided with literature and material to thoroughly familiarize themselves with the topic, research background and literature, plan and prepare experiments etc. In the two lab weeks the experiments are conducted and a scientific writing workshop is held. At the end of the lab course each team has to defend their work in a 10 min presentation followed by 5 minutes of discussion in front of peers and examiners. Additionally, the work needs to be documented in the style of a scientific paper.

Workload
6 credit points corresponds to approx. 180 working hours, of which
- Attendance time / meetings in large and small groups: 10h
- Select and carry out project work: 140h
- Writing a research report and preparing a presentation: 30 hours

Recommendations
- Knowledge of the fundamentals of energy informatics is a prerequisite.
- Knowledge of the fundamentals of electrical engineering and energy technology is required.
- Knowledge of the basics of mechatronics, data analysis and signal processing is helpful.
- Knowledge of power systems or power electronics is helpful.

M 4.117 Module: Practical Course: Software Development and Application of Mobile, Bio-Inspired Robots [M-MACH-106904]

Coordinators: Prof. Dr.-Ing. Arne Rönnau
Organisation: KIT Department of Mechanical Engineering
Part of: Minor Studies: Biologically Inspired Robotics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-MACH-113854	Practical Course: Software Development and Application of Mobile, Bio-Inspired Robots	**WT**	**6 CP**	**Rönnau**

Assessment
See partial achievement

Prerequisites
None

Competence Goal
Students are able to understand biologically inspired mobile robots and extend their software.

Content
This module teaches students how to work with and expand biologically inspired mobile robotics. The topics covered include control engineering, computer vision, 3D mapping, navigation and human-machine interaction.

Students work in groups and produce a joint final report and presentation.

Workload
180h

- 30h weekly regular meeting
- 120h preparation and follow-up time
- 30h Presentation and report preparation

Recommendations
See partial achievement

M 4.118 Module: Practical Course: Visual Computing [M-INFO-101567]

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

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-103000	Practical Course: Visual Computing	**WT+ST**	**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 4.119 Module: Practical Introduction to Hardware Security [M-INFO-107241]

Coordinators: Prof. Dr. Mehdi Baradaran Tahoori
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Cryptography and Security
Area of Specialization: Design of Embedded Systems and Computer Architectures
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114267	Practical Introduction to Hardware Security	**WT+ST**	**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 4.120 Module: Practical SAT Solving [M-INFO-107238]

Coordinators: Prof. Dr. Peter Sanders
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Theoretical Foundations
Elective Studies in Informatics

Credits	Grading	Recurrence	Duration	Language	Level	Version
5 CP	graded	Irregular	1 term	English	4	2

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114262	Practical SAT Solving	**Irreg.**	**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 4.121 Module: Practice of Research (Methods, 1st Semester) [M-INFO-107829]

Coordinators: Prof. Dr. Bernhard Beckert
Prof. Dr.-Ing. Michael Beigl
Prof. Dr. Ralf Reussner

Organisation: KIT Department of Informatics

Part of: Interdisciplinary Qualifications (Usage from 10/1/2026)

Credits	Grading	Recurrence	Duration	Language	Level	Version
2 CP	pass/fail	Each term	1 term	English	4	1

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-115231	Practice of Research (Methods, 1st Semester)	**WT+ST**	**2 CP**	**Beckert**

Assessment
See Partial Achievements (Teilleistung).

Prerequisites
See Partial Achievements (Teilleistung).

Competence Goal
The aim of “Practice of Research” is to acquire both subject-specific knowledge and methodological skills for scientific work, and to apply them to an actual research project.

After completing all four modules of “Practice of Research,” participants will be able to:
• conduct a literature search based on a given topic, independently identify, locate, classify, evaluate, and analyze relevant literature,
• present the results of the literature search to a specialist audience in their own words using self-created presentation slides, and discuss them critically,
• formulate, define, and articulate the relevance of a research question or research problem,
• explain the basics of the philosophy of science and relate them to their project,
• discuss the fundamentals of the research approach used (e.g., experimental design and execution) and apply them to their project,
• design, justify, evaluate, and position their own research (sub-)approach,
• derive concrete work steps and a project plan from the research question and the chosen approach,
• determine workloads, coordinate tasks, and, if applicable, allocate them within a team,
• identify and analyze risk factors and develop and plan countermeasures,
• conduct scientific work in the project’s research field,
• identify, plan, and carry out the necessary preparatory work for the project,
• work scientifically in the project’s research area,
• know and apply the relevant substantive foundations for the project and assess their relevance to the research question,
• document, summarize, and present their planning and project progress,
• recognize and evaluate progress and develop and apply steering 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 or in a team.

Content
The content of “Practice of Research” is the guided execution of a scientific research project. Over a total period of two semesters, intensive and continuous work on the project takes place. Within the framework established by “Practice of Research,” students acquire both subject knowledge and methodological competence for scientific work.
The topics of the participants’ projects come from the research areas of the respective supervisors. In general, the project takes place within an ongoing research initiative, which ensures a strong integration of research and teaching.
The emphasis in the first semester is on project planning and carrying out preparatory work. The emphasis in the second semester is on project execution and presentation of results.
At the end of “Practice of Research” (end of the second semester), participants write a scientific paper on the project results. This work should meet the quality standards of a scientific publication and, if possible, be published.
Participation in “Practice of Research” also serves as preparation for a Master’s thesis for which the scholarly level may go beyond the usually expected scope.
In parallel to the project work, there are accompanying courses in which competencies for scientific and project-oriented work are taught (these are credited as cross-disciplinary qualifications; see the modules “Practice of Research (Methods, 1st semester)” and “Practice of Research (Methods, 2nd Semester)”). The topics of these accompanying courses are:

- scientific research methods;
- methodical search for related works on a research topic, in particular literature search, basic understanding of scientific literature;
- presentation of scientific works;
- teamwork in scientific contexts;
- methodical creation of work plans for scientific projects;
- methodical evaluation of scientific works;
- strategies for conducting scientific projects;
- creating scientific publications.

Additional Information
This module forms a unit with the modules “Practice of Research (Project, 1st Semester)”, “Practice of Research (Project, 2nd Semester)”, and “Practice of Research (Methods, 2nd Semester)”. Across the four modules, a continuous research project is conducted over two semesters.

The module can also be provided in German if needed.

Workload
The total workload for this module is 60 hours (the total workload for all four modules of “Practice of Research” is 720 hours).
Teaching corresponding to 0.5 of the module’s 2 credit points is provided by lecturers of the KIT Faculty of Informatics, and teaching corresponding to 1.5 credit points is provided by the House of Competence. The courses offered by the House of Competence are:
- Workshop “Presenting for Computer Science Students (Master)”, 1 CP
- Workshop “Project Management for Computer Science Students (Master)”, 0.5 CP

* Contact hours in workshops and courses: 26 hours
* Preparation and follow-up of the courses: 8 hours
* Reflection and transfer to the context of the student’s own project: 14 hours
* Working on exercise tasks: 4 hours
* Exam preparation: 8 hours
Total: 60 hours (= 2 credit points)

M 4.122 Module: Practice of Research (Methods, 2nd Semester) [M-INFO-107830]

Coordinators: Prof. Dr. Bernhard Beckert
Prof. Dr.-Ing. Michael Beigl
Prof. Dr. Ralf Reussner

Organisation: KIT Department of Informatics

Part of: Interdisciplinary Qualifications (Usage from 10/1/2026)

Credits	Grading	Recurrence	Duration	Language	Level	Version
2 CP	pass/fail	Each term	1 term	English	4	1

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-115232	Practice of Research (Methods, 2nd Semester)	**WT+ST**	**2 CP**	**Beckert**

Assessment
See Partial Achievements (Teilleistung).

Prerequisites
See Partial Achievements (Teilleistung).

Competence Goal
The aim of “Practice of Research" is to acquire both subject-specific knowledge and methodological competences for scientific work, and to test them on an actual research project.

After completing all four modules of “Practice of Research,” participants can:
- conduct a literature search starting from a given topic, independently identify, locate, classify, evaluate and analyze relevant literature,
- present the results of the literature search to a specialist audience in their own words using self-created presentation slides, and discuss them critically,
- formulate, delimit and articulate the relevance of a research question or research problem,
- explain the basics of the philosophy of science and relate them to their project,
- discuss the fundamentals of the employed research approach (e.g., experimental design and execution) and apply them to their project,
- design, justify, evaluate and place their own research (sub-)approach,
- derive concrete work steps and a project plan from the research question and the chosen approach,
- determine workloads, coordinate tasks and, if applicable, allocate them within a team,
- identify and analyze risk factors and develop and plan countermeasures,
- conduct scientific work in the project’s research field,
- identify, plan and carry out the necessary preparatory work for the project,
- work scientifically in the project’s research area,
- know, apply the relevant substantive foundations for the project and assess their relevance to the research question,
- document, summarize and present their planning and project progress,
- recognize and evaluate progress and develop and apply steering 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 or in a team.

Content
The content of “Practice of Research” is the guided execution of a scientific research project. Over a total period of two semesters, intensive and continuous work on the project takes place. Within the framework established by “Practice of Research,” students acquire both subject knowledge and methodological competence for scientific work.

The topics of the participants’ projects come from the research areas of the respective supervisors. In general, the project takes place within an ongoing research initiative, which ensures a strong integration of research and teaching.

The emphasis in the first semester is on project planning and carrying out preparatory work. The emphasis in the second semester is on project execution and presentation of results.
At the end of “Practice of Research” (end of the second semester), participants write a scientific paper on the project results. This work should meet the quality standards of a scientific publication and, if possible, be published.

Participation in “Practice of Research” also serves as preparation for a Master’s thesis for which the scholarly level may go beyond the usually expected scope.
In parallel to the project work, there are accompanying courses in which competencies for scientific and project-oriented work are taught (these are credited as cross-disciplinary qualifications; see the modules “Practice of Research (Methods, 1st semester)” and “Practice of Research (Methods, 2nd Semester)”). The topics of these accompanying courses are:

- scientific research methods;
- methodical search for related works on a research topic, in particular literature search, basic understanding of scientific literature;
- presentation of scientific works;
- teamwork in scientific contexts;
- methodical creation of work plans for scientific projects;
- methodical evaluation of scientific works;
- strategies for conducting scientific projects;
- creating scientific publications.

Additional Information
This module forms a unit with the modules “Practice of Research (Project, 1st Semester)”, “Practice of Research (Project, 2nd Semester)”, and “Practice of Research (Methods, 1st Semester)”. Across the four modules, a continuous research project is conducted over two semesters.

The module can also be provided in German if needed.

Workload
The total workload for this module is 60 hours (the total workload for all four modules of “Practice of Research” is 720 hours).
Teaching corresponding to 0.5 of the module’s 2 credit points is provided by lecturers of the KIT Faculty of Informatics, and teaching corresponding to 1.5 credit points is provided by the House of Competence. The courses offered by the House of Competence are:

- Workshop “Presenting for Computer Science Students (Master)”, 1 CP
- Workshop “Project Management for Computer Science Students (Master)”, 0.5 CP

* Contact hours in workshops and courses: 26 hours
* Preparation and follow-up of the courses: 8 hours
* Reflection and transfer to the context of the student’s own project: 14 hours
* Working on exercise tasks: 4 hours
* Exam preparation: 8 hours
Total: 60 hours (= 2 credit points)

M 4.123 Module: Practice of Research (Project, 1st Semester) [M-INFO-107831]

Coordinators: Prof. Dr. Bernhard Beckert
Prof. Dr.-Ing. Michael Beigl
Prof. Dr. Ralf Reussner

Organisation: KIT Department of Informatics

Part of: Area of Specialization: Theoretical Foundations (Usage from 10/1/2026)
Area of Specialization: Algorithm Engineering (Usage from 10/1/2026)
Area of Specialization: Cryptography and Security (Usage from 10/1/2026)
Area of Specialization: Design of Embedded Systems and Computer Architectures (Usage from 10/1/2026)
Area of Specialization: Telematics (Usage from 10/1/2026)
Area of Specialization: Robotics and Automation (Usage from 10/1/2026)
Area of Specialization: Human-centred Machine Intelligence (Usage from 10/1/2026)
Area of Specialization: Software Engineering and Compiler Construction (Usage from 10/1/2026)
Area of Specialization: Data Science (Usage from 10/1/2026)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-115235	Practice of Research (Project, 1st Semester) - Oral Exam	**WT+ST**	**3 CP**	**Beckert**
T-INFO-115233	Practice of Research (Project, 1st Semester) - Presentation	**WT+ST**	**3 CP**	**Beckert**
T-INFO-115234	Practice of Research (Project, 1st Semester) - Project Proposal	**WT+ST**	**4 CP**	**Beckert**

Competence Goal
The aim of “Practice of Research" is to acquire both subject-specific knowledge and methodological competences for scientific work, and to test them on an actual research project.

After completing all four modules of “Practice of Research,” participants can:
- conduct a literature search starting from a given topic, independently identify, locate, classify, evaluate and analyze relevant literature,
- present the results of the literature search to a specialist audience in their own words using self-created presentation slides, and discuss them critically,
- formulate, delimit and articulate the relevance of a research question or research problem,
- explain the basics of the philosophy of science and relate them to their project,
- discuss the fundamentals of the employed research approach (e.g., experimental design and execution) and apply them to their project,
- design, justify, evaluate and place their own research (sub-)approach,
- derive concrete work steps and a project plan from the research question and the chosen approach,
- determine workloads, coordinate tasks and, if applicable, allocate them within a team,
- identify and analyze risk factors and develop and plan countermeasures,
- conduct scientific work in the project’s research field,
- identify, plan and carry out the necessary preparatory work for the project,
- work scientifically in the project’s research area,
- know, apply the relevant substantive foundations for the project and assess their relevance to the research question,
- document, summarize and present their planning and project progress,
- recognize and evaluate progress and develop and apply steering 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 or in a team.

Content
The content of “Practice of Research” is the guided execution of a scientific research project. Over a total period of two semesters, intensive and continuous work on the project takes place. Within the framework established by “Practice of Research,” students acquire both subject knowledge and methodological competence for scientific work.
The topics of the participants’ projects come from the research areas of the respective supervisors. In general, the project takes place within an ongoing research initiative, which ensures a strong integration of research and teaching.
The emphasis in the first semester is on project planning and carrying out preparatory work. The emphasis in the second semester is on project execution and presentation of results.
At the end of “Practice of Research” (end of the second semester), participants write a scientific paper on the project results. This work should meet the quality standards of a scientific publication and, if possible, be published.
Participation in “Practice of Research” also serves as preparation for a Master’s thesis for which the scholarly level may go beyond the usually expected scope.
In parallel to the project work, there are accompanying courses in which competencies for scientific and project-oriented work are taught (these are credited as cross-disciplinary qualifications; see the modules “Practice of Research (Methods, 1st semester)” and “Practice of Research (Methods, 2nd Semester)”). The topics of these accompanying courses are:

- scientific research methods;
- methodical search for related works on a research topic, in particular literature search, basic understanding of scientific literature;
- presentation of scientific works;
- teamwork in scientific contexts;
- methodical creation of work plans for scientific projects;
- methodical evaluation of scientific works;
- strategies for conducting scientific projects;
- creating scientific publications.

Additional Information
- This module forms a unit with the modules “Practice of Research (Project, 2nd Semester)”, “Practice of Research (Methods, 1st Semester)” and “Practice of Research (Methods, 2nd Semester)”. Across the four modules, a continuous research project is conducted over two semesters.
- This module can be credited either in an area of specialization or in the elective area. The corresponding mapping of offered projects to specialization areas will be announced at the beginning of the semester.
- This module includes lecture credit points, practical course credit points and seminar credit points. The practical course points cover practical scientific work under supervision; the seminar points cover the independent study and (written and oral) presentation of external scientific works; the lecture points cover acquiring substantive knowledge through reading, listening, etc. The distribution of the module’s credit points among the different types of credits will be announced at the beginning of the first semester for each project (where the modules “Practice of Research (Project, 1st Semester)” and “Practice of Research (Project, 2nd Semester)” together have at least 5 lecture credits, at least 3 seminar credits and at least 3 practical course credits).

The module can also be provided in German if needed.

Workload
The total workload for this module is 300 hours (the total workload for all four modules of “Practice of Research” is 720 hours).
The distribution of workload across the various phases and steps is project-dependent and will be announced at the beginning of the first semester.

- Attendance time in lectures and discussions: 8 hours
- Literature research and drafting the written work: 72 hours
- Practical project work individually and in a team: 136 hours
- Creation of the project proposal: 72 hours
- Exam preparation: 12 hours

Total: 300 hours (= 10 credit points)

M 4.124 Module: Practice of Research (Project, 2nd Semester) [M-INFO-107832]

Coordinators: Prof. Dr. Bernhard Beckert
Prof. Dr.-Ing. Michael Beigl
Prof. Dr. Ralf Reussner

Organisation: KIT Department of Informatics

Part of: Area of Specialization: Theoretical Foundations (Usage from 10/1/2026)
Area of Specialization: Algorithm Engineering (Usage from 10/1/2026)
Area of Specialization: Cryptography and Security (Usage from 10/1/2026)
Area of Specialization: Design of Embedded Systems and Computer Architectures (Usage from 10/1/2026)
Area of Specialization: Telematics (Usage from 10/1/2026)
Area of Specialization: Robotics and Automation (Usage from 10/1/2026)
Area of Specialization: Human-centred Machine Intelligence (Usage from 10/1/2026)
Area of Specialization: Software Engineering and Compiler Construction (Usage from 10/1/2026)
Area of Specialization: Data Science (Usage from 10/1/2026)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-115236	Practice of Research (Project, 2nd Semester) - Oral Exam	**WT+ST**	**3 CP**	**Beckert**
T-INFO-115237	Practice of Research (Project, 2nd Semester) - Presentation	**WT+ST**	**3 CP**	**Beckert**
T-INFO-115238	Research Project (Project, 2nd Semester) - Scientific Report	**WT+ST**	**4 CP**	**Beckert**

Assessment
See Partial Achievements (Teilleistung).

Prerequisites
See Partial Achievements (Teilleistung).

Modeled Prerequisites
The following conditions have to be fulfilled:
1. You have to fulfill one of 3 conditions:
    1. The module M-INFO-102418 - Team Project (Project, 1st Semester) must have been started.
    2. The module M-INFO-105037 - Research Project (Project, 1st Semester) must have been started.
    3. The module M-INFO-107831 - Practice of Research (Project, 1st Semester) must have been started.

Competence Goal
The aim of “Practice of Research" is to acquire both subject-specific knowledge and methodological competences for scientific work, and to test them on an actual research project.

After completing all four modules of “Practice of Research,” participants can:

- conduct a literature search starting from a given topic, independently identify, locate, classify, evaluate and analyze relevant literature,
- present the results of the literature search to a specialist audience in their own words using self-created presentation slides, and discuss them critically,
- formulate, delimit and articulate the relevance of a research question or research problem,
- explain the basics of the philosophy of science and relate them to their project,
- discuss the fundamentals of the employed research approach (e.g., experimental design and execution) and apply them to their project,
- design, justify, evaluate and place their own research (sub-)approach,
- derive concrete work steps and a project plan from the research question and the chosen approach,
- determine workloads, coordinate tasks and, if applicable, allocate them within a team,
- identify and analyze risk factors and develop and plan countermeasures,
- conduct scientific work in the project’s research field,
- identify, plan and carry out the necessary preparatory work for the project,
- work scientifically in the project’s research area,
- know, apply the relevant substantive foundations for the project and assess their relevance to the research question,
- document, summarize and present their planning and project progress,
- recognize and evaluate progress and develop and apply steering 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 or in a team.

Content
The content of “Practice of Research” is the guided execution of a scientific research project. Over a total period of two semesters, intensive and continuous work on the project takes place. Within the framework established by “Practice of Research,” students acquire both subject knowledge and methodological competence for scientific work.
The topics of the participants’ projects come from the research areas of the respective supervisors. In general, the project takes place within an ongoing research initiative, which ensures a strong integration of research and teaching.
The emphasis in the first semester is on project planning and carrying out preparatory work. The emphasis in the second semester is on project execution and presentation of results.

At the end of “Practice of Research” (end of the second semester), participants write a scientific paper on the project results. This work should meet the quality standards of a scientific publication and, if possible, be published.
Participation in “Practice of Research” also serves as preparation for a Master’s thesis for which the scholarly level may go beyond the usually expected scope.

In parallel to the project work, there are accompanying courses in which competencies for scientific and project-oriented work are taught (these are credited as cross-disciplinary qualifications; see the modules “Practice of Research (Methods, 1st semester)” and “Practice of Research (Methods, 2nd Semester)”). The topics of these accompanying courses are:

- scientific research methods;
- methodical search for related works on a research topic, in particular literature search, basic understanding of scientific literature;
- presentation of scientific works;
- teamwork in scientific contexts;
- methodical creation of work plans for scientific projects;
- methodical evaluation of scientific works;
- strategies for conducting scientific projects;
- creating scientific publications.

Additional Information

- This module forms a unit with the modules “Practice of Research (Project, 1st Semester)”, “Practice of Research (Methods, 1st Semester)” and “Practice of Research (Methods, 2nd Semester)”. Across the four modules, a continuous research project is conducted over two semesters.
- This module can be credited either in an area of specialization or in the elective area. The corresponding mapping of offered projects to specialization areas will be announced at the beginning of the semester.
- This module includes lecture credit points, practical course credit points and seminar credit points. The practical course points cover practical scientific work under supervision; the seminar points cover the independent study and (written and oral) presentation of external scientific works; the lecture points cover acquiring substantive knowledge through reading, listening, etc. The distribution of the module’s credit points among the different types of credits will be announced at the beginning of the first semester for each project (where the modules “Practice of Research (Project, 1st Semester)” and “Practice of Research (Project, 2nd Semester)” together have at least 5 lecture credits, at least 3 seminar credits and at least 3 practical course credits).

The module can also be provided in German if needed.

Workload

The total workload for this module is 300 hours (the total workload for all four modules of “Practice of Research” is 720 hours).
The distribution of workload across the various phases and steps is project-dependent and will be announced at the beginning of the first semester.

- Attendance time in lectures and discussions: 6 hours
- Practical project work, individually and in a team: 220 hours
- Preparation of the paper: 62 hours
- Exam preparation: 12 hours

Total: 300 hours (= 10 credit points)

M 4.125 Module: Privacy Enhancing Technologies [M-INFO-105452]

Coordinators: Prof. Dr. Thorsten Strufe
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Cryptography and Security
Area of Specialization: Telematics
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-110989	Privacy Enhancing Technologies	**ST**	**6 CP**	**Strufe**

Assessment
See partial achivements (Teilleistung)

Prerequisites
See partial achivements (Teilleistung)

Competence Goal
This course will provide students with a basic understanding of privacy risks, the most common technologies to tackle them and the human factors shaping their design. The course will analyze the adversary models and evaluation metrics underlying the design of privacy-enhancing technologies

- The students have a critical reasoning about privacy,
- have knowledge in the evaluation of privacy risks,
- understand the design aspects of privacy-enhancing technologies,
- are familiar with the latest research in the field
- are able to analyze and discuss the space of solutions to a given privacy problem

Content
The following topics will be covered
- Freedom of information, the surveillance economy, and other motivations for privacy
- Privacy metrics and adversary models
- Anonymous communications
- Data-perturbative privacy-enhancing technologies
- Anonymization algorithms for databases
- Homomorphic encryption and zero knowledge proofs
- Selective disclosure for identity management
- Usable privacy
- Applying privacy principles and case studies

Workload
Attendance time in lectures: 45 h
Preparation and follow-up of the same: 90 h
Exam preparation and attendance in the same: 45 h

M 4.126 Module: Probability and Computing [M-INFO-107168]

Coordinators: TT-Prof. Dr. Thomas Bläsius
Prof. Dr. Peter Sanders

Organisation: KIT Department of Informatics

Part of: Area of Specialization: Theoretical Foundations
Area of Specialization: Algorithm Engineering
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114196	Probability and Computing	**Irreg.**	**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 4.127 Module: Public International Law with an Economic Law Focus [M-INFO-107029]

Coordinators: Dr. Sebastian Kasper-Schöniger
Organisation: KIT Department of Informatics
Part of: Minor Studies: Law

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113381	Public International Law	**ST**	**3 CP**	**Zufall**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
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.

Workload
90h

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.

M 4.128 Module: Reinforcement Learning [M-INFO-105623]

Coordinators: TT-Prof. Dr. Rudolf Lioutikov
Prof. Dr. Gerhard Neumann

Organisation: KIT Department of Informatics

Part of: Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-111255	Reinforcement Learning	**WT**	**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 4.129 Module: Reliable Computing I [M-INFO-100850]

Coordinators: Prof. Dr. Mehdi Baradaran Tahoori
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Design of Embedded Systems and Computer Architectures
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-101387	Reliable Computing I	**Irreg.**	**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 4.130 Module: Research Focus Class: Blockchain & Cryptocurrencies [M-INFO-106654]

Coordinators: Prof. Dr. Hannes Hartenstein
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Cryptography and Security
Area of Specialization: Telematics
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113400	Research Focus Class: Blockchain & Cryptocurrencies	**Irreg.**	**3 CP**	**Hartenstein**
T-INFO-113401	Research Focus Class: Blockchain & Cryptocurrencies - Seminar	**Irreg.**	**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 4.131 Module: Research Practical Course on Behavior Foundation Models [M-INFO-107728]

Coordinators: TT-Prof. Dr. Rudolf Lioutikov
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Robotics and Automation (Usage from 4/1/2026)
Area of Specialization: Human-centred Machine Intelligence (Usage from 4/1/2026)
Elective Studies in Informatics (Usage from 4/1/2026)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-115118	Research Practical Course on Behavior Foundation Models	**ST**	**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 Behavior Foundation Models. 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 “Seminar on Behavior Foundation Models, 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 Seminar on Behavior Foundation Models.

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 4.132 Module: Research Practical Course: Artificial Intelligence & Security [M-INFO-106866]

Coordinators: Prof. Dr. Christian Wressnegger
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Cryptography and Security
Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113759	Research Practical Course: Artificial Intelligence & Security	**WT+ST**	**6 CP**	**Wressnegger**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Qualifikationsziele: Students understand how to interpret results from state-of-the-art research and are able to actively contribute to timely research.

Lernziele:
← Students know and understand concepts of recent research at the intersection of artificial intelligence and computer security.
← Students are able independently research topics and methods in this field of research.
← Students understand limits of current approach in computer security research.

Content
In this practical course, the students work on a project at the intersection of artificial intelligence, machine learning, and computer security. They come in contact with and participate in timely and state-of-the-art research in this exciting field. In this scope, the students read up on a sub-field, design and implement a learning-based system, and conduct evaluations on real-world data.

Topics include but are not limited to adversarial machine learning, explainability of machine learning in computer security, learning-based attack detection, and vulnerability discovery.

Workload
- 140h Project work
- 20h Final report
- 15h Preparation of final presentation
- 5h attendance time (final event)

M 4.133 Module: Research Practical Course: Explainable Artificial Intelligence [M-INFO-106495]

Coordinators: TT-Prof. Dr. Rudolf Lioutikov
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics (Usage from 4/1/2026)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113114	Research Practical Course: Explainable Artificial Intelligence	**WT**	**6 CP**	**Lioutikov**

Assessment
See partial achievements (Teilleistung).

Prerequisites
See partial achievements (Teilleistung).

Competence Goal
Students learn to understand and question complex scientific topics and to reproduce and verify published results.
to reproduce and review published results. Students gain in-depth knowledge of interactive learning and experience with the use of novel learning methods.

Content
Each student will select a topic in the field of Explainable Artificial Intelligence and study and analyze it in the context of Robot Learning. The organizers will suggest topics but the students are welcome suggest relevant topics. The students will then implement and evaluate several algorithms corresponding to the chosen topic. The experimental evaluation will be documented in a report and presented to their peers.
It is highly recommended to take this research project in combination with the “Explainable Artificial Intelligence” Seminar, where the students get the chance to acquire the required background on the literature.

Additional Information
It is only possible to resign within two weeks after assignment of the topic.

Workload
Workload = 180h = 6 ECTS
- Attendance time: 15h
- Project work: 135h
- Write scientific report + prepare presentation: 30h

Recommendations
We recommend taking this Praktikum after attending the “Explainable Artificial Intelligence” lecture in the summer semester.

We highly recommend to take this research project in combination with the “Explainable Artificial Intelligence” seminar.

• Experience in Machine Learning is recommended, e.g. through prior coursework.
◦ The Computer Science Department offers several great lectures e.g., “Maschinelles Lernen - Grundlagen und Algorithmen” and “Deep Learning ”
• A good mathematical background will be beneficial
• Python experience is recommended
• We might use the PyTorch deep learning library In the exercises. Some prior knowledge in this is helpful but not necessary.

M 4.134 Module: Research Project Deep Learning for Robotics [M-INFO-107174]

Coordinators: Prof. Dr. Gerhard Neumann
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Robotics and Automation
Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114203	Research Project Deep Learning for Robotics	**WT**	**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 4.135 Module: Research Project: Generative AI for Autonomous Agents [M-INFO-107163]

Coordinators: Prof. Dr. Gerhard Neumann
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114189	Research Project: Generative AI for Autonomous Agents	**ST**	**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 4.136 Module: Resilient Networking [M-INFO-105591]

Coordinators: Prof. Dr. Thorsten Strufe
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Cryptography and Security
Area of Specialization: Telematics
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-111209	Resilient Networking	**WT**	**6 CP**	**Strufe**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
This course will provide students with a basic understanding of threats to the Internet, and the most common technologies to tackle them. The course will analyze the adversary models and evaluation metrics underlying their design.

- The students have a critical reasoning about network resilience,
- have knowledge in the evaluation of threats to network operation,
- understand the design aspects of protection measures,
- are familiar with the latest research in the field
- are able to analyze and discuss the space of solutions to a given challenge to Internet security and robustness

Content
The lecture resilient networking provides an overview on the basics of secure networks as well as on current threats and respective countermeasures. Especially bandwidth-depleting Denial of Service attacks represent a serious threat. Moreover, over the last years the number of targeted and highly sophisticated attacks on company and governmental networks increased. To make it worse, as a new trend at the moment, the interconnection of the Internet with cyber physical systems takes place. Such systems, e.g., the energy network (smart grid), trans- portation systems and large industrial facilities, are critical infrastructures with severe results in case of their failure. Thus, the Internet that interconnects these systems has evolved to a critical infrastructure as well.

The lecture introduces the current state-of-the-art in the research towards resilient networks. Resilience-enhancing techniques can be generally classified in proactive and reactive methods. Proactive techniques are redundancy and compartmentalization. Redundancy allows to tolerate attacks to a certain extent, while compartmentalization attempts to restrict the attack locally and preventing its expansion across the whole system. Reactive techniques follow a three step approach by comprising the phases of detecting an attack, mitigate its impacts, and finally restore a system's usual operation.

Based upon this categorisation of resilience strategies the lecture will give an excursus to graph theorie and will introduce generic strategies to increase the resilience of networks, e.g., proactively establishing backup routes and fast restoration strategies. Furthermore, the lecture will provide an overview on BGP routing and the Domain Name Service, as two essential Internet services. Both services are presented and current attacks as well as corresponding countermeasures are described. Moreover, Denial of Service attacks and their mitigation are observed in detail as well as mechanism for increasing the resilience of P2P networks. Finally, Intrusion Detection systems are covered as mechanisms to mitigate the impacts of successful attacks.

Workload
1. Attendance time in lectures: 45 h
2. Preparation and follow-up of the same: 90 h
3. Exam preparation and attendance in the same: 45 h

Recommendations
Knowledge of the basics of cryptography and computer networks is helpful.

M 4.137 Module: Robotic Intelligence: Navigation and Mobile Manipulation [M-MACH-107621]

Coordinators: Prof. Dr.-Ing. Arne Rönnau
Organisation: KIT Department of Mechanical Engineering
Part of: Minor Studies: Biologically Inspired Robotics (Usage from 4/1/2026)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-MACH-114952	Robotic Intelligence: Navigation and Mobile Manipulation	**ST**	**6 CP**	**Rönnau**

Assessment
See module component

Prerequisites
See module component

Competence Goal
Students acquire a solid understanding of fundamental principles and current methods in robotics, including navigation, legged locomotion, and manipulation with mobile systems. They can apply suitable techniques from machine learning, simultaneous localisation and mapping (SLAM), decision-making, and collision-free path planning to autonomously traverse complex real-world environments—for example, with a multi-legged robot. A particular emphasis is placed on the direct physical interaction of legged robots with terrain and obstacles. Students learn to design suitable machine learning approaches for locomotion and to train them in dynamic simulation environments, enabling robots to perform movements on simple, flat terrain and to overcome complex obstacles such as stairs.

Furthermore, students gain knowledge of various manipulation techniques, including robotic grasping and object handling. They can analyse and compare both classical manipulation approaches and modern machine-learning-based methods, and evaluate their performance. Combined, these capabilities enable mobile robots to navigate challenging terrain and autonomously manipulate objects at their destination.

Content
The lecture *Robotic Intelligence: Navigation and Mobile Manipulation* provides fundamental and advanced concepts for developing intelligent, autonomous robots for complex environments. The focus is on methods for navigation, legged locomotion, and mobile manipulation, as well as their integration into real robotic systems. Covered topics include sensor fusion, localization and mapping (SLAM), decision-making, and collision-free motion and path planning. Additionally, machine learning techniques for controlling legged robots in challenging terrain and for direct physical interaction with the environment are introduced. The course further addresses concepts of mobile manipulation, enabling robots to safely grasp, handle, or interact with objects and their surroundings. Both classical and modern, learning-based approaches are presented and discussed. By combining these methods, robotic systems can achieve a high level of autonomy. The lecture integrates theoretical foundations with application-oriented methods and enables students to develop and critically assess autonomous robotic systems and their methods for real-world scenarios.

An important component of the course is the practical group work conducted in the *Machine Intelligence and Robotics Lab (MaiRo)*, where students solve tasks using real sensors and robots. They develop both technical competencies and teamwork skills to address complex navigation and manipulation challenges of mobile systems.
The topics include:

- Fundamentals of machine learning and sensor fusion
- Simultaneous Localization and Mapping (SLAM) in unknown environments
- Approaches for motion planning and collision avoidance
- Intelligent decision-making and task planning
- Reinforcement learning for the locomotion of legged robots
- Machine learning approaches for traversing and coping with complex obstacles
- Manipulation of objects in static scenarios
- Mobile manipulation in complex environments

By the end of the course, students can design, implement, and integrate methods for navigation and mobile manipulation. These approaches enable mobile systems to autonomously navigate through complex, dynamic environments, apply learned locomotion strategies, and perform various manipulation tasks.

Module Grade Calculation
Written exam: duration 60 minutes. A grade bonus can be achieved by successfully completing the exercises.

Additional Information
See further details on course organization at: teaching.imi.kit.edu and in ILIAS.

Workload
180 hours total, including approximately:

- **30h** of in-person lecture time
- **110h** of exercises and group work
- **40h** for exam preparation and participation in the written exam

Teaching and Learning Methods
Vorlesung, Übung und Gruppenarbeit

M 4.138 Module: Robotic Intelligence: Perception and Scene Understanding [M-MACH-107558]

Coordinators: Prof. Dr.-Ing. Arne Rönnau
Organisation: KIT Department of Mechanical Engineering
Part of: Minor Studies: Biologically Inspired Robotics (Usage from 4/1/2026)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-MACH-114813	Robotic Intelligence: Perception and Scene Understanding	**WT+ST**	**6 CP**	**Rönnau**

Assessment
See module component

Prerequisites
See module component

Competence Goal
The student will understand the fundamental principles and state-of-the-art methods for robotic perception and scene understanding. They will gain the ability to select and apply suitable machine learning and computer vision techniques to interpret complex real-world environments, from raw sensory data to structured scene representations. The student will be able to design perception pipelines that combine multiple sensing modalities, enabling robust object recognition, tracking, segmentation, and 3D scene analysis. Furthermore, they will be able to critically assess and adapt these methods for robotic applications that require situational awareness and informed decision-making.

Content
The lecture *Robotic Intelligence: Perception and Scene Understanding* combines modern AI-based perception methods with the engineering skills needed to apply them in robotics. It covers the full perception chain, from acquiring and calibrating sensor data to interpreting scenes and integrating perception modules into robotic systems, like mobile walking robots.
Students will first build a foundation in machine learning and computer vision, covering image classification, object detection, tracking, and segmentation in both 2D and 3D. The course then explores advanced deep learning architectures, including Vision Transformers, multimodal perception systems, and end-to-end multimodal machine learning pipelines. Special emphasis is placed on techniques for integrating vision, depth, and other sensing modalities, enabling robust perception in challenging real-world environments.

A key part of the course is practical group work in the *Machine Intelligence and Robotics Lab (MaiRo)*, where students solve hands-on tasks using real sensors and robots, building both technical competence and teamwork skills.

Topics include:

- Fundamentals of machine learning and computer vision for robotics
- Vision Transformers and advanced deep learning architectures
- Object detection, tracking, and segmentation (2D and 3D)
- Instance, semantic, and panoptic segmentation
- Multimodal sensing, fusion, and end-to-end multimodal ML
- World models and their role in robotics
- Sensor modeling, calibration, and perception system integration

By the end of the course, students will be able to design, implement, and integrate intelligent robotic perception systems that enable mobile robots to understand and act within complex, dynamic environments.

Module Grade Calculation
Written exam: duration 60 minutes. A grade bonus can be achieved by successfully completing the exercises.

Workload
180 working hours, of which approx:

- 30h for attendance time in lectures
- 110h for exercises and group work
- 40h for exam preparation and participation in the written exam

Teaching and Learning Methods
Lecture, exercise and group work

M 4.139 Module: Robotics - Practical Course [M-INFO-107155]

Coordinators: Prof. Dr.-Ing. Tamim Asfour
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Robotics and Automation
Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114172	Practical Course: Robotics	**ST**	**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 4.140 Module: Robotics I - Introduction to Robotics [M-INFO-107162]

Coordinators: Prof. Dr.-Ing. Tamim Asfour
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Robotics and Automation
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114190	Robotics I - Introduction to Robotics	**WT**	**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 4.141 Module: Robotics II - Humanoid Robotics [M-INFO-107123]

Coordinators: Prof. Dr.-Ing. Tamim Asfour
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Robotics and Automation
Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114152	Robotics II - Humanoid Robotics	**ST**	**3 CP**	**Asfour**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Students can explain the challenges and goals of humanoid robotics research, particularly regarding the implementation of complex sensorimotor and cognitive abilities in humanoid robots. They are familiar with the history of the field and understand how biomechanical models of the human body inform humanoid robot design.

Students have comprehensive knowledge of human and robotic grasping and manipulation. They can analyze human grasping and manipulation strategies, understand taxonomies, and evaluate different computational approaches for grasping and manipulation. They understand the challenges in transferring concepts from human studies to humanoid robots.

Students understand fundamentals of learning from human demonstration and imitation learning. They can explain the learning from demonstration cycle and methods for learning generalized task representation, especially task constraints from demonstrations, and how learned behaviors are reproduced on robots.

Students can describe cognitive and AI-based architectures for humanoid robots, including approaches to address the signal-to-symbol gap and human-inspired memory architectures that enable intelligent robot behavior.

Content
This lecture addresses the implementation of complex sensorimotor and cognitive abilities in humanoid robots, with humans serving as inspiration. The lecture begins by addressing the motivation for humanoid robotics. The history of humanoid robotics and biomechanical models of the human body that inform robot design are covered, along with some mechatronic principles underlying humanoid robot systems.

The first main topic comprehensively addresses grasping and manipulation. After covering fundamentals, the lecture discusses neuroscientific insights and concepts like grasp phases and grasping synergies to reduce control complexity. Taxonomies are presented as structured frameworks for understanding the space of possible constraints in grasping and manipulation. The lecture addresses computational approaches for grasping known, familiar, and unknown objects, covering both classical methods and modern learning-based approaches using deep learning and vision-language-action models.

The second main topic covers learning from demonstration and imitation learning. After introducing the topic, fundamentals are presented including the learning from demonstration cycle. The lecture emphasizes learning task models on both symbolic/semantic and subsymbolic/sensorimotor levels. While methods for capturing human demonstrations are briefly covered, the focus is on semantic segmentation of human demonstrations and learning of task constraints that capture the task and allow generalization. Movement primitives are presented as efficient representations that allow robots to generalize learned behaviors to new situations.

The lecture concludes with cognitive and AI-based architectures for humanoid robots, discussing state-of-the-art approaches, methods to address the signal-to-symbol gap, and human-inspired memory architectures that enable intelligent robot behavior.

Workload
Lecture with 2 SWS, 3 ECTS.
3 ECTS corresponds to approx. 90 hours, thereof:
approx. 15 * 2h = 30h attendance time
approx. 15 * 2h = 30h self-study prior/after the lecture
approx. 30h preparation for the exam and exam itself

Recommendations
Having visited the lecture on Robotics I – Introduction to Robotics is recommended

M 4.142 Module: Robotics III - Sensors and Perception in Robotics [M-INFO-107130]

Coordinators: Prof. Dr.-Ing. Tamim Asfour
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Robotics and Automation
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114155	Robotics III - Sensors and Perception in Robotics	**ST**	**3 CP**	**Asfour**

Assessment
See partial achivements (Teilleistung)

Prerequisites
See partial achivements (Teilleistung)

Competence Goal
Students can explain the main sensor principles used in robotics and distinguish between proprioceptive sensors (encoders, force/torque sensors, IMUs) and exteroceptive sensors (proximity, range, visual, and tactile sensors). They understand and can characterize sensor properties such as resolution, range, accuracy, and bandwidth, and can explain the principles of analog-to-digital conversion. Students are able to propose, analyze, and justify suitable sensor concepts for specific robotic tasks, taking into account trade-offs between different sensor modalities.

Students can apply fundamental perception methods for robotic applications. This includes robot vision techniques such as feature detection and matching, object detection and recognition, and semantic segmentation, including deep learning-based approaches. They can describe and analyze perception methods for manipulation tasks, including object pose estimation, grasp detection, active vision strategies, and haptic exploration. In addition, students can explain point cloud processing methods for registration and surface reconstruction, as well as principles of simultaneous localization and mapping (SLAM).

Content
This lecture complements the lecture “Robotics I” and provides a comprehensive overview of sensors and perception methods in robotics. It is divided into two main parts.

The first part introduces fundamental concepts of perception in robotics, including the distinction between sensation and perception within the perception-cognition-action loop. It covers sensor fundamentals, such as sensor characteristics (resolution, range, accuracy, bandwidth), analog-to-digital conversion, and common sensor classification schemes. Proprioceptive sensors for measuring the robot’s internal state are discussed, including encoders (optical, magnetic, absolute, and incremental), force/torque sensors, and inertial measurement units (IMUs). The lecture then covers exteroceptive sensors, including proximity sensors, range sensors (LiDAR, time-of-flight cameras, ultrasonic sensors), visual sensors (monocular, stereo, RGB-D cameras), and tactile sensing technologies (capacitive, resistive, and optical).

The second part focuses on processing and interpreting sensor data. Topics in robot vision include image representation, feature detection and matching, object detection and recognition, semantic segmentation, and corresponding deep learning approaches. Point cloud processing is covered with emphasis on data structures, registration, surface reconstruction, and semantic segmentation. The lecture also addresses perception for manipulation, covering object pose estimation, grasp detection, visual servoing, active vision, and haptic exploration. It concludes with the simultaneous localization and mapping (SLAM) problem, including EKF SLAM, Graph SLAM, and FastSLAM.

Workload
Lecture with 2 SWS, 3 ECTS.
3 ECTS corresponds to approx. 90 hours, thereof:
approx. 15 * 2h = 30h attendance time
approx. 15 * 2h = 30h self-study prior/after the lecture
approx. 30h preparation for the exam and exam itself

Recommendations
Having visited the lectures on Robotics I – Introduction to Robotics is recommended.

M 4.143 Module: Robotics Institute Germany - Lecture Series [M-INFO-107598]

Coordinators: Prof. Dr.-Ing. Tamim Asfour
TT-Prof. Dr. Barbara Bruno
Prof. Dr. Jan Niehues

Organisation: KIT Department of Informatics

Part of: Area of Specialization: Robotics and Automation
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114895	Robotics Institute Germany - Lecture Series	**WT**	**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 4.144 Module: Sampling Methods for Machine Learning [M-INFO-107090]

Coordinators: Prof. Dr.-Ing. Uwe Hanebeck
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Robotics and Automation
Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114133	Sampling Methods for Machine Learning	**ST**	**6 CP**	**Hanebeck**
T-INFO-114134	Sampling Methods for Machine Learning - Pass	**ST**	**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 4.145 Module: Scalable Graph and Sparse Matrix Algorithms for Learning [M-INFO-107867]

Coordinators: Prof. Dr. Henning Meyerhenke
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Algorithm Engineering
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-115282	Scalable Graph and Sparse Matrix Algorithms for Learning	**Irreg.**	**5 CP**	**Meyerhenke**

Assessment
See Partial Achievements (Teilleistung).

Prerequisites
See Partial Achievements (Teilleistung).

Competence Goal
Students acquire a unified view of graph algorithms, sparse linear algebra, and graph learning. They learn to formulate graph computations as sparse operators, to analyze their algorithmic and architectural properties, and to develop scalable implementations for modern parallel systems.

After successful completion of the module, students are able to

- analyze large-scale graph and sparse matrix problems and identify suitable algorithmic abstractions for their solution;
- formulate graph algorithms using sparse linear algebra concepts and relate classical graph algorithms to sparse computational kernels;
- evaluate algorithmic trade-offs with respect to computational complexity, memory consumption, communication requirements, and scalability;
- design and implement efficient graph and sparse matrix algorithms on modern parallel architectures;
- apply advanced techniques such as spectral methods, graph coarsening, sparsification, and multilevel approaches to reduce computational complexity and improve scalability;
- assess the impact of memory hierarchies, communication costs, and load balancing on algorithm performance and derive suitable optimization strategies;
- explain graph neural networks and related graph learning methods as parameterized sparse propagation operators and assess their computational characteristics;
- transfer algorithmic concepts and implementation techniques to new sparse data models

Content
The module introduces algorithmic and computational foundations for the analysis and learning of large-scale graph-structured data. A central theme is the interpretation of graph computations as sparse operators and the resulting interplay between graph algorithms, sparse linear algebra, and modern parallel architectures.

The course revisits classical graph algorithms from the perspective of propagation processes and sparse computations. It covers sparse matrix representations and kernels, graph algorithms based on sparse linear algebra, iterative methods, and spectral techniques. Advanced algorithmic topics include sparse matrix-matrix multiplication, graph coarsening, multilevel methods, and sparsification.

Building on these foundations, the course investigates the design and implementation of scalable graph and sparse matrix algorithms. Topics include parallel graph algorithms, performance engineering for sparse computations, graph partitioning, and communication-efficient computation.

Finally, the course introduces graph learning methods and relates them to the concepts developed throughout the module. Graph neural networks are studied as parameterized sparse propagation operators, with a particular focus on their computational characteristics.

Workload
1. Attendance time (Course, exercise, etc.) 45 h
2. Self-study (e.g. independent review of course material, work on homework assignments) 75 h
3. Preparation for the exam 30 h

Recommendations
Basic knowledge of graph algorithms, linear algebra, and C++.

M 4.146 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: Area of Specialization: Cryptography and Security
Area of Specialization: Telematics
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-111568	Scientific Methods to Design and Analyze Secure Decentralized Systems	**WT**	**6 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 with respect to the security of a given decentralized system.
2. Empirical Methods: Observation / Monitoring: The student can construct setups for observation studies of system properties related to performance or security. The student knows how to monitor 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 can 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 cover a mix of both 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
Lecture workload:
1. Attendance time (Course, exercise,): 4 SWS: 15 x 4h = 60h
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 4 SWS x 1,25h = 75h
3. Preparation for the exam: 45h
Σ = 180h = 6 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 4.147 Module: Seminar Dependable Computing [M-INFO-102662]

Coordinators: Prof. Dr. Mehdi Baradaran Tahoori
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Design of Embedded Systems and Computer Architectures
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-105577	Seminar Dependable Computing	**WT+ST**	**3 CP**	**Tahoori**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
The objective of this seminar is to become familiar with general and state of the art techniques used in design and analysis of fault-tolerant digital systems.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

Content
Reliability plays a major role in design of contemporary and next generation electronics. In many safety-critical application domains, reliability is considered as the main design criteria. With nanoscale technologies, the reliability of individual devices is decreasing, therefore, reliable computing must be considered in the design flow in order to ensure correctness of computing.
The objective of this seminar is to become familiar with general and state of the art techniques used in design and analysis of fault-tolerant digital systems. This seminar overviews reliable (fault-tolerant) computing and the design and evaluation of dependable systems, and provides a base for research in reliable systems.
The topics include study and investigation of existing and classical fault-tolerant systems as well as current trend in the research of reliable computing. Since reliability spans from hardware to software, and from device-level to system-level, various topics can be envisioned in the scope of this seminar and the prospective students can choose specific topic from a wide range of areas based on their interests and background.

Workload
4 SWS / 3CP = 90h/week

Recommendations
Knowledge of “Fault Tolerant Computing” and Computer Architecture is helpful.

M 4.148 Module: Seminar for Practical Course: Machine Learning and Intelligent Systems [M-INFO-107846]

Coordinators: Prof. Dr.-Ing. Uwe Hanebeck
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Theoretical Foundations (Usage from 10/1/2026)
Area of Specialization: Robotics and Automation (Usage from 10/1/2026)
Area of Specialization: Human-centred Machine Intelligence (Usage from 10/1/2026)
Elective Studies in Informatics (Usage from 10/1/2026)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-115260	Seminar for Practical Course: Machine Learning and Intelligent Systems	**Irreg.**	**3 CP**	**Hanebeck**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
- Students are able to independently research literature on a given topic.
- Students are proficient in working with academic texts written by others.
- Students can create a short academic paper using LaTeX.
- Students can prepare and deliver a presentation
- Students are familiar with the DFG Code of Conduct, “Guidelines for Ensuring Good Research Practice,” and successfully apply these guidelines when writing their scholarly papers.

Content
- This course builds on the “Practical Course: Machine Learning and Intelligent Systems.” Students study one of the topics introduced there in greater depth and prepare a scientific report and presentation. The seminar is intended to prepare students for writing their master’s thesis.

  http://isas.iar.kit.edu

Workload
- Attendance time: 5h
- Research and writing report: 55h
- Preparation of presentation: 30h

M 4.149 Module: Seminar in Privacy [M-INFO-107242]

Coordinators: Prof. Dr. Thorsten Strufe
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Cryptography and Security
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114268	Seminar in Privacy	**ST**	**4 CP**	**Strufe**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
The seminar deals with current topics from the research field of technical data protection.
These include, for example:
- Attacks on private information in behavioral data
- Anonymous communication
- Publication of anonymized usage data (semantic/syntactic privacy)
- Understanding and supporting the use of online media
- Security in networks

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

Content
The student is able to
- carry out a literature search based on a given topic, identify and evaluate the relevant literature;
- independently compile research results from IT security and technical data protection;
- analyze and discuss scientific studies and place them in their context;
- carry out their own classifications and evaluations of scientific studies, report on them in writing and present the results in a short scientific presentation.

Workload
Workload attendance time in the seminar: 10h
Research and preparation of a paper: 75h
Reviewing and commenting on the preliminary papers of fellow students: 5h
Preparing the presentation: 30h

Recommendations
Fundamentals of IT security, computer networks and distributed systems are required

M 4.150 Module: Seminar on Behavior Foundation Models [M-INFO-107729]

Coordinators: TT-Prof. Dr. Rudolf Lioutikov
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Robotics and Automation (Usage from 4/1/2026)
Area of Specialization: Human-centred Machine Intelligence (Usage from 4/1/2026)
Elective Studies in Informatics (Usage from 4/1/2026)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-115119	Seminar on Behavior Foundation Models	**ST**	**3 CP**	**Lioutikov**

Assessment
See Partial Achivements (Teilleistung).

Prerequisites
See Partial Achivements (Teilleistung).

Competence Goal
Students are able to independently understand a complex research topic, present the content in a concise and understandable way and prepare a scientific report summarizing the topic.

Students are able to independently understand a complex research topic, present the content in a concise and understandable way and prepare a scientific report summarizing the topic. Students get a deeper understanding of state-of-the art learning algorithms and get to know current research challenges.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

Content
Each student will select several related papers in the field of Behavior Foundation Models. 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 Research Practical Course on Behavior Foundation Models (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 Research Practical Course on Behavior Foundation Models (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 4.151 Module: Seminar Radiation Protection in Medicine [M-ETIT-107839]

Coordinators: PD Dr. Bastian Breustedt
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Minor Studies: Electrical Engineering (Usage from 10/1/2026)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-ETIT-115253	Seminar Radiation Protection in Medicine	**WT**	**3 CP**	**Breustedt**

Assessment
The examination consists of a written handout (approx. 2-3 pages) and an oral presentation (approx. 25-35 min.) of the students work. Considered will be the quality of the contents, the style of the presentation, the quality and content of the handout. The overall impression is rated.

Prerequisites
none

Competence Goal
- The students have an overview of the applications of radiation protection in medicine.
- The students are able to understand medical exposures in terms of their magnitude (dose) and risk. They are able to propose appropriate radiation protection measures for the cases considered.
- The students can analyze, structure and formally describe radiation protection issues in medicine.
- The students have an understanding of the radiation protection principles and the system proposed by the International Commission of Radiological Protection. They are able to describe the systems' implementation into legal force via Basic Safety Standards and national regulations. They are able to define the interplay with other fields of regulations (such as the medical devices act).
- The students are able to present cases of use of (ionizing) radiation in medicine and will be able to classify these in the framework of radiological protection and discuss appropriate regulations and practical measures that need to be applied.

Content
The seminar will consist of a block of 3 introductory lectures presenting medical exposures in the system of radiological protection. Applications of radiation in medicine will be presented and their specific issues regarding protection of patient, staff and public will be outlined. The second block will consist of presentations of the students on a dedicated topic, which will be selected by them a the begin of the term. Students shall look into the problem and develop a solution to the issues identified. The presentations shall introduce the topic, state the problems from a radiation protection perspective and introduce solutions and methods applied. The topic will then be discussed within the group. A final lecture will summarize the presentations of the students and offer space for a final discussion on medical radiation protection.

Module Grade Calculation
The module grade is the grade of the seminar contributions. Details will be given during the lecture.

Additional Information
For capacity reasons, the seminar is limited to 20 students. If necessary, a selection procedure will be carried out. Places will be allocated according to the progress of the students (semester and number of attended courses with topics covering radiation medicine). Details will be announced in the first course and on the course homepage.

Workload
1. Attendance in lectures: 15* 2 h= 30 h
2. Preparation / follow up of lectures: 15 * 2 h = 30 h
3. Preparation of Presentation/Handout = 30h
4. A total of 90 h = 3 CR

Recommendations
Knowledge about of the basics of radiation protection is strongly recommanded. Information and material for self-study will be provided in the seminar.

Teaching and Learning Methods
2 SWS

M 4.152 Module: Seminar: Advanced Topics in Natural Language Processing [M-INFO-107353]

Coordinators: Prof. Dr. Jan Niehues
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Human-centred Machine Intelligence (Usage from 10/1/2025)
Elective Studies in Informatics (Usage from 10/1/2025)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114433	Seminar: Advanced Topics in Natural Language Processing	**WT+ST**	**3 CP**	**Niehues**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Students learn to familiarise themselves independently with topics based on scientific literature and prepare them for presentations.
From the other presentations, students gain in-depth knowledge in sub-areas of machine translation and learn to critically analyse the work presented.

Content
Machine translation now makes it possible to automatically translate both written texts and spoken language into another language. In statistical approaches to machine translation, methods from machine learning are primarily used to train statistical models for the translation process.
In the seminar, current research results on various aspects of the systems will be discussed. Selected publications from the fields will be presented by the participants. Possible topics include improvement of word order and grammar of the target language, adaptation to topic or genre, treatment of spoken language phenomena, error correction, ...
Students are familiar with the DFG Code of Good Scientific Practice and successfully apply these guidelines when writing their scientific work.

Workload
90h

Recommendations
Previous knowledge from the lecture "Machine Translation" is an advantage.

M 4.153 Module: Seminar: Advanced Topics on SAT Solving [M-INFO-107209]

Coordinators: Prof. Dr. Peter Sanders
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Theoretical Foundations
Area of Specialization: Algorithm Engineering
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114231	Seminar: Advanced Topics on SAT Solving	**WT**	**3 CP**	**Iser, Sanders**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

Content
With selected high-influence papers from the field of SAT solving, we take a close look at how SAT solvers evolved in the past decade and learn about the major cornerstones of modern and efficient large scale SAT solving systems.

Workload
Attendance time (3-4 dates): 4.5 - 6h
Reading, summarising and relating (2-3 papers): 30 - 40h
Preparation of the presentation: 16 - 24h
Total 90h

Recommendations
Knowledge of the basics from "SAT Solving in Practice" is helpful.

M 4.154 Module: Seminar: Algorithm Engineering [M-INFO-106086]

Coordinators: Prof. Dr. Peter Sanders
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Theoretical Foundations
Area of Specialization: Algorithm Engineering
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-112312	Seminar: Algorithm Engineering	**Irreg.**	**4 CP**	**Sanders**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Students can
- carry out a literature search based on a given topic, identify, locate, evaluate and finally analyse the relevant literature.
- prepare presentations in a scientific context. To this end, students master techniques that enable them to prepare and present the content to be presented to the audience.
- prepare their written seminar paper (as required later for further academic work) in accordance with the requirements and quality standards of academic writing, taking into account the format requirements specified by academic publishers for the publication of documents.
Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

Content
This seminar covers various topics from the field of algorithm engineering. The focus can be on scalability, parallelism, efficiency or theoretical guarantees of algorithms. Example topics may include graph algorithms, sorting algorithms, string algorithms, SAT solvers, data structures or other algorithms. The exact focus of the seminar for the current semester will be announced in advance on the institute website by the chair of Prof. Sanders.
Participants in the seminar carry out their own literature research, present their results to their fellow students and prepare a paper.
The exact formalities will be announced at a kick-off event at the beginning of the semester, which will also be announced on the institute's website.

Workload
4 LP corresponds to approx. 120 working hours, of which
- 10h seminar attendance
- 45h Literature research, assessment and evaluation of relevant literature
- 25h preparation of own presentation
- 25h Preparation of the written paper
- 15h preparation and follow-up work

Recommendations
Knowledge of algorithms is an advantage. Exemplary lectures are Algorithms I, Algorithms II, Algorithm Engineering and Parallel Algorithms.

M 4.155 Module: Seminar: Artificial Intelligence for Energy Systems [M-INFO-106490]

Coordinators: TT-Prof. Dr. Benjamin Schäfer
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Telematics
Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113110	Seminar: Artificial Intelligence for Energy Systems	**WT**	**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 4.156 Module: Seminar: Bionic Algorithms and Robot Technologies [M-MACH-106902]

Coordinators: Prof. Dr.-Ing. Arne Rönnau
Organisation: KIT Department of Mechanical Engineering
Part of: Minor Studies: Biologically Inspired Robotics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-MACH-113842	Seminar: Bionic Algorithms and Robot Technologies	**WT+ST**	**3 CP**	**Rönnau**

Assessment
See partial achievement

Prerequisites
None

Competence Goal
The aim is to work independently on a scientific topic in the field of biologically inspired algorithms and robot technologies.

Students are able to independently carry out a literature search on the state of research, summarize external work accurately, relate it to each other and evaluate it.

The results and content can be summerized in a seminar paper and an oral presentation.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and apply these guidelines successfully in the preparation of their scientific work.

Content
Biologically inspired robots and their methods and technologies transfer concepts for problem solving from nature to mechanical design, sensor technology, navigation, control and interpretation, among other things. These solution approaches are approximated by technical systems. The spectrum of robotics inspired by biology ranges from multi-legged walking robots, distributed sensor concepts and lightweight construction to machine learning methods and neuromorphic hardware.

Workload
90h workload

- Literature research: 35h
- Elaboration of the seminar paper: 35h
- Preparation of the final presentation: 10h
- Attendance time: Kickoff, presentation and discussion as well as meeting with supervisors: 10h

Recommendations
The visit of the lecture "Biologically Inspired Robots" is helpful.

M 4.157 Module: Seminar: Continuous Software Engineering [M-INFO-105309]

Coordinators: Prof. Dr.-Ing. Anne Koziolek
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Software Engineering and Compiler Construction
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-110794	Seminar: Continuous Software Engineering	**ST**	**4 CP**	**Koziolek**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Students can

- carry out a literature search based on a given topic, identify, locate, evaluate and finally analyze the relevant literature.

- prepare their seminar paper (and later their Bachelor's/Master's thesis) with a minimum of training, taking into account the format requirements specified by all publishers for the publication of documents.

- Preparing presentations in a scientific context. To this end, techniques are introduced that make it possible to prepare and present the content to be presented in an auditorium-appropriate manner.

present the results of their research in written form, as is generally the case in scientific publications.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and apply these guidelines successfully in the preparation of their scientific work.

Content
Modern software engineering takes place in short cycles that enable rapid feedback Technologies such as build servers and containerization enable fast, frequent and automatic deployment of software in productive operation and rapid feedback into development (DevOps).

The term "Continuous Software Engineering" summarizes the interlocking of the various activities.

The seminar will examine various current challenges in the field of continuous software engineering, including the engineering of applications with machine learning components.

Workload
25 working hours for the literature research
55 working hours for the preparation of the thesis and peer reviews
20 working hours for the preparation of the final presentation
20 working hours for the final block event and meeting with the supervisor.
This results in a total of 120 working hours

M 4.158 Module: Seminar: Critical Topics in AI [M-INFO-106958]

Coordinators: Prof. Dr. Pascal Friederich
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113915	Seminar: Critical Topics in AI	**ST**	**3 CP**	**Friederich**

Assessment
See partial achivements (Teilleistung)

Prerequisites
See partial achivements (Teilleistung)

Competence Goal
Qualification objectives:
• Students are able to work independently on literature about a topic of current research and to critically evaluate it, to find and understand relevant publications, and to classify and process their content accordingly in order to be able to present the chosen topic area in the form of a presentation and a written paper.

Learning Objectives
• Overview of positive as well as negative impact of AI technology
• Overview of scientific and related ethical issues in current AI research

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

Content
This seminar covers the technical as well as ethical aspects of critical issues in AI. Topics covered include bias in machine learning methods, ethically and socially critical applications of AI, and the impact of AI on society. The exact topics will be determined in each semester.

Students will work independently on an advanced topic and critically engage with it, presenting and discussing their findings in a lecture and summarizing them in a seminar paper.

Workload
Total 90 h, of which:
• Introductory courses: 4 h
• Literature research: 30 h
• Writing the report (10-15 pages) and preparing the presentation (30+15 minutes): 50 h
• Presentation of the results: 6 h

Recommendations
Interest in social topics and research questions is required

M 4.159 Module: Seminar: Current Trends in Theoretical Computer Science [M-INFO-107027]

Coordinators: Prof. Dr.-Ing. Marvin Künnemann-Goos
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Theoretical Foundations
Area of Specialization: Algorithm Engineering
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114091	Seminar: Current Trends in Theoretical Computer Science	**Irreg.**	**4 CP**	**Künnemann-Goos**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Students are able to:
- perform a literature review on the basis of a given topic/scientific paper, to read and understand relevant scientific works in theoretical computer science and to identify the scientific context.
- present a scientific paper and its context.
- lead the discussion on the merits of the paper.
- create a written report of their topic in accordance to usual quality standards
for scientific writing

Content
This seminar discusses current trends and topics in theoretical computer science, with a focus on algorithms & complexity theory. This includes short deep-dives into hot topics of research, as well as possibly required background material. Topics covered in this class may well inspire subsequent research projects/thesis topics.

The seminar is organized in a reading group format: Each student is expected to perform a basic reading of the topic for each session. A designated session leader (either a student or non-student participant) has prepared the material more thoroughly and leads the discussion, usually including a basic presentation. Every student participant is expected to lead a session at least once.

The sessions usually take place in blocked format (i.e., on a small number of dates).

The specific contents vary, but often focus on 2-3 main themes of current research in the field.

Workload
4 CP amounts to 120 h, distributed as follows:
- about 15 h attendance in class
- about 45 h reviewing the literature
- about 40 h preparation of presentation/discussion
- about 20 h writing of scientific report

Recommendations
Basic knowledge of theoretical computer science and algorithm design is recommended.

M 4.160 Module: Seminar: Deep Learning for Robotics [M-INFO-107175]

Coordinators: Prof. Dr. Gerhard Neumann
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Robotics and Automation
Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114204	Seminar: Deep Learning for Robotics	**WT**	**3 CP**	**Neumann**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Students are able to independently understand a complex research topic, present the content in a concise and understandable way and prepare a scientific report summarizing the topic.

Students are able to independently understand a complex research topic, present the content in a concise and understandable way and prepare a scientific report summarizing the topic. Students get a deeper understanding of state-of-the art learning algorithms and get to know current research challenges.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

Content
Each student has to choose one of the offered topics from the area of deep learning / robot learning / deep reinforcement learning / deep imitation learning. Each topic consists of several research papers for which the students have to prepare a presentation as well as a report in form of a scientific research paper. It is recommended to take the seminar together with the “Research Project Deep Learning for Robotics”, where the presented algorithms will be implemented and evaluated. Students will work in teams of 2.

Workload
Workload = 90 h = 3 ECTS
Attendance time: 15h
Self-study: 45h
Writing a scientific report: 20h
Prepare presentation: 10h

Recommendations
Attendance of the lecture "Machine Learning - Fundamentals and Algorithms" is recommended.

M 4.161 Module: Seminar: Embedded Systems I [M-INFO-107231]

Coordinators: Prof. Dr.-Ing. Jörg Henkel
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Design of Embedded Systems and Computer Architectures
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114255	Seminar: Embedded Systems I	**WT+ST**	**3 CP**	**Henkel**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Students learn the basics of scientific work in the form of literature research, writing a scientific paper and giving a presentation to a specialist audience.

Learning objectives:

Students learn to read conference papers, articles in specialist journals and standard literature. Furthermore, they interpret these texts in order to give an overview of the topic in their own words in a paper. Finally, they also present an overview of the topic to other computer scientists. In doing so, they are trained in scientific writing in the form of expression, text structure and reduction to the essentials.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines when writing their scientific work.

Content
This module bundles the seminars at the Chair of Embedded Systems:

Internt of Things

Machine Learning

Embedded Security and Architectures

For current information, please check the course catalog and the Chair of Embedded Systems homepage at https://ces.itec.kit.edu.

Workload
90 h

M 4.162 Module: Seminar: Embedded Systems II [M-INFO-107232]

Coordinators: Prof. Dr.-Ing. Jörg Henkel
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Design of Embedded Systems and Computer Architectures
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114256	Seminar: Embedded Systems II	**WT+ST**	**3 CP**	**Henkel**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Qualification objective: Students learn the basics of scientific work in the form of literature research, writing a scientific paper and giving a presentation to a specialist audience.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines when writing their scientific work.

Learning objectives:Students learn how to read conference papers, articles in specialist journals and standard literature. Furthermore, they interpret these texts in order to give an overview of the topic in their own words in a paper. Finally, they also present an overview of the topic to other computer scientists. In doing so, they are trained in scientific writing in the form of expression, text structure and reduction to the essentials.

Content
This module bundles the seminars at the Chair of Embedded Systems:
Internet of Things (IoT) for Healthcare

Internet of Things (IoT) in Embedded Systems

Approximate Computing

Thermal-aware Embedded Systems

Dependability in Internet of Things (IoT)
Performance Optimization for Multicore Chips
Power Efficient Reliability

Distributed Decision Making

Low Power Design for Embedded Systems

Reconfigurable Embedded Systems

Mixed Criticality Systems

Security in Internet of Things (IoT)

For current information, please refer to the course catalog and the Chair of Embedded Systems homepage at http://ces.itec.kit.edu.

Additional Information
This is identical to the module 'Seminars: Embedded Systems I' and enables participation in a second seminar at the CES Chair.

Workload
90 h

M 4.163 Module: Seminar: Exoskeletons & Motion Capture [M-INFO-106927]

Coordinators: Prof. Dr. Katja Mombaur
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Robotics and Automation (Usage from 10/1/2025)
Elective Studies in Informatics (Usage from 10/1/2025)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113892	Seminar: Exoskeletons & Motion Capture	**WT**	**3 CP**	**Mombaur**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
- The students know the state of the art of exoskeletons and assistive robots and current medical applications.
- Students are familiar with the most important methods and devices for measuring human movements with and without robotic mobility assistance systems
- Students are able to independently research, understand, critically evaluate and summarize scientific literature on a given topic (usually in English).
- Students will be able to prepare and deliver a scientific presentation, taking into account the level of knowledge of the other seminar participants, and to answer detailed questions on the topic
- Students will be able to ask questions about scientific presentations of other students and make active contributions to scientific discussions
- Students will be able to use Latex to create a scientific text (in English) incorporating the sources they have read.

Content
This seminar provides an insight into the current state of research and the practical use of exoskeletons in medicine and their potential to improve the quality of life of people with and without physical disabilities. It also gives an overview of different motion capture technologies, which play an important role in exoskeleton research but have many other applications. The proseminar is offered by the research group Optimization and Biomechanics for Human-Centred Robotics at the IAR.

Exoskeletons are used to improve mobility and are worn by people directly on the body to support or completely replace their muscle strength. One class of exoskeletons assists people with mobility impairments to walk, stand and perform other physical activities so that they can regain their independence and participate in the activities of daily living. Other types of exoskeletons are used by healthy people to prevent injuries in difficult working conditions.

The applications of motion capture include many disciplines in which human behavior and movements are of interest, such as sports science, biomechanics, medicine, psychology, etc., but they also play an important role in the creation of animated films and computer games. In robotics, and especially in the development of exoskeletons, they are important for analyzing human-robot interaction and improving robot design and control. Various motion capture technologies exist for recording movement kinematics, ground reaction forces and muscle activity.

The proseminar presentation topics cover the spectrum of different exoskeleton types and motion capture technologies.

Schedule of the proseminar:
In an event in the first week of the semester, the topic of the seminar and the individual lecture topics are presented in detail and distributed to the students according to their preferences. In a second session in week 3, an introduction to academic literature research, writing and presentations will take place. Afterwards, the students carry out a literature search under supervision and prepare a presentation and a corresponding paper. As the scientific literature is mostly in English, the paper should also be written in English. Presentations can be held in either English or German and take place in one or more block courses during the last third of the semester.

Additional Information
Limited number of participants

Workload
Estimated effort for this module is 90 hours:
20h – In person events (kickoff meeting, indiidual preparatory meetings, seminar block)
20h – Literature research
20h – Preparation of presentation
30h - Paper writing

Recommendations
Knowledge in Robotics (e.g. from the class Robotics 1 and follow-ups) is helpful

M 4.164 Module: Seminar: Explainable Artificial Intelligence [M-INFO-106497]

Coordinators: TT-Prof. Dr. Rudolf Lioutikov
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113115	Seminar: Explainable Artificial Intelligence	**WT**	**3 CP**	**Lioutikov**

Assessment
See partial achievements (Teilleistung).

Prerequisites
See partial achievements (Teilleistung).

Competence Goal
Students are able to independently understand a complex research topic, present the content in a concise and understandable way and prepare a scientific report summarizing the topic.
Students are able to independently understand a complex research topic, present the content in a concise and understandable way and prepare a scientific report summarizing the topic. Students get a deeper understanding of state-of-the art learning algorithms and get to know current research challenges.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

Content
Each student will select several related papers in the field of Explainable Artificial Intelligence and study and analyze it in the context of Robot Learning. The organizers will suggest several papers but the students will be encouraged to 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 “Explainable Robot Intelligence” Research Project (Forschungspraktikum), where the students get the chance to deepen their understanding, implement and evaluate their presented work.

Additional Information
It is only possible to resign within two weeks after assignment of the topic.

Workload
Workload = 90 h = 3 ECTS
- Attendance time: 15h
- Self-study: 45h
- Writing a scientific report: 20h
- Preparing a presentation: 10h

Recommendations
We recommend taking this research project after attending the “Explainable Artificial Intelligence” lecture in the summer semester.

We highly recommend to take this seminar in combination with the “Explainable Artificial Intelligence” research project (Forschungspraktikum).

• Experience in Machine Learning is recommended, e.g. through prior coursework.
◦ The Computer Science Department offers several great lectures e.g., “Maschinelles Lernen - Grundlagen und Algorithmen” and “Deep Learning ”
• A good mathematical background will be beneficial
• Python experience is recommended
• We will use the PyTorch deep learning library. Some prior knowledge in this is helpful but not necessary.

M 4.165 Module: Seminar: Exploring Robotics - Insights from Science Fiction, Research and Society [M-INFO-106651]

Coordinators: TT-Prof. Dr. Barbara Bruno
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Robotics and Automation
Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113398	Seminar: Exploring Robotics - Insights from Science Fiction, Research and Society	**ST**	**3 CP**	**Bruno**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
The students gain experience with literature research on a current research topic. They explore, understand and compare different approaches to a selected scientific problem. The students are able to write a summary of their literature research in the form of a scientific publication in English and give a scientific talk on it.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

Content
The students choose a topic from the field of robotics (e.g. remote control, behavior-based robotics, human-robot interaction, the “uncanny valley,” natural language understanding, machine learning) and conduct a research on it that, building on literature findings, also includes and addresses the perspectives of society and the general media (as given by science fiction books, movies and games, as well as media and news outlets) and technology assessment (including social/societal expectations and needs, ethical implications, and risks/benefits analyses).
Students work under the guidance of a scientific supervisor. At the end of the semester, they present the results and write an elaboration in English in the form of a scientific publication.

Workload
Seminar with 2 SWS, 3 LP.
3 LP corresponds to approx. 90 hours, of which
approx. 45 hours of literature research
approx. 25 hrs. elaboration
approx. 10 hrs. preparation of presentation
approx. 10 hrs. compulsory attendance

Recommendations
Knowledge of the content of modules Robotics I - Introduction to Robotics, Robotics II: Humanoid Robotics, Robotics III - Sensors and Perception in Robotics is helpful.

M 4.166 Module: Seminar: Failing Forward: Robotics, Critical Reading and the Making of Good Research [M-INFO-107436]

Coordinators: TT-Prof. Dr. Barbara Bruno
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Robotics and Automation
Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114604	Seminar: Failing Forward: Robotics, Critical Reading and the Making of Good Research	**WT**	**3 CP**	**Bruno**

Assessment
See partial achievements (Teilleistung

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
The students refine their critical reading skills and gain experience with literature research on a current research topic. They can identify and propose good research practices. The students are able to present their findings and reflections in the form of a scientific publication in English and give a scientific talk on it.

Content
The students choose a topic from the field of human-robot interaction (e.g. about robots in public spaces, or robots and diversity, or companion robots for older adults). They then conduct a literature research under the guidance of a scientific supervisor, aimed at identifying what makes good research and good research reporting on the chosen topic. At the end of the semester, they present the results and write an elaboration in English in the form of a short scientific position paper.

Workload
Seminar with 2 SWS, 3 LP.
3 LP corresponds to approx. 90 hours, of which
approx. 45 hours of literature research
approx. 25 hrs. elaboration
approx. 10 hrs. preparation of presentation
approx. 10 hrs. compulsory attendance

Recommendations
Knowledge of the content of modules Robotics I - Introduction to Robotics, Robotics II: Humanoid Robotics, Robotics III - Sensors and Perception in Robotics is helpful.

M 4.167 Module: Seminar: Fine-Grained Complexity Theory & Algorithms [M-INFO-106645]

Coordinators: Prof. Dr.-Ing. Marvin Künnemann-Goos
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Theoretical Foundations
Area of Specialization: Algorithm Engineering
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113392	Seminar: Fine-Grained Complexity Theory & Algorithms	**Irreg.**	**4 CP**	**Künnemann-Goos**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Students are able to:
- perform a literature review on the basis of a given topic/scientific paper, to read and understand relevant scientific works in algorithms & complexity theory and to identify the scientific context.
- present a scientific paper and its context. This includes competency in tools and techniques for making the content accessible for a target audience.
- create a written report of their topic in accordance to usual quality standards
for scientific writing

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
Selected topics from the field of fine-grained complexity theory & algorithm design. This consists of recent papers on fine-grained hardness assumptions, conditional lower bounds and algorithmic results for important problems from various sub-areas.

Each student will present a topic and summarize it in a scientific report.

Workload
4 CP amounts to 120 h, distributed as follows:
- about 10 h attendance in class
- about 40 h literature search and review
- about 40 h preparation of presentation
- about 30 h writing of scientific report

Recommendations
Basic knowledge of theoretical computer science and algorithm design is recommended.

Concurrent or previous attendance of the lecture “Fine-Grained Complexity Theory & Algorithms” is helpful, but not required. This seminar can be attended independently.

M 4.168 Module: Seminar: Hot Topics in Artificial Intelligence & Security 1 [M-INFO-106868]

Coordinators: Prof. Dr. Christian Wressnegger
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Cryptography and Security
Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113761	Seminar: Hot Topics in Artificial Intelligence & Security 1	**WT**	**4 CP**	**Wressnegger**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Students know basic concepts artificial intelligence and machine learning in computer security, and are able to understand/interpret results from state-of-the-art research.

- Students know and understand basic concepts of combining artificial intelligence and computer security.
- Students are able independently research topics and methods.
- Students understand limits of current methods and applications

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work

Content
This seminar is concerned with the combination of artificial intelligence, machine learning and computer security in practice. Many tasks in the security landscape are based on manual labor, such as searching for vulnerabilities or analyzing malware. Here, machine learning can be used to establish a higher degree of automation, providing more "intelligent" security
solutions (AI for Security). However, also these learning-based systems can be attacked and need to be secured (Security of AI).

This module is part of a seminar series to intensifies the contents of the AISEC lecture. It can be attended individually and in no particular order. The module puts focus on timely topics from recent research and teaches students to work up results from state-of-the-art research. To this end, the they will read up on a sub-field, prepare a seminar report, and present their work at the end of the term to their colleagues.

Workload
- 30h Literature research
- 60h Elaboration of the seminar paper
- 20h Preparation of final presentation
- 10h attendance time

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

M 4.169 Module: Seminar: Hot Topics in Artificial Intelligence & Security 2 [M-INFO-106869]

Coordinators: Prof. Dr. Christian Wressnegger
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Cryptography and Security
Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113762	Seminar: Hot Topics in Artificial Intelligence & Security 2	**ST**	**4 CP**	**Wressnegger**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Students know basic concepts artificial intelligence and machine learning in computer security, and are able to understand/interpret results from state-of-the-art research.

- Students know and understand basic concepts of combining artificial intelligence and computer security.
- Students are able independently research topics and methods.
- Students understand limits of current methods and applications

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work

Content
This seminar is concerned with the combination of artificial intelligence, machine learning and computer security in practice. Many tasks in the security landscape are based on manual labor, such as searching for vulnerabilities or analyzing malware. Here, machine learning can be used to establish a higher degree of automation, providing more "intelligent" security
solutions (AI for Security). However, also these learning-based systems can be attacked and need to be secured (Security of AI).

This module is part of a seminar series to intensifies the contents of the AISEC lecture. It can be attended individually and in no particular order. The module puts focus on timely topics from recent research and teaches students to work up results from state-of-the-art research. To this end, the they will read up on a sub-field, prepare a seminar report, and present their work at the end of the term to their colleagues.

Workload
- 30h Literature research
- 60h Elaboration of the seminar paper
- 20h Preparation of final presentation
- 10h attendance time

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

M 4.170 Module: Seminar: Hot Topics in Bioinformatics [M-INFO-100750]

Coordinators: Prof. Dr. Alexandros Stamatakis
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Algorithm Engineering
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-101287	Seminar: Hot Topics in Bioinformatics	**ST**	**3 CP**	**Stamatakis**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Participants will be able to understand, critically evaluate and compare current scientific publications in the field of sequence-based bioinformatics. They are able to present, understand, and critically assess the algorithms and models from current publications orally and in writing at a level that corresponds to the quality of scientific publications and conference presentations. They are able to suggest possible extensions to existing work and assess if the results are reproducible.

Content
The field of Bioinformatics is by now established as an independent application area of computer science. One of the main objectives of classical bioinformatics is to generate biological knowledge (usually from molecular data, e.g., DNA data sets) using appropriate models and algorithms. The so-called molecular data flood, which is being driven by increasingly faster and cheaper methods for extracting DNA, presents bioinformatics with new challenges regarding data storage and processing. These challenges range from discrete algorithms on strings and trees to parallel processing of data and large numerical simulations on supercomputers. The aim of the module is to provide an insight into the many facets of current bioinformatics research.

Workload
10 hours of topic selection + 10 hours of attending the seminar lectures + 30 hours of reading and understanding the paper(s) + 10 hours of lecture preparation + 30 hours for writing the report = 90 hours = 3 ECTS

M 4.171 Module: Seminar: Hot Topics in Decentralized Systems [M-INFO-104891]

Coordinators: Prof. Dr. Hannes Hartenstein
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Cryptography and Security
Area of Specialization: Telematics
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-109922	Seminar: Hot Topics in Decentralized Systems	**Irreg.**	**3 CP**	**Hartenstein**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
The student is familiar with the current state of research in the field of decentralised systems.
The student is able to familiarise him/herself independently with a current research topic and the associated fundamentals by identifying relevant literature and processing it in a structured manner.
The student is able to write a paper according to scientific standards.
The student is able to present and discuss a scientific topic in a colloquium.
The student is able to consider the challenges of a specific technical problem in the context of decentralised systems and transfer existing solution approaches to the given problem and evaluate them with regard to performance and security.
Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

Content
The seminar deals with current work in the field of decentralised systems. Based on current research work, challenges and approaches are identified. Corresponding solutions are analysed and compared. Finally, the reference to related domains is established.

Workload
Kick-off events: 4h
Meeting with the supervisor: 4h
Presentation dates: 8h
Literature research: 25h
Writing the paper and preparing the presentation: 50h
Total: 91h = 3 ECTS points

Recommendations
Knowledge of the basics of IT security management for networked systems and the basic security module is helpful.

M 4.172 Module: Seminar: Hot Topics in Explainable Artificial Intelligence (XAI) [M-INFO-106392]

Coordinators: Prof. Dr. Christian Wressnegger
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Cryptography and Security
Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-112917	Seminar: Hot Topics in Explainable Artificial Intelligence (XAI)	**ST**	**4 CP**	**Wressnegger**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Students know concepts of explainable machine learning and are able to understand/interpret results from state-of-the-art research.

- Students know and understand concepts of methods for explaining machine learning algorithms.
- Students are able independently research topics and methods in the field of explainable machine learning.
- Students understand limits of current approaches for explaining machine learning.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

Content
This seminar is concerned with explainable machine learning in computer security. Learning-based systems often are difficult to interpret, and their decisions are opaque to practitioners. This lack of transparency is a considerable problem in computer security, as black-box learning systems are hard to audit and protect from attacks.

The module introduces students to the emerging field of explainable machine learning and teaches them to work up results from recent research. To this end, the students will read up on a sub-field, prepare a seminar report, and present their work at the end of the term to their colleagues.

Topics cover different aspects of the explainability of machine learning methods for the application in computer security in particular.

Workload
- 24h literature research
- 48h Elaboration of the seminar paper
- 24h Review of preliminary work by fellow students
- 16h preparation of final presentation
- 8h attendance time

In total 120h

M 4.173 Module: Seminar: Information Systems [M-INFO-107686]

Coordinators: Prof. Dr.-Ing. Klemens Böhm
Organisation: KIT Department of Informatics
Part of: Elective Studies in Informatics (Usage from 4/1/2026)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-115055	Seminar: Information Systems	**WT+ST**	**3 CP**	**Böhm**

Assessment
See Partial Achievements (Teilleistung).

Prerequisites
See Partial Achievements (Teilleistung).

Competence Goal
- Students receive an initial introduction to scientific work in a specific specialist area in the field of information systems.
- Working on the seminar paper also prepares students for writing their Master's thesis.
- By attending the seminars, students are taught not only techniques of scientific work but also key qualifications.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines when writing their scientific work.

Content
The Chair of Information Management Systems offers at least one seminar per semester on a selected information systems topic (every seminar at the "Chair of Information Management Systems" that is not a proseminar counts as an "Information Systems Seminar").

These are usually current research topics, for example from the fields of databases, data mining or workflow management.

Details are announced each semester (notices and homepage of the Chair of Information Management Systems).

Workload
- General introduction 2h
- Introduction to presentations 2h
- Reading and understanding articles and publications 6x4,5h=27h
- Creating a paper 6x4,5h=27h
- Creating a presentation 6x4,5h=27h
- Lectures 10x0.5h=5h

Total = 90h (3 ECTS)

Recommendations
Lectures of the Chair of Information Management Systems that match the topic of the seminar are strongly recommended.

M 4.174 Module: Seminar: Interpretability and Causality in Machine Learning [M-INFO-107217]

Coordinators: Jun.-Prof. Dr. Jan Stühmer
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114237	Seminar: Interpretability and Causality in Machine Learning	**ST**	**3 CP**	**Stühmer**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Qualification target:

Students acquire the foundations of scientific literature research, writing of a scientific report, and presenting their results in front of an audience.

Learning objectives:

Students independently acquire an understanding of their research topic from scientific literature such as conference papers, journal papers and textbooks.
They are able to independently present the content in a concise and understandable way in a written report and in a presentation in front of an audience.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

Content
Topic of this Masterseminar are machine learning approaches and deep learning methods for learning of interpretable representations. These methods enable to reconstruct underlying principles from data, for example the reconstruction of generative factors of a dataset.
Starting from these methods for interpretable representations, we will discuss further methods for causal discovery, that enable the inference of causal dependencies in data.
Methods and algorithms covered include for example variational inference, contrastive learning, as well as statistical methods for factor analysis.
There will be a kick-off meeting at the beginning of the semester and 2-3 block seminars towards the end of the term.
Dates for both will still be determined.
The Masterseminar will be held in English language.

Workload
90h

Recommendations
Attendance of the lecture "Machine Learning - Fundamentals and Algorithms" is recommended.

M 4.175 Module: Seminar: Law and Legal Studies [M-INFO-107028]

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

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114094	Seminar: Law and Legal Studies	**WT+ST**	**3 CP**	**Gil Gasiola, Pathak**

Assessment
See partial archievements (Teilleistung)

Prerequisites
See partial archievements (Teilleistung)

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.

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.

Workload
The total workload for this module is approx. 90 hours (3 credits) for attendance time, preparation and follow-up work as well as the course examination.

The actual workload varies depending on the specific seminar chosen and is described for the individual course.

M 4.176 Module: Seminar: Machine Learning in Climate and Environmental Sciences [M-INFO-106719]

Coordinators: TT-Prof. Dr. Peer Nowack
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113519	Seminar: Machine Learning in Climate and Environmental Sciences	**Irreg.**	**3 CP**	**Nowack**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
The students will learn to:
- independently discuss current research topics on machine learning in climate and environmental sciences.
- summarize published research in a structured way and explain it in their own words, in group discussions and in the form of a presentation.
- contrast modern problem-solving approaches and methods and propose suitable solutions for a variety of subject-relevant issues.
- Optional: students are invited to develop their own research ideas on the basis of what they have learned and to refine them in discussion with their supervisors. Such ideas could be pursued as a project internship, in the “Practical Research course” or in the form of a master’s thesis.

Content
Machine learning (ML) methods are already ubiquitous in many areas of society and research. This is especially true for climate and environmental sciences, where ML algorithms help e.g. to improve predictions of climate change and weather, or to optimize energy supply systems. In this session, we will discuss cutting-edge publications on ML applications in climate and environmental sciences, as well as the underlying theory behind the classes of algorithms. While organizers will suggest initial papers, students will be encouraged to seek out additional relevant literature throughout the semester.
The seminar will cover both the in-depth study of the climate/environmental sciences topic as well as of the specific machine learning method(s) employed in the literature. It will include two short and one longer final presentation from each student. The first presentation will focus solely on the chosen climate or environmental event or phenomenon, while the second presentation will cover the machine learning methods employed in studying it. Next to suggested reading by the module organizers, students will be encouraged to seek out additional relevant literature throughout the semester.
Towards the end, students will compile their findings into the final presentation accompanied by a scientific report, presenting the results in the form of a lecture.

Workload
Total 90 h, consisting of:
Seminar attendance and personal meetings with the supervisors: 10 h
Literature research: 30 h
Writing the seminar paper and preparing the final presentation: 50 h

Recommendations
- An interest in climate and environmental sciences topics is a prerequisite.

M 4.177 Module: Seminar: Neural Networks and Artificial Intelligence [M-INFO-107816]

Coordinators: Prof. Dr. Jan Niehues
Organisation: KIT Department of Informatics
Part of: Elective Studies in Informatics (Usage from 10/1/2026)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-115209	Seminar: Neural Networks and Artificial Intelligence	**WT**	**3 CP**	**Niehues**

Assessment
See Partial Achievements (Teilleistung).

Prerequisites
See Partial Achievements (Teilleistung).

Competence Goal
Students learn to independently familiarize themselves with topics using academic literature and to prepare them for presentations.
Through the other presentations, students gain in-depth knowledge in specific areas of neural networks.
By evaluating their peers' presentations, students improve their social skills.

Students are familiar with the DFG Code of Conduct "Guidelines for Ensuring Good Scientific Practice" and successfully apply these guidelines when writing their academic papers.

Content
Even the fastest computers are no match for the human brain when it comes to many tasks that we take for granted. Neural networks attempt to simulate the brain's parallel and distributed architecture in order to better master these capabilities through learning processes. In this context, the course covers neural approaches in image and speech recognition, robotics, and other fields.
Students independently research individual topics using the provided literature and present their findings in the form of a slide-based presentation to the other seminar participants.

Workload
Approx. 6 in-person sessions = 12 hours; seminar
paper and presentation = 78 hours;
total = 90 hours

Recommendations
Advanced Artificial Intelligence

M 4.178 Module: Seminar: Operating Systems [M-INFO-107205]

Coordinators: Prof. Dr.-Ing. Frank Bellosa
Organisation: KIT Department of Informatics
Part of: Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114230	Seminar: Operating Systems	**Irreg.**	**3 CP**	**Bellosa**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Students analyse and present scientific work in the field of operating systems.
In addition to techniques of scientific work, key qualifications are also taught in an integrative manner by attending the seminars.
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 seminar is dedicated to a current area of operating system research.

Workload
30 h = 2 SWS * 15 attendance
30 h preparation
10 h Presentation
20 h elaboration
90 h = 3 ECTS

M 4.179 Module: Seminar: Post-Quantum Cryptography [M-INFO-105585]

Coordinators: Prof. Dr. Jörn Müller-Quade
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Cryptography and Security
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-111200	Seminar: Post-Quantum Cryptography	**Irreg.**	**3 CP**	**Müller-Quade**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
The student

- can describe the mathematical foundations of different quantum-hard problems
- knows basic post-quantum cryptosystems
- analyzes and discusses specific problems within the scope of his seminar paper
- presents technical arguments and is able to defend them within the scope of a certain assignment
- manages and prepares his seminar paper and his presentation largly independent

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

Content
The Seminar deals with the foundations of post-quantum cryptography and quantum hard problems.

First, the mathematical basics describing several quantum-hard problems are introduced in introductionary lectures. Subsequently, different post-quantum cryptosytems and common cryptographic notions will be introduced. Furthermore the seminar covers related topics, such as provability in the event of quantum adversaries.

Workload
Attendance time in seminar: 15 h
Writing the paper: 30 h
Designing and preparing the presentation: 45 h

Recommendations
Basic knowledge of IT-Security and cryptography are recommended.

M 4.180 Module: Seminar: Practical Graph Algorithms [M-INFO-107264]

Coordinators: Prof. Dr. Henning Meyerhenke
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Algorithm Engineering
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114297	Seminar: Practical Graph Algorithms	**Irreg.**	**4 CP**	**Meyerhenke**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Students are able to:
- perform a literature review on the basis of a given topic/scientific paper, to read and understand relevant scientific works in algorithm engineering for graph problem and to identify the scientific context.
- present a scientific paper and its context. This includes competency in tools and techniques for making the content accessible for a target audience.
- create a written report of their topic in accordance to usual quality standards for scientific writing
- critically assess the work of other participants and make constructive suggestions for improvement.
- Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

Content
This seminar covers various topics from the field of practical graph algorithms such as small subgraph detection, graph robustness, centrality computations, and related ones. The exact focus of the seminar for the current semester will be announced in advance on the website of Prof. Meyerhenke's chair. Participants in the seminar carry out their own literature research, present their results to their fellow students and prepare a paper.

The seminar will be held in several blocks, partially online, partially on-site. The exact formalities will be announced at an online kick-off event at the beginning of the semester, which will also be announced on the course website mentioned above.

Workload
4 LP corresponds to approx. 120 working hours, of which
- 15h seminar attendance
- 35h Literature research, assessment and evaluation of relevant literature
- 35h preparation of own presentation
- 35h preparation of the scientific report

Recommendations
Knowledge of algorithms, in particular graph algorithms, is a clear advantage. Exemplary lectures are Algorithms I and Algorithms II.

M 4.181 Module: Seminar: Privacy and Security [M-INFO-107216]

Coordinators: Prof. Dr. Thorsten Strufe
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Cryptography and Security
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114236	Seminar: Privacy and Security	**WT**	**4 CP**	**Strufe**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
The student is able to
- conduct a literature search based on a given topic, identify and evaluate the relevant literature;
- independently compile research results from IT security and technical data protection;
- analyze and discuss scientific studies and place them in their context;
- conduct their own classifications and evaluations of scientific studies, report on them in writing and present the results in a short scientific presentation.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

Content
The seminar deals with current topics from the research field of data protection and security.
These include, for example:
- Privacy attacks on communication
- Network security
- Anonymized online services
- Evaluation of the anonymity of online services
- Anonymized publication of data (differential privacy, k-anonymity)
- Transparency/awareness-enhancing systems
- Behavioral analysis of media use
- Biometric authentication

Workload
Seminar attendance time: 10h
Researching and writing a paper: 75h
Reviewing and commenting on the preliminary papers of fellow students: 5h
Preparing the presentation: 30h

Recommendations
Fundamentals of IT security, computer networks and distributed systems are required

M 4.182 Module: Seminar: Proofs from THE BOOK [M-INFO-103306]

Coordinators: Prof. Dr. Peter Sanders
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Theoretical Foundations
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-106604	Seminar: Proofs from THE BOOK	**Irreg.**	**3 CP**	**Sanders**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
The students learn to follow and understand complex mathematical proofs on their own. They learn to represent these proofs in an appealing manner and present the proofs to the other participants using a blackboard.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

Content
According to the Hungarian mathematician Paul Erdős, God is keeping a book – the BOOK – under wraps that contains the most elegant mathematical proofs. Erdős' loftiest goal was to find such proofs from the BOOK.
After Erdős' death in 1996, Martin Aigner and Günter Ziegler published the book "Proofs from THE BOOK" in 1998. The book has also been published in German with the title "Das BUCH der Beweise". In Aigner and Ziegler's collection, there are some 40 of the most elegant proofs which are handled as candidates for BOOK-proofs.

In this seminar, the participants will present and discuss proofs from "Proofs from THE BOOK" and other well known and well studied proofs in the area of mathematics and informatics.

Workload
Seminar with 2 SWS, 3 LP
3 LP correspond to about 90h of work, split into

about 20h attendance
about 60h preparation for seminar
about 10h follow-up

Recommendations
The German version "Das Buch der Beweise" is available online at the KIT library within the KIT network. The English version "Proofs from THE BOOK" is available as a physical copy at the KIT library. We recommend having a look inside either version before registering for this seminar.

M 4.183 Module: Seminar: Quantum Information Theory [M-INFO-105408]

Coordinators: Prof. Dr. Jörn Müller-Quade
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Cryptography and Security
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-110904	Seminar: Quantum Information Theory	**Irreg.**	**3 CP**	**Müller-Quade**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
The student…
• understands the basics of Quantum Information Theory.
• understands formalizing quantum states via state vectors and is able to autonomously use the state vector formalism to design and analyze quantum algorithms.
• knows and understands the quantum gates introduced in the seminar.
• knows the visual quantum circuit tool “Quirk” and is able to autonomously apply it to design and analyze quantum algorithms.
• knows and understands the quantum problems and algorithms discussed in the seminar and is able to explain them and relate them to one another.
• knows and understands the impact quantum algorithms have on classic cryptography.
• knows and understands the basics of and presented protocols for quantum key distribution.
• is able to autonomously apply the techniques presented in the seminar, e.g. to prove correctness of simple quantum algorithms.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

Content
• Basics of Quantum Information Theory
• Formalism for dealing with quantum systems
• “Quirk”
• Important quantum problems and algorithms
• Quantum key distribution
• Quantum walks

Workload
Seminar attendance time: 18h
Preparation and follow-up work: 12h
Preparation of a presentation: 30h
Preparation of a written examination: 30h

Recommendations
Students should be familiar with the contents of the module "Linear Algebra 1 and 2", as well as the basics of IT security.

M 4.184 Module: Seminar: Recent Highlights in Algorithms [M-INFO-107172]

Coordinators: TT-Prof. Dr. Thomas Bläsius
Prof. Dr. Peter Sanders

Organisation: KIT Department of Informatics

Part of: Area of Specialization: Theoretical Foundations
Area of Specialization: Algorithm Engineering
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114201	Seminar: Recent Highlights in Algorithms	**Irreg.**	**4 CP**	**Bläsius, Sanders, Ueckerdt**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Students can,
- carry out a literature search based on a given topic, identify, locate, evaluate and finally analyse the relevant literature.
- prepare presentations in a scientific context. To this end, students master techniques that enable them to prepare and present the content to be presented in a manner suitable for an audience.
- prepare their written seminar paper (as required later for further academic work) in accordance with the requirements and quality standards of academic writing, taking into account the format requirements specified by academic publishers for the publication of documents.
- critically assess the work of other participants and make constructive suggestions for improvement.
Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

Content
The seminars offered as part of this seminar module deal with current topics in algorithm technology and explore them in depth. As a rule, the prerequisite for passing the module is the preparation of a written paper of max. 15 pages and an oral presentation of at least 45 minutes.

Workload
Seminar with 2SWS, 4LP
4 LP corresponds to approx. 120 working hours, of which
approx. 10h seminar attendance
approx. 40 hours of literature research, assessment and evaluation of relevant literature
approx. 30h preparation of own presentation
approx. 30 hours writing the paper
approx. 10h Reading two papers and formulating constructive criticism and suggestions for improvement in writing

M 4.185 Module: Seminar: Robot Reinforcement Learning [M-INFO-107926]

Coordinators: Prof. Dr. Gerhard Neumann
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Robotics and Automation (Usage from 7/29/2026)
Area of Specialization: Human-centred Machine Intelligence (Usage from 7/29/2026)
Elective Studies in Informatics (Usage from 7/29/2026)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-115349	Seminar: Robot Reinforcement Learning	**Irreg.**	**3 CP**	**Neumann**

Assessment
See partial achievement (Teilleistung).

Prerequisites
See partial achievement (Teilleistung).

Competence Goal
Students are able to independently understand a complex research topic, present the content in a concise and understandable way and prepare a scientific report summarizing the topic. Students get a deeper understanding of state-of-the art RL 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
Reinforcement Learning is a popular machine learning method where an artificial agent has to learn how to act optimally in an unknown environment by trial and error. In this seminar, we will focus on recent developments in RL for robotics, i.e., RL for continuous state and action spaces.

The students can choose from different topics from the area of reinforcement learning (RL) for robotics, including deep reinforcement learning, model-free RL, actor-critic methods, model-based RL, meta learning, hierarchical reinforcement learning and robot applications of RL. 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.

Workload
Workload = 90 hours = 3 ECTS

M 4.186 Module: Seminar: Secure Multiparty Computation [M-INFO-105761]

Coordinators: Prof. Dr. Jörn Müller-Quade
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Cryptography and Security
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-111501	Seminar: Secure Multiparty Computation	**Irreg.**	**3 CP**	**Müller-Quade**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Students learn to familiarize themselves thoroughly with scientific papers, to present them to other students and to deal with questions on their topic in a subsequent discussion round.

Students will be able to differentiate between different protocols for secure multiparty computation and weigh up their advantages and weaknesses.

Students will be able to present academic publications from the research field of secure multiparty computation in a suitable manner, place them in the historical context of the research field and critically examine the results and findings presented.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and apply these guidelines successfully in the preparation of their academic work.

Content
In the setting of secure multiparty computation, two or more parties with private inputs wish to compute some joint function of their inputs. The security requirements of such a computation are privacy (meaning that the parties learn the output and nothing more), correctness (meaning that the output is correctly distributed), independence of inputs, and more. Due to its generality, secure computation is a central tool in cryptography.

In this seminar, we examine modern protocols for secure multiparty computation of arbitrary functions.

Workload
Attendance time in seminar: 15 h

Meeting with supervisors: 5 h

Independent work in relation to the individual seminar topic: 70 h

Recommendations
Knowledge of the content of the lecture Cryptographic Protocols is assumed.

M 4.187 Module: Seminar: Software Architecture, Security and Privacy [M-INFO-107236]

Coordinators: Prof. Dr. Ralf Reussner
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Software Engineering and Compiler Construction
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114260	Seminar: Software Architecture, Security and Privacy	**Irreg.**	**4 CP**	**Reussner**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Students can,

- carry out a literature search based on a given topic, identify, locate, evaluate and finally analyze the relevant literature.
- prepare their seminar paper (and later their Bachelor's/Master's thesis) with a minimum of training, taking into account the format requirements specified by all publishers for the publication of documents.
- Preparing presentations in a scientific context. To this end, techniques are introduced that make it possible to prepare and present the content to be presented in an auditorium-appropriate manner.
- present the results of their research in written form, as is generally the case in scientific publications.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and apply these guidelines successfully in the preparation of their scientific work.

Content
Anyone who processes personal data automatically must effectively protect this data from unauthorized access in order to act in accordance with data protection laws, but also to prevent damage to reputation and trustworthiness should data protection violations become public. Protecting personal data from unauthorized access and complying with other data protection obligations is therefore actually one of the most important goals in software design and operation.

However, looking at data protection in isolation does not do justice to reality. If an attacker gains access to personal data, voluntary commitments and internal data protection regulations no longer apply. In case of doubt, the operator of the software is liable for severe fines. Effective security precautions are therefore indispensable as a mainstay for protecting personal data.

Security-critical vulnerabilities must be identified at an early stage, ideally before the vulnerability is introduced. Such quality assessments are performed by software architecture-based analyses. How security can be described and analyzed at the software architecture level is the subject of ongoing research, as is the question of whether - and how - security can be expressed in figures.

In this seminar, students deal with these questions and the state of research at the interface between data protection, security and software architecture. Possible topics are located in one or more of these areas.

Workload
25 working hours for literature research
55 working hours for writing the thesis and preparing peer reviews
20 working hours for preparing the final presentation
20 working hours for the final block event and meeting with the supervisor.
This results in a total of 120 working hours

M 4.188 Module: Seminar: Speech-to-Speech Translation [M-INFO-107179]

Coordinators: Prof. Dr. Jan Niehues
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114208	Seminar: Speech-to-Speech Translation	**ST**	**3 CP**	**Niehues**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Students learn to familiarise themselves independently with topics based on academic literature and prepare them for presentations.
From the other presentations, students gain in-depth knowledge in sub-areas of language-to-language translation
By evaluating the presentations of their fellow students, students improve their social skills.
Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and successfully apply these guidelines in the preparation of their scientific work.

Content
Speech-to-speech translation is a popular application that combines automatic speech recognition and machine translation. However, a user-friendly combination requires more than just a linear connection of the individual techniques.
In this seminar, students work independently on individual topics from the fields of automatic speech recognition, machine translation and their combination into speech-to-speech translation systems using the literature provided and present the summarised findings to the other participants in the seminar in the form of a slide-based presentation.

Workload
90 h

M 4.189 Module: Seminar: Type Systems and Static Program Analysis [M-INFO-107625]

Coordinators: Prof. Dr. Sebastian Erdweg
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Theoretical Foundations (Usage from 10/1/2025)
Area of Specialization: Software Engineering and Compiler Construction (Usage from 10/1/2025)
Elective Studies in Informatics (Usage from 10/1/2025)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114955	Seminar: Type Systems and Static Program Analysis	**WT**	**4 CP**	**Erdweg**

Assessment
See partial achievements (Teilleistung)

Prerequisites
None.

Competence Goal
Students can:

- carry out a literature search based on a given topic. They can identify, locate, evaluate and comprehend the relevant literature.
- prepare and deliver a scientific presentation on a given topic, using adequate presentation techniques.
- write a seminar paper that meets the requirements and quality standards of academic writing.
- participate in academic discussions with their peers.

Students are familiar with the DFG Code of Conduct "Guidelines for Safeguarding Good Scientific Practice" and apply these guidelines successfully in the preparation of their scientific work.

Content
Type systems and static program analyses predict the behavior of programs through source-code analysis, but without executing the program. They are fundamental for isolating ill-defined program behavior (e.g., from type errors), but also can provide guarantees (e.g., memory safety). Topics covered in this seminar include the design, definition, formalization, and application of type systems and static program analyses, including type inference, dependent typing, control flow, data flow, abstract interpretation, soundness, and precision.

Workload
10 working hours for independent study of the seminar topic
25 working hours for literature research
20 working hours for preparing the presentation
55 working hours for writing the thesis and preparing peer reviews
10 working hours for the final block event and meetings with the supervisor

This results in a total of 120 working hours

Recommendations
Students should be familiar with the foundational knowledge about type systems (e.g., typing rules, type checking, polymorphism) or static program analysis (e.g., data flow, abstract interpretation).

M 4.190 Module: Service Design Thinking [M-WIWI-101503]

Coordinators: Prof. Dr. Gerhard Satzger
Prof. Dr. Orestis Terzidis
Organisation: KIT Department of Business and Economics
Part of: Minor Studies: Economics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-WIWI-102849	Service Design Thinking	**Irreg.**	**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.

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 4.191 Module: Simulation and Optimization in Robotics and Biomechanics [M-INFO-106504]

Coordinators: Prof. Dr. Katja Mombaur
Organisation: KIT Department of Informatics
Part of: Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-113123	Simulation and Optimization in Robotics and Biomechanics	**WT**	**6 CP**	**Mombaur**
T-INFO-114838	Simulation and Optimization in Robotics and Biomechanics - Pass	**WT**	**0 CP**	**Mombaur**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
The students
- can explain advanced principles of modeling, optimization and control of dynamic processes, in particular mechanical systems and can apply them
- can model, classify and analyze complex motions in robotics or biomechanics, and investigate specific properties such as stability.
- can apply nonlinear optimization and optimal control methods and can compare and evaluate different mathematical approaches.
- know how to use software tools based on C++ and Lua for modeling, simulation, optimization and visualization of humanoid and robotic systems

are capable of solving optimal control problems numerically and to evaluate the quality of the solution.

Content
The goal of this course is to give a practical introduction into simulation and optimization of motions in robotics and biomechanics. Simulation and optimization play an important role in generating and controlling motions in complex robotics systems and in predicting and analyzing motions of humans. Theory and methods will be covered, but the focus is on the use software tools for modeling, simulation, optimization and visualization of multibody systems. Topics covered include:
- Dynamic process modeling
- Transforming real world problems into mathematical models
- Modeling of complex robotics and biomechanics systems (e.g. humanoids), based on previous modeling knowledge
- Common template models for bipedal walking and running in robotics and biomechanics
- Simulation of mechanical / robotics systems (Integrators and Initial value problems)
- Boundary value problems
- Nonlinear optimization problems
- Optimal control problems
- Direct and indirect methods for optimal control problems, focus on direct methods, especially direct multiple shooting
- Stability of dynamical systems, stability in biomechanics and robotics

Additional Information
Limitation to 30 participants

Workload
Estimated effort for this module is 180 hours:
60h - Lecture and exercises (2+2 SWS)
80h - Independent work (repetition of lecture contents, preparation of assignments
40h - Exam preparation

M 4.192 Module: Software Architecture and Quality [M-INFO-107237]

Coordinators: Prof. Dr. Ralf Reussner
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Software Engineering and Compiler Construction
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114261	Software Architecture and Quality	**WT**	**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 4.193 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: Area of Specialization: Software Engineering and Compiler Construction
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114259	Software Engineering II	**ST**	**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 4.194 Module: Software Product Line Engineering [M-INFO-107212]

Coordinators: Prof. Dr.-Ing. Ina Schaefer
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Software Engineering and Compiler Construction
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114234	Software Product Line Engineering	**ST**	**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 4.195 Module: Software Security Engineering [M-INFO-106344]

Coordinators: Prof. Dr. Ralf Reussner
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Cryptography and Security
Area of Specialization: Software Engineering and Compiler Construction
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-112862	Software Security Engineering	**ST**	**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 4.196 Module: Software Test and Quality Management (SQM) [M-INFO-107239]

Coordinators: Prof. Dr.-Ing. Ina Schaefer
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Software Engineering and Compiler Construction
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114263	Softwaretest and Quality Management (SQM)	**WT**	**5 CP**	**Schaefer**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
After completing the module, participants will be familiar with the basic principles of software testing. They will be able to apply the general testing process and master the activities and techniques to support it. Participants will be able to specify test cases in all phases of the software life cycle. They know test procedures and methods with which they can prepare and carry out software tests efficiently. They are familiar with common methods of
test management methods and test tools for automating test activities.

Content
1. Basics (introduction, definition of terms, principles of software testing, fundamental test process, psychology of testing)
2. Testing in the software life cycle (general V-model, component test, integration test, system test, acceptance test, testing of new product versions, overview of test types)
3. Static testing (structured group tests, static analyses, metrics)
4. Dynamic testing (black-box procedure, white-box procedure, experience-based test case determination)
5. Test management (test organisation and planning, economic aspects, test strategy, management of test work, error management, requirements for configuration management).
6. Testing tools (types, selection, introduction)
7. Modern test procedures (model-based testing, regression testing, testing of variant-rich systems)
8. Debugging

Additional Information
At the end of the course there is also the opportunity to be certified as an "ISTQB - Certified Tester - Foundation Level". A date and the modalities for the exam will be agreed on in the lecture.

Workload
150h

M 4.197 Module: Software-Evolution [M-INFO-100719]

Coordinators: Prof. Dr. Ralf Reussner
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Software Engineering and Compiler Construction (Usage from 1/16/2026)
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-101256	Software-Evolution	**WT**	**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 4.198 Module: Stochastic Information Processing [M-INFO-107847]

Coordinators: Prof. Dr.-Ing. Uwe Hanebeck
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Robotics and Automation (Usage from 10/1/2026)
Area of Specialization: Human-centred Machine Intelligence (Usage from 10/1/2026)
Elective Studies in Informatics (Usage from 10/1/2026)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-115261	Stochastic Information Processing	**WT**	**6 CP**	**Hanebeck**

Assessment
See Partial Achievements (Teilleistung).

Prerequisites
See Partial Achievements (Teilleistung).

Competence Goal
Qualification objective: Students can describe a given nonlinear dynamic model probabilistically and set up the equations for Bayesian inference. If no analytical solution exists, they can estimate the strength of the nonlinearity and select and implement a suitable practical filter for real-time state estimation.

Learning objective: Students are familiar with dynamic state models and methods for recursively estimating the state. The advantages and disadvantages of the various practical filters can be assessed in a problem-oriented manner.

Content
To deal with complex dynamic systems, as they occur for example in robotics, one typically requires both system models and the temporal evolution of the system states. For both system identification and state reconstruction, however, usually only noisy data are available.

For continuous state spaces, an exact calculation of the probability densities is only possible in a few special cases. In practice, general nonlinear systems are often traced back to these special cases by simplifying assumptions. One extreme is linearization with subsequent application of linear estimation theory. However, this often leads to unsatisfactory results and requires additional heuristic measures. At the other extreme are numerical approximation methods, which only evaluate the desired probability densities at discrete points in the state space. Although the basic principle of these methods is usually quite simple, their practical implementation is often difficult and, in particular for higher-dimensional systems, computationally demanding.

As a middle ground, analytical nonlinear estimation methods would therefore often be desirable. In this lecture the main difficulties in the development of such estimation methods are outlined and corresponding solution modules are presented. Based on these building blocks, some analytical estimation methods are discussed in detail as examples, which are very suitable for practical implementation and offer a good compromise between computing effort and performance. Useful applications of these estimation methods are also discussed. Both known methods and the results of current research are presented.

Additional Information
As a theoretical foundation lecture, "Stochastic Information Processing" is an ideal introduction to the ISAS lectures. Conversely, prior knowledge of "Localization of Mobile Agents" (LMA) [course no. 24613] may nevertheless be helpful depending on the type of learner - more concrete applications are highlighted there. In all of our lectures, the content is always derived and explained in detail from the beginning; it is therefore possible to start with SI or LMA.

Workload
[1.5 h lecture + 1.5 h exercise (3 SWS)] x 15
+ [4.5 h follow-up lecture + 3.5 h preparation exercise] x 15
+ 15 h exam preparation
= 180 h ≙ 6 ECTS

Recommendations
Knowledge of the basics of probability theory is helpful.

M 4.199 Module: Student Innovation Lab [M-ETIT-105073]

Coordinators: Prof. Dr.-Ing. Sören Hohmann
Prof. Dr. Werner Nahm
Prof. Dr.-Ing. Eric Sax
Prof. Dr. Wilhelm Stork
Prof. Dr. Orestis Terzidis
Prof. Dr.-Ing. Thomas Zwick

Organisation: KIT Department of Electrical Engineering and Information Technology

Part of: Minor Studies: Electrical Engineering

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-ETIT-110291	Innovation Lab	**WT+ST**	**9 CP**	**Hohmann, Nahm, Sax, Stork, Zwick**
T-WIWI-102864	Entrepreneurship	**WT+ST**	**3 CP**	**Terzidis**
T-WIWI-110166	SIL Entrepreneurship Project	**WT**	**3 CP**	**Terzidis**

Assessment
This module consists of an 60-minute written exam on the contents of the Entrepreneurship lectures, as well as 5 other types of exams on the contents of the seminar Entrepreneurship and Innovation Lab in the form of term papers and presentations. All exams results are graded. Details are given in the module components and will be given during the course.

Prerequisites
none

Competence Goal
Personal competence

- Reflection faculty:
  The students are able to analyze, evaluate and develop an alternative for action for certain elements of action in social interaction
- Decision-making ability:
  The students are able to prepare a decision template in time and to provide the necessary arguments for alternative decisions and therefore are able to decide in time.
- Interdisciplinary teamwork
  Students are able to detect their limits of competence in one domain and to adjust to a the non-specialist domain. The students are able to detect a lack in competence and to compensate this lack via competences of other team members. The students are able to communicate their domain-specific knowledge and develop a basic understanding of other domains.
- Value-based action:
  The students are able to use selected psychological tools to determine their own values. They are able to match these values with team members and reflect if their offer fits these values.

Social competence

- Ability to cooperate:
  The students are able to analyze and judge their cooperative behavior in a group.
- Communication competence:
  The students are able to present their information in persuasive, focused and target group oriented way.
- Ability to deal with conflicts:
  The students are able to detect conflicts in advance, analyze them and name solution concepts.

Innovation and entrepreneurship competence

- Agile product development:
  The students are able to apply methods of agile product development e.g. Scrum.
- Methodical innovation retrieval:
  The students are able to conduct processes for user- and technology-centered innovation to develop sustainable value propositions for certain target groups (e.g. Design Thinking (DT), Technology Application Selection (TAS)-process).
- Orientation on management of new technology-based firms (NTBF):
  The students are able to name central concepts of intellectual property and legal structures. The students are able to name the most important tasks of entrepreneurial leadership. They are able to name the most common form of business modeling and to setup a business plan. The students know important approaches to establish an organization. The students are able to determine the ownership structure in an investment situation. The students are able to name marketing concepts and setup a business model.
- Generate investment readiness:
  The students are able to setup rudimentary revenue and cost plan. Furthermore, they are able to establish a project plan for a company in order to derive an investment plan. The students are able to present their business proposal to investors and develop empathy for the investors.
- Competence to develop a business model:
  The students are able to apply respective tools for business modeling e.g. Business Model Canvas. The students are able to develop and assess alternative business models.
- Risk handling:
  The students are able to name basic risks w.r.t. requirements, technical limitations and profitability. The students are able to apply methods of customer interaction for evaluation of requirements and willingness to pay. The students are able to setup a rudimentary competitors analyze. The students are able to name and identify risks and present potential reactions.

Systemic technical competence

- Problem solution competence:
  The students are able to analyze, assess and structurally solve a technical problem.
- Agile methodology of system development:
  The students are able to name and apply different system development processes.
- Validation in volatile environment:
  The students are able to conduct technical and economical validation under volatile constraints. For this, they are able to name the constraints and interpret the results of the validation.
- Functional decomposition:
  The students are able to identify, interpret and derive functional requirements from complex customer needs.
- Architecture development:
  The students are able to recognize coherences from the functional requirements and derive a suitable system architecture.

Content
This module strives to combine technical, social and personal competences from the technical and entrepreneurial domain. The objective is to prepare students as best as possible for entrepreneurial activity within or outside of an established organization. Our teaching methods are research-based with a practical orientation.

The lecture Entrepreneurship as the essential component offers the theoretical basis and provides insight in important theoretical concepts and empirical evidence. Currently released case studies and practical experiences of successful founders support the theoretical and empirical content. In order to run a company for the long term additional knowledge is important. That's why the lecture also teaches basic principles for opportunity recognition, business modeling, an introduction to entrepreneurial marketing and leadership. Customer-based design methods from the lean startup approach as well as methods of technology-centered innovation are presented. Future founders have to be able to develop and handle resources such as financial and human capital, infrastructure and intellectual property. Further aspects tackle the establishment of an organization and funding of the own project.

The knowledge taught in the lecture Entrepreneurship will be applied in an application-oriented seminar and the labs. Hence we use an action learning approach to extend the taught knowledge by practical skills and reflection capabilities. In an team of five, the students will experience their way from the ideation process to the final pitch in front of investors.

The students are able to choose between the following options concerning the labs:

- The Automation Innovation Lab offers drones as an innovation platform for cooperative swarm solutions.
- The Industry 4.0 Innovation Lab enables innovation in the context of the next industrial revolution via mobile robot platforms.
- In the Interconnected Intelligent Systems Lab innovations in the context of Assisted Living and Smart Housing are enabled by providing a rich assembly set of mobile robots, actuators 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 presents methods of agile system development (Scrum) along with associated validation methods as well as methods for functional prototyping. Gate plans are used within the module to determine the progress of the project. Methods for single person work and teamwork are presented and applied. Additionally group-specific knowledge of the different roles of team members, solutions to conflict situations and interdisciplinary teams are presented.

Module Grade Calculation
The module grade consists of the written exam of the Lecture Entrepreneurship (40%), of the submissions and presentation of the Innovation Lab (40%) and of the submissions and presentation of the SIL Entrepreneurship Project (20%).

Additional Information
An application is required to participate in this module. Information about the application: www.kit-student-innovation-lab.de**.**

Workload
Lecture Entrepreneurship: 32h attendance time, 48h preparation and follow-up time, 10h preparation time for assessment

Seminar Entrepreneurship: 34h attendance time, 3h preparation and follow-up time, 53h preparation time for assessment.

Innovation Lab: 8h attendance time, 213h preparation and follow-up time, 49h preparation time for assessment.

This results in a total of 450 hours and a total of 15 LPs for both semesters (15*30/2 = 225).

Recommendations
It is recommended to attend the lecture Entrepreneurship at the same time as the seminar Entrepreneurship Project and the Innovation Lab in the winter semester.

Teaching and Learning Methods
Related courses:

Lecture Entrepreneurship
Seminar Entrepreneurship Project
Innovation Labs
Please note that the courses must be booked in parallel.

Related exams:

Written exams covering the content of lecture Entrepreneurship
Presentation of the Value Profile (seminar Entrepreneurship)
Submission of the Business Plan (seminar Entrepreneurship)
Submission of a Technical Report with requirements list and system architecture (Innovation Lab)
Submission of the reflection of the Gate Plans (Innovation Lab)
Presentation of the High-fidelity (Innovation Lab)

M 4.200 Module: Systems and Software Engineering [M-ETIT-100537]

Coordinators: Prof. Dr.-Ing. Eric Sax
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Minor Studies: Electrical Engineering

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-ETIT-100675	Systems and Software Engineering	**WT**	**6 CP**	**Sax**

Assessment
Written exam of 90 minutes.

Students are given the opportunity to earn a grade bonus through separate task 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. Bonus points do not expire and remain valid for exams taken at a later date.

Prerequisites
none

Competence Goal
• Students are able to analyse and explain the functional principles and applications of embedded systems.

• Students are able to evaluate and apply maturity models as well as Software Development Life Cycle models including the waterfall model, V-model, prototyping model, agile models, and DevOps.

• Students are able to apply various creativity techniques to develop innovative solutions to problems. They will be able to derive and analyse requirements.

• Students are familiar with diagram formats software modelling languages; they can evaluate and create these based on problem descriptions of an application area. They will be able to create and evaluate functional, data-oriented, algorithmic, state-oriented, and object-oriented views.

• Students are able to understand and apply various aspects of the realization of embedded systems. They will be able to consider implementation alternatives: hardware, co-design and scheduling aspects.

• Students are familiar with the various testing phases in a project and can explain them. They can assess the reliability of a system and understand the concept of functional safety.

Content
The focus of the course is on processes and methods for the design of systems composed of electrical, electronic and electronically programmable systems that contain software, hardware and mechanical components. The desired competencies of the course include the knowledge and goal-oriented use of modeling techniques, design processes, description and representation tools as well as specification languages that correspond to the current state of the art.

Module Grade Calculation
The grade is determined by the written exam and the bonus points.

Workload
- 15 weeks of 1.5h attendance in lecture and of 1.5h attendance in each exercise = 45 h
- 15 weeks of 2h preparation and follow-up per lecture and at least 3h preparation for each exercise (includes processing of exercise sheets and additional learning material, the processing of tasks for the acquisition of bonus points) = 75h
- Preparation for the exam = 60h

In total: 180h

Recommendations
Knowledge in Digital Technology and Information and Automation Technology (e.g. module M-ETIT-102102 and M-ETIT-106336)

M 4.201 Module: Systems Engineering for Automotive Electronics [M-ETIT-100462]

Coordinators: Prof. Dr.-Ing. Jürgen Bortolazzi
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: Minor Studies: Electrical Engineering

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-ETIT-100677	Systems Engineering for Automotive Electronics	**ST**	**4 CP**	**Bortolazzi**

Assessment
The type and method (written or oral examination) of the assessment will be announced at the beginning of the course.

The examination will take place without any aids.

Prerequisites
none

Competence Goal
Students are familiar with the systematic development process of electrical and electronic systems and architectures in the field of vehicle technology and the automotive industry. They are able to apply the tools supporting systematic development and to describe electrical and electronic architectures based on models. You will be able to analyze and evaluate systems in the domains of functional and physical modeling.

Content
The lecture provides knowledge of methods, techniques and procedures used in the development phases of electrical and electronic systems for vehicles.

Module Grade Calculation
The module grade is the grade of the written or oral examination. Attendance of the laboratory/exercise for the lecture is a prerequisite for admission to the examination.

Additional Information
The type of assessment (written or oral examination) will be announced at the beginning of the course.

The lecture will be examined in writing on the main date; for the follow-up date, the examination may also be oral.

The examination takes place without aids.

Attendance of the laboratory/exercise for the lecture is a prerequisite for admission to the examination.

Workload
1. attendance time in lecture and exercise: 60 h

2. preparation/follow-up of the same: 30 h

3. exam preparation: 30 h

Recommendations
It is recommended to attend the lecture SE (23611)

M 4.202 Module: Telematics [M-INFO-107243]

Coordinators: Prof. Dr. Martina Zitterbart
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Telematics (Usage until 3/31/2027)
Elective Studies in Informatics (Usage until 3/31/2027)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114269	Telematics	**WT**	**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

Additional Information
Offered for the last time in WS 26/27!!!!!

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 4.203 Module: Testing Digital Systems I [M-INFO-100851]

Coordinators: Prof. Dr. Mehdi Baradaran Tahoori
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Design of Embedded Systems and Computer Architectures
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-101388	Testing Digital Systems I	**Irreg.**	**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 4.204 Module: Testing Digital Systems II [M-INFO-102962]

Coordinators: Prof. Dr. Mehdi Baradaran Tahoori
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Design of Embedded Systems and Computer Architectures
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-105936	Testing Digital Systems II	**Irreg.**	**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 4.205 Module: Text Indexing [M-INFO-107202]

Coordinators: Prof. Dr. Peter Sanders
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Algorithm Engineering
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114226	Text-Indexing	**WT**	**4 CP**	**Sanders**
T-INFO-114227	Text-Indexing Project/Experiment	**WT**	**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 text indexing, 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 the area of text indexing.

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 algorithms and data structures for texts, especially text indices. Text indices are data structures that provide additional information about a text in order to accelerate queries regarding this text. These can be simple pattern matching queries ("Does a pattern occur in the text?") or more complex data mining queries ("Which pattern of a certain length occurs most often in the text?").

Furthermore, we deal with text compression. Here, we want to represent a text as space-efficiently as possible. However, we have to make sure that the original text can be reconstructed completely. Here, we speak of lossless compression. In the lecture, we will learn about techniques that are used in compression programs such as gzip.

Workload
The lectures including the project/experiment with 5 ECTS 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

Recommendations
The lecture builds on parts of the contents of the lectures Algorithms I and Algorithms II. Corresponding knowledge is therefore helpful.

M 4.206 Module: Theory of Satisfiability Algorithms [M-INFO-107639]

Coordinators: Prof. Dr.-Ing. Marvin Künnemann-Goos
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Theoretical Foundations (Usage from 4/1/2026)
Area of Specialization: Algorithm Engineering (Usage from 4/1/2026)
Elective Studies in Informatics (Usage from 4/1/2026)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114982	Theory of Satisfiability Algorithms	**Irreg.**	**4 CP**	**Künnemann-Goos**

Assessment
See Partial Achievements (Teilleistung).

Prerequisites
See Partial Achievements (Teilleistung).

Competence Goal
Students know the foundations of the rigorous theoretical analysis of algorithms for the Satisfiability problem and its many variants. They have an overview over the state of the art of worst-case time upper bounds. They understand further theoretical aspects such as combinatorial properties, hardness conjectures, etc. and are able to derive implications for the (sub)exponential-time solvability of related problems.

Content
The Satisfiability (SAT) problem for Boolean formulas is fundamental for computer science, due to a variety of applications (cf. the practical success of SAT solvers) as well as its central role for the theory of computation. This course focuses on theoretical aspects of the problem, which includes topics among:

- exponential-time algorithms with provable worst-case guarantees (e.g., for k-SAT, CNF-SAT and further variants)
- tractable special cases of the problem
- classification of constraint satisfaction problems
- combinatorial insights (e.g., the algorithmic Lovasz Local Lemma)
- the sparsification lemma and its limits
- generalizations: MaxSAT, #SAT, Quantified SAT
- hardness hypotheses and their implications: ETH, SETH, NSETH, MASETH, Formula-SETH
- isolation lemma

Workload
4 CP correspond to approx. 120 h of work, estimated as follows:
- ca. 30 h attendance in lectures
- ca. 60 h follow-up on lectures, solving exercises, independent review
- ca. 30 h preparation for exam

Recommendations
See Partial Achievements (Teilleistung).

M 4.207 Module: Type Systems and Program Analysis [M-INFO-107664]

Coordinators: Prof. Dr. Sebastian Erdweg
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Theoretical Foundations
Area of Specialization: Software Engineering and Compiler Construction
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-115016	Type Systems and Program Analysis	**Irreg.**	**6 CP**	**Erdweg**

Assessment
See Partial Achievements (Teilleistung).

Prerequisites
See Partial Achievements (Teilleistung).

Competence Goal
- Students can understand, design, and implement static type systems.
- Students can validate the soundness of static type systems.
- Students know the foundations of abstract interpretation.
- Students can understand, design, and implement data-flow analyses.
- Students can assess analyses based on their soundness, recall, and precision.

Content
Static type systems and program analyses predict the behavior of programs through source-code analysis, but without executing the program. They are fundamental for isolating ill-defined program behavior (e.g., from type errors), but can also find bugs or also can provide guarantees (e.g., memory safety). Topics covered in this course include the design, definition, formalization, and application of type systems and static program analyses, including type inference, dependent typing, control flow, data flow, abstract interpretation, soundness, and precision.

Workload
1. Attendance time 4 h x 15 weeks = 60 h
2. Self-study 7 h x 15 weeks = 105 h
3. Preparation for the exam 15 h

Recommendations
Knowledge of programming semantics is helpful but not required.
Knowledge of logic inference systems is helpful but not required.

M 4.208 Module: Ubiquitous Computing [M-INFO-107161]

Coordinators: Prof. Dr.-Ing. Michael Beigl
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Telematics
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114188	Ubiquitous Computing	**WT**	**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 4.209 Module: User Studies in Human-Robot Interaction [M-INFO-107834]

Coordinators: TT-Prof. Dr. Barbara Bruno
Organisation: KIT Department of Informatics
Part of: Area of Specialization: Robotics and Automation (Usage from 10/1/2026)
Area of Specialization: Human-centred Machine Intelligence (Usage from 10/1/2026)
Elective Studies in Informatics (Usage from 10/1/2026)

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-115244	User Studies in Human-Robot Interaction	**WT**	**6 CP**	**Bruno, Neef, Norman**

Assessment
See Partial Achievements (Teilleistung).

Prerequisites
See Partial Achievements (Teilleistung).

Competence Goal
Students acquire methodological competencies for independently designing, conducting, and critically evaluating empirical user studies in Human-Robot Interaction (HRI). The focus is on robots interacting with people in social and interactive contexts (e.g., as assistants, companions, tutors, coaches, or collaborative partners).

Students develop the ability to formulate research questions based on existing HRI literature and to select appropriate empirical methods for answering them. This includes quantitative, qualitative, and mixed-methods approaches. Students gain familiarity with central constructs commonly investigated in HRI, such as engagement, trust, acceptance, social presence, and interaction quality.

Particular emphasis is placed on informed methodological decision-making. Students are trained to consider the technical, contextual, and ethical constraints that often arise in HRI studies, especially when robots are evaluated with human participants in realistic or semi-realistic settings. The module draws on perspectives from computer science, engineering, psychology, and the social sciences. Students are able to address both the technical preparation of an interaction scenario and the human-centered evaluation of the resulting interaction.

Through hands-on project work, students gain practical experience in planning and conducting an HRI user study. This includes the development of interaction scenarios, preparation of study materials, participant recruitment, data collection and analysis, and reflection on methodological trade-offs, such as experimental control versus ecological validity. Students also develop the ability to communicate empirical findings and their limitations in written and oral research-oriented formats.

Content
The module focuses on empirical research methods for studying how people interact with robots. It covers the systematic design, execution, analysis, and critical reflection of HRI user studies.

Topics include the formulation of research questions; experimental, quasi-experimental, and exploratory study designs; Wizard-of-Oz methodologies (i.e., robots partly or fully controlled by a human during a study); qualitative and quantitative data collection techniques; mixed-methods approaches; data analysis strategies; and ethical considerations in HRI research. Ethical aspects include informed consent, responsible handling of participant data, and the consideration of participant comfort and safety during human-robot interaction.

Students work in small groups to plan, pilot, and conduct their own HRI user study projects. Depending on the project, this may include interaction design and scripting, study protocols, participant recruitment, data logging, observation, and questionnaire as well as interview-based data collection, and the analysis of behavioral, observational, and self-report data.
Empirical results are interpreted in relation to methodological limitations, contextual factors, and study assumptions. Students critically reflect on the strengths and weaknesses of different study designs and motivate their methodological choices. Group discussions and peer feedback support exchange between student groups and encourage critical engagement with different research approaches.

The module prepares students for independent research projects, Master's theses, and empirical work in academic or industrial HRI contexts.

The module is designed as a methodological complement to and continuation of the lecture "HRI and Social Robotics". While the lecture provides a broad introduction to theories, technologies, and interaction capabilities of social robots, "User Studies in Human-Robot Interaction" focuses on the empirical study of human-robot interaction. The two modules are independent but mutually reinforcing.

Additional Information
Attendance is mandatory, as active participation in discussions, group work, and presentations is required.

Workload
Course workload:

1) Attendance of interactive course/exercise sessions: 45h (15 x 180 min)
2) Self-study of course material and work on homework assignments: 45h (≈3h/week)
3) Project work (study design, data collection, analysis, reporting): 90 h

Total Load = 180 h

Recommendations
Participation in the lecture "HRI and Social Robotics" or similar introductory courses is recommended but not required. Familiarization with the lecture content is recommended if the course has not been attended.

M 4.210 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: Area of Specialization: Robotics and Automation
Area of Specialization: Human-centred Machine Intelligence
Elective Studies in Informatics

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

ID	Name	Term offered	Credits	Lecturers
Mandatory				
T-INFO-114145	Wearable Robotic Technologies	**ST**	**4 CP**	**Asfour, Beigl**

Assessment
See partial achievements (Teilleistung)

Prerequisites
See partial achievements (Teilleistung)

Competence Goal
Students can explain the fundamentals, motivation, and applications of wearable robotic technologies including exoskeletons, orthoses, and prostheses. They have comprehensive knowledge of human anatomy, biomechanics, and the neuromuscular system relevant to wearable robot design.

Students understand the core components and challenges associated with the design of wearable robotic technologies, including mechanisms, actuation technologies, sensing approaches, and wearable computing concepts. They can analyze design requirements and challenges including kinematic compatibility and human-robot interfaces for wearable robots.

Students can explain control strategies for prosthetic and exoskeleton systems, understand both physical and cognitive aspects of human-robot interaction, and comprehend concepts such as body schema and symbiotic human-machine interaction in wearable systems.

Content
The lecture provides a comprehensive introduction to wearable robotic technologies. It covers human anatomy and biomechanics as foundations for wearable robot design. Joint biomechanics, locomotion and gait analysis, the neuromuscular system, and models of the human body are discussed to understand how wearable robots can be designed and controlled.

Design principles and mechanisms of wearable robots are addressed. Actuation technologies are covered in depth: requirements analysis based on human motion and user needs, compliant actuation approaches (serial elastic, parallel elastic, variable stiffness actuation), and strategies for increasing efficiency such as energy harvesting, multi-articulation, and underactuation.

The lecture covers wearable computing principles such as body signals and phenomena, design principles for body-worn systems, attachment considerations based on body maps for heat tolerance, weight distribution, and flexibility, and fabric design with textile-embedded electronics.

Exoskeleton systems are presented, covering application areas, design challenges such as redundancy, kinematic compatibility, and misalignments, various types of exoskeletons, and the general design process. Prosthetic systems cover types of hand and lower limb prostheses, hand synergies for control, and mechanical interfaces through socket design.

Human-robot interaction addresses both physical and cognitive interfaces. Control strategies are presented for prosthetic systems (semi-autonomous grasping) and exoskeleton systems (hierarchical control, assistance evaluation). The concept of body schema from both neuroscience and robotics perspectives is discussed, emphasizing symbiotic human-machine interaction in tightly coupled wearable systems. State-of-the-art examples across various application domains illustrate current research and developments.

Workload
Lecture with 2 SWS, 4 ECTS.
4 ECTS corresponds to ca. 120 hours, thereof
ca. 15 * 2h = 30h attendance in the lecture
ca. 15 * 3h = 45h preparation and follow-up of the lecture
ca. 45h preparation for the exam and exam itself

5 Module components

T 5.1 Module component: Practical Course: Decentralized Learning Lab [T-INFO-115246]

Coordinators: Prof. Dr. Hannes Hartenstein
Organisation: KIT Department of Informatics
Part of: M-INFO-107836 - Practical Course: Decentralized Learning Lab

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

Courses					
WT 26/27	**2400102**	Practical Course: Decentralized Learning Lab	**1 SWS**	**Practical course /** 🗣	**Hartenstein, Hemken**

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO). The following partial aspects are included in the grading: Presentation (duration approx. 20 min.) and a corresponding report. 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
Basic knowledge of Machine Learning and Decentralized Systems is helpful.

T 5.2 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

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

Courses					
ST 2026	**2400147**	Access Control Systems: Models and Technology	**3 SWS**	**Lecture / Practice /** 🗣	**Hartenstein, Hemken**
Exams					
ST 2026	**7500176**	Access Control Systems: Models and Technology			**Hartenstein**
WT 26/27	**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.

T 5.3 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	Term offered	Version
Written examination	5 CP	graded	Each winter term	1

Courses					
WT 26/27	**2400120**	Advanced Bayesian Data Analysis	**3 SWS**	**Lecture / Practice /**	**Klein**
Exams					
ST 2026	**7500233**	Nachklausur 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 5.4 Module component: Advanced Competitive Programming [T-INFO-115279]

Coordinators: TT-Prof. Dr. Thomas Bläsius
Prof. Dr.-Ing. Marvin Künnemann-Goos
Organisation: KIT Department of Informatics
Part of: M-INFO-107863 - Advanced Competitive Programming

Type	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Irregular	1

Courses					
WT 26/27	**2400145**	Advanced Competitive Programming	**2 SWS**	**Lecture /** 🗣	**Künnemann-Goos, Bläsius**
Exams					
WT 26/27	**7500317**	Advanced Competitive Programming			**Künnemann-Goos, Bläsius**

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO). The grade will be determined by the performance in solving programming assignments in the form of homework contests, live contests and a final exam contest. The grading scale will be announced in the course. Students may redraw from the examination until the second live contest.

Prerequisites
None.

Recommendations
The course assumes basic knowledge of algorithms and data structures (e.g., lectures Algorithms 1 and 2) and coding in C++.

We strongly recommend successful participation in “Basispraktikum zum ICPC Programmierwettbewerb”, a similar course or basic experience with competitive programming contests.

T 5.5 Module component: Advanced Data Structures [T-INFO-114223]

Coordinators: Prof. Dr. Peter Sanders
Organisation: KIT Department of Informatics
Part of: M-INFO-107200 - Advanced Data Structures

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2026	**2400164**	Advanced Data Structures	**3 SWS**	**Lecture /** 🗣	**Sanders, Hermann, Walzer, Groot Koerkamp**
Exams					
ST 2026	**7500155**	Advanced Data Structures			**Sanders**
WT 26/27	**7500538**	Advanced Data Structures			**Sanders**

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

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

Prerequisites
None.

Modeled Prerequisites
The following conditions have to be fulfilled:
1. The module component T-INFO-114224 - Advanced Data Structures Project/Experiment must have been started.

Recommendations
The lecture builds on parts of the contents of the lectures Algorithms I and Algorithms II. Corresponding knowledge is therefore helpful.

T 5.6 Module component: Advanced Data Structures Project/Experiment [T-INFO-114224]

Coordinators: Prof. Dr. Peter Sanders
Organisation: KIT Department of Informatics
Part of: M-INFO-107200 - Advanced Data Structures

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

Courses					
ST 2026	**2400164**	Advanced Data Structures	**3 SWS**	**Lecture /** 🗣	**Sanders, Hermann, Walzer, Groot Koerkamp**
Exams					
ST 2026	**7500135**	Advanced Data Structures Project/Experiment			**Sanders**
WT 26/27	**7500216**	Advanced Data Structures Project/Experiment			**Sanders**

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

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 5.7 Module component: Advanced Machine Learning and Data Science [T-WIWI-111305]

Coordinators: Prof. Dr. Maxim Ulrich
Organisation: KIT Department of Business and Economics
Part of: M-WIWI-105659 - Advanced Machine Learning and Data Science

Type	Credits	Grading	Term offered	Version
Examination of another type	9 CP	graded	Each term	5

Courses					
ST 2026	**2500016**	Advanced Machine Learning and Data Science	**4 SWS**	**Project /**	**Ulrich**
WT 26/27	**2500063**	Advanced Machine Learning and Data Science	**4 SWS**	**Project /**	**Ulrich**
Exams					
ST 2026	**7900378**	Advanced Machine Learning and Data Science			**Ulrich**
WT 26/27	**7900378**	Advanced Machine Learning and Data Science			**Ulrich**

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

Assessment
The assessment is carried out as a single examination of another type. It includes the interim presentations during the project, the quality of the implementation, the written final paper, and the final presentation. All components are integrated into a single overall assessment, and the resulting grade reflects the overall impression of the combined performance.

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

T 5.8 Module component: AI- and Data-Driven B2B Sales [T-WIWI-115326]

Coordinators: Prof. Dr. Martin Klarmann
Anja Konhäuser
Organisation: KIT Department of Business and Economics
Part of: M-WIWI-106258 - Digital Marketing

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

Exams			
ST 2026	**7900297**	Digital Marketing and Sales in B2B	**Klarmann**

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
The course “AI- and Data-Driven B2B Sales” provides a comprehensive understanding of how digital and AI-enabled business models are designed, scaled, and evaluated. Particular emphasis is placed on the role of data and artificial intelligence throughout the customer journey and their impact on both B2B and B2C environments. Students learn how to analyze structured and unstructured data, apply relevant KPIs, and transform data- and AI-driven insights into tangible business value. The course content is reinforced through a practical case study in which students develop a business case based on data, assumptions, and forecasts, and evaluate its economic impact.

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

T 5.9 Module component: Algorithm Engineering [T-INFO-101332]

Coordinators: Prof. Dr. Peter Sanders
Organisation: KIT Department of Informatics
Part of: M-INFO-100795 - Algorithm Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	4

Courses					
ST 2026	**2400022**	Algorithm Engineering	**3 SWS**	**Lecture /** 🗣	**Sanders, Hermann**
WT 26/27	**2400021**	Algorithm Engineering		**Lecture /** 🗣	**Sanders, Seemaier**
Exams					
ST 2026	**7500276**	Algorithm Engineering			**Sanders**
ST 2026	**75514**	Algorithm Engineering			**Sanders**
WT 26/27	**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.

Modeled Prerequisites
The following conditions have to be fulfilled:
1. The module component T-INFO-111856 - Algorithm Engineering Pass must have been started.

T 5.10 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 2026	**7500339**	Algorithm Engineering Pass	**Sanders**
WT 26/27	**7500187**	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 5.11 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 2026	**2400028**	Algorithmic Graph Theory	**3 SWS**	**Lecture / Practice /** 🗣	**Ueckerdt**
Exams					
ST 2026	**7500238**	Algorithmic Graph Theory			**Ueckerdt**
WT 26/27	**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

T 5.12 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

Courses					
ST 2026	**2400155**	Graph Drawing	**3 SWS**	**Lecture / Practice /** 🗣	**Ueckerdt**
Exams					
ST 2026	**7500404**	Graph Drawing			**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.

T 5.13 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 26/27	**2424079**	Algorithms II	**4 SWS**	**Lecture /** 🗣	**Sanders, Künnemann-Goos, Stieß, Gokaj**
Exams					
ST 2026	**7500080**	Algorithms II - Nachklausur			**Künnemann-Goos**
WT 26/27	**7500245**	Algorithms II			**Künnemann-Goos**

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.

T 5.14 Module component: Artificial Intelligence & IT-Security [T-INFO-113668]

Coordinators: Prof. Dr. Christian Wressnegger
Organisation: KIT Department of Informatics
Part of: M-INFO-106810 - Artificial Intelligence & IT-Security

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

Courses					
WT 26/27	**24000**	Artificial Intelligence & IT-Security	**4 SWS**	**Lecture / Practice /** 🗣	**Wressnegger**
Exams					
WT 26/27	**7500396**	Artificial Intelligence & IT-Security			

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

Assessment
The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 120 minutes.

Depending on the number of participants, it will be announced six weeks before the examination performance (§ 6 Abs. 3 SPO) whether the performance review will be

- in the form of an oral examination according to § 4 Abs. 2 no. 2 SPO **or**
- in the form of a written examination according to § 4 Abs. 2 Nr. 1 SPO

takes place.

Prerequisites
None.

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

T 5.15 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

Courses					
ST 2026	**2400108**	Nicht im SoSe 2026! Automated Planning and Scheduling		**Lecture / Practice**	**Schreiber, Sanders**
WT 26/27	**2400026**	Nicht im WS 2026/27! - Automated Planning and Scheduling		**Lecture / Practice**	**Schreiber, Sanders**

Assessment
The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting 30 minutes.

Prerequisites
None.

T 5.16 Module component: Autonomous Driving in Practice [T-MACH-115202]

Coordinators: Kevin Simon
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-107806 - Autonomous Driving in Practice

Type	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Each winter term	1

Courses					
WT 26/27	**2113820**	Autonomous Driving in Practice	**3 SWS**	**Lecture / Practice /** 🗣	**Frey, Simon**
Exams					
WT 26/27	**76-T-MACH-115202**	Autonomous Driving in Practice			**Simon**

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

Assessment
The final grade is based on: 2 written exams (duration about 30 minutes) and the final presentation of the practical task (duration 30 minutes max.), including the final report (2-3 pages). Submission of the homework is mandatory.

The overall impression will be evaluated.

Recommendations
Prior experience in autonomous driving, automotive engineering, and machine learning is a plus.

Additional Information
Due to capacity limitations, the lecture is limited to 16 students. If necessary, a selection process will be conducted. Places will be allocated based on the students' academic progress (semester level and subject-specific programming skills).

The course will be conducted in English.

Workload
180 hours

T 5.17 Module component: Autonomous Learning for Intelligent Robot Perception [T-INFO-113327]

Coordinators: Prof. Dr. Rudolph Triebel
Organisation: KIT Department of Informatics
Part of: M-INFO-106608 - Autonomous Learning for Intelligent Robot Perception

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

Courses					
WT 26/27	**2400213**	Autonomous Learning for Intelligent Robot Perception	**2 SWS**	**Lecture / Practice /** 🗣	**Triebel**
Exams					
ST 2026	**7500423**	Autonomous Learning for Intelligent Robot Perception			**Triebel**
WT 26/27	**7500373**	Autonomous Learning for Intelligent Robot Perception			**Triebel**

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
A basic understanding of probability theory and linear algebra is required

T 5.18 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 26/27	**2400121**	Beating the Worst Case in Practice: Surprisingly Efficient Algorithms	**4 SWS**	**Practical course /** 🗣	**Wilhelm, von der Heydt, Bläsius**
WT 26/27	**2400253**	Beating the Worst-Case in Practice: Unexpectedly Efficient Algorithms	**4 SWS**	**Practical course /** 🗣	**Bläsius, von der Heydt, Göttlicher**
Exams					
WT 26/27	**7500368**	Beating the Worst-Case in Practice: Unexpectedly Efficient Algorithms			**Bläsius**

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO). An implementation and a written elaboration must be prepared.

Prerequisites
None.

T 5.19 Module component: Biologically Inspired Robots [T-MACH-113856]

Coordinators: Prof. Dr.-Ing. Arne Rönnau
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106903 - Biologically Inspired Robots

Type	Credits	Grading	Term offered	Expansion	Version
Oral examination	3 CP	graded	Each summer term	1 semesters	1

Courses					
ST 2026	**2122330**	Biologically Inspired Robots	**2 SWS**	**Lecture /** 🗣	**Rönnau**
Exams					
ST 2026	**76-T-MACH-113856**	Biologically Inspired Robots			**Rönnau**
ST 2026	**76-T-MACH-113856-mdl**	Biologically Inspired Robots			**Rönnau**
WT 26/27	**76-T-MACH-113856**	Biologically Inspired Robots			**Rönnau**

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

Assessment
Success is assessed in the form of an oral examination (approx. 15-20 minutes)

Prerequisites
none

Recommendations
It is recommended to listen to the course "Robotics I" beforehand .

Additional Information
The course is offered in English.

Workload
90 hours

T 5.20 Module component: Business Innovation in Optics and Photonics [T-ETIT-104572]

Coordinators: Prof. Dr. Werner Nahm
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-101834 - Business Innovation in Optics and Photonics

Type	Credits	Grading	Term offered	Version
Examination of another type	4 CP	graded	Each winter term	2

Courses					
WT 26/27	**2305742**	Business Innovation in Optics and Photonics	**2 SWS**	**Lecture /** 🗣	**Riedel, Nahm**
WT 26/27	**2305743**	Erxercise for 2305742 Business Innovation in Optics and Photonics	**1 SWS**	**Practice /** 🗣	**Riedel, Nahm**
Exams					
WT 26/27	**7305742**	Business Innovation in Optics and Photonics			**Nahm, Riedel**

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

Assessment
Type of Examination: examination of another type

Duration of Examination: 4 group presentations à 20 minutes (approx.)

Modality of Exam: The exam consists of four group presentations. 2nd day: Technology Presentation. 3rd day: Development plan presentation. 4th day: Business Canvas presentation. Final presentation: Business pitch. The overall impression is rated.

Prerequisites
none

Recommendations
Good knowledge in optics & photonics. Personal motivation and interest for getting deeper into business development aspects, methods and tools. Commitment to active, regular and coninuous participation in the group work.

T 5.21 Module component: CAD Engineering Project for Intelligent Systems [T-MACH-113857]

Coordinators: Prof. Dr.-Ing. Arne Rönnau
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106905 - CAD Engineering Project for Intelligent Systems

Type	Credits	Grading	Term offered	Expansion	Version
Examination of another type	6 CP	graded	Each term	1 semesters	2

Courses					
ST 2026	**2122331**	CAD Engineering Project for Intelligent Systems	**4 SWS**	**Project /** 🗣	**Rönnau**
WT 26/27	**2122331**	CAD Engineering Project for Intelligent Systems	**4 SWS**	**Seminar /** 🗣	**Rönnau**
Exams					
ST 2026	**76-T-MACH-113857**	CAD Engineering Project for Intelligent Systems			**Rönnau**

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

Assessment
Success control takes place in the form of another type of examination. Design project as well as written elaboration in a team and a final presentation. The overall impression is rated. Further details will be provided at the beginning of the course.

Prerequisites
none

Additional Information
The course is offered in English.

Workload
180 hours

T 5.22 Module component: Channel Coding: Algebraic Methods for Communications and Storage [T-ETIT-111244]

Coordinators: Prof. Dr.-Ing. Laurent Schmalen
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-105616 - Channel Coding: Algebraic Methods for Communications and Storage

Type	Credits	Grading	Term offered	Expansion	Version
Oral examination	3 CP	graded	Each summer term	1 semesters	1

Courses					
ST 2026	**2310546**	Channel Coding: Algebraic Methods for Communications and Storage	**2 SWS**	**Lecture /** 🗣	**Fengler, Schmalen**
Exams					
ST 2026	**7310546-1**	Channel Coding: Algebraic Methods for Communications and Storage			**Fengler**
WT 26/27	**7310546-1**	Channel Coding: Algebraic Methods for Communications and Storage			**Fengler**

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

Assessment
The exam is held as an oral exam of approx. 20 min.

The module grade of the module corresponds to the grade of the oral exam.

Prerequisites
none

Recommendations
Previous attendance of the lectures "Communication Engineering I" and "Probability Theory" is recommended.

T 5.23 Module component: Channel Coding: Graph-Based Codes [T-ETIT-111245]

Coordinators: Prof. Dr.-Ing. Laurent Schmalen
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-105617 - Channel Coding: Graph-Based Codes

Type	Credits	Grading	Term offered	Expansion	Version
Oral examination	6 CP	graded	Each winter term	1 semesters	1

Courses					
WT 26/27	**2310520**	Channel Coding: Graph-Based Codes	**3 SWS**	**Lecture /** 🗣	**Schmalen**
WT 26/27	**2310521**	Exercise for 2310520 Channel Coding: Graph-Based Codes	**1 SWS**	**Practice /** 🗣	**Schmalen**
Exams					
ST 2026	**7310520-1**	Channel Coding: Graph-Based Codes			**Schmalen**
WT 26/27	**7310520-1**	Channel Coding: Graph-Based Codes			**Schmalen**

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

Assessment
The success control takes place in the form of an oral examination lasting approx. 25 minutes. Before the examination, there is a preparation phase of 30 minutes in which preparatory tasks are solved.

Prerequisites
none

Recommendations
Previous attendance of the lectures "Communication Engineering I" and "Theory of Probability" is recommended. Knowledge from the lectures "Applied Information Theory" and "Verfahren der Kanalcodierung" is helpful.

T 5.24 Module component: Combinatorics [T-MATH-105916]

Coordinators: Prof. Dr. Maria Aksenovich
Organisation: KIT Department of Mathematics
Part of: M-MATH-102950 - Combinatorics

Type	Credits	Grading	Term offered	Version
Written examination	9 CP	graded	Irregular	4

Courses					
ST 2026	**0150300**	Combinatorics	**4 SWS**	**Lecture**	**Aksenovich, Sagdeev**
ST 2026	**0150310**	Tutorial for Combinatorics (0150300)	**2 SWS**	**Practice**	**Aksenovich, Sagdeev**
Exams					
ST 2026	**00009**	Combinatorics			**Aksenovich**
WT 26/27	**7700076**	Combinatorics			**Aksenovich**

Prerequisites
none

T 5.25 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 2026	**2400055**	Compiler Design	**4 SWS**	**Lecture /** 🗣	**Platzer**
Exams					
ST 2026	**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 5.26 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 2026	**2400119**	Computational Geometry	**4 SWS**	**Lecture / Practice /** 🗣	**Bläsius, Yi, Wilhelm, von der Heydt**
WT 26/27	**2400156**	Computational Geometry	**4 SWS**	**Lecture / Practice /** 🗣	**Bläsius, Yi, von der Heydt, Schmidt**
Exams					
ST 2026	**7500247**	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.

T 5.27 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 2026	**2400119**	Computational Geometry	**4 SWS**	**Lecture / Practice /** 🗣	**Bläsius, Yi, Wilhelm, von der Heydt**
WT 26/27	**2400156**	Computational Geometry	**4 SWS**	**Lecture / Practice /** 🗣	**Bläsius, Yi, von der Heydt, Schmidt**
Exams					
ST 2026	**7500034**	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.

T 5.28 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 26/27	**2400173**	Computational Imaging	**3 SWS**	**Lecture / Practice /** 🗣	**Meyer, Beyerer**
Exams					
ST 2026	**7500351**	Computational Imaging			**Beyerer**
WT 26/27	**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.

T 5.29 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

Courses					
ST 2026	**2400097**	Constructive Logic (findet im SoSe 26 nicht statt!)	**4 SWS**	**Lecture / 🗣**	**Platzer**
Exams					
ST 2026	**7500206**	Constructive Logic			**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.

Prerequisites
None.

Recommendations
You will be expected to follow the lecture notes.

T 5.30 Module component: Cryptographic Protocols II: Universal Composability [T-INFO-114602]

Coordinators: Prof. Dr. Jörn Müller-Quade
Organisation: KIT Department of Informatics
Part of: M-INFO-107435 - Cryptographic Protocols II: Universal Composability

Type	Credits	Grading	Term offered	Version
Oral examination	3 CP	graded	Each winter term	1

Courses					
WT 26/27	**2400022**	Cryptographic Protocols II: Universal Composability	**2 SWS**	**Lecture /** 🗣	**Müller-Quade, Mechler**
Exams					
ST 2026	**7500179**	Cryptographic Protocols II: Universal Composability			**Müller-Quade, Mechler**
WT 26/27	**7500296**	Cryptographic Protocols II: Universal Composability			**Müller-Quade, Mechler**

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

Assessment
The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) approx. 30 minutes.

Prerequisites
None.

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

T 5.31 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					
ST 2026	**2400098**	Data science and Artificial Intelligence for Energy Systems	**2 SWS**	**Lecture /** 🗣	**Schäfer**
ST 2026	**2400173**	Data science and Artificial Intelligence for Energy Systems (Excercise)	**2 SWS**	**Practice /** 🗣	**Schäfer**
WT 26/27	**2400079**	Data Science and Artificial Intelligence for Energy Systems	**2 SWS**	**Lecture /** 🗣	**Schäfer**
WT 26/27	**2400082**	Data Science and Artificial Intelligence for Energy Systems	**2 SWS**	**Practice /** 🗣	**Schäfer, Nikoltchovska, Sadric**
Exams					
ST 2026	**7500309**	Data Science and Artificial Intelligence for Energy Systems			**Schäfer**
WT 26/27	**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.

T 5.32 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 2026	**2400089**	Decentralized Systems: Fundamentals, Modeling, and Applications	**4 SWS**	**Lecture / Practice /** 🗣	**Hartenstein, Jacob**
Exams					
ST 2026	**7500070**	Decentralized Systems: Fundamentals, Modeling, and Applications			**Hartenstein**
ST 2026	**7500284**	Decentralized Systems: Fundamentals, Modeling, and Applications			**Hartenstein**
WT 26/27	**7500141**	Decentralized Systems: Fundamentals, Modeling, and Applications			**Hartenstein**
WT 26/27	**7500371**	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.

T 5.33 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 2026	**2400024**	Deep Learning and Neural Networks	**4 SWS**	**Lecture /** 🗣	**Niehues**
Exams					
ST 2026	**7500044**	Deep Learning and Neural Networks			**Niehues**
WT 26/27	**7500400**	Deep Learning and Neural Networks (Nachklausur)			**Niehues**

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

Assessment
The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 60 minutes.

Prerequisites
T-INFO-101383 - Neural networks must not be started.

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

T 5.34 Module component: Deep Learning for Computer Vision: Advanced Topics [T-INFO-115257]

Coordinators: Prof. Dr.-Ing. Rainer Stiefelhagen
Organisation: KIT Department of Informatics
Part of: M-INFO-107843 - Deep Learning for Computer Vision: Advanced Topics

Type	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each winter term	1

Assessment
Success is assessed in the form of a written examination (lasting 60 minutes) in accordance with § 4 Abs. 2 No. 1 SPO .

Prerequisites
None.

Recommendations
Knowledge of deep learning basics is strongly recommended.

T 5.35 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 26/27	**2424106**	Design and architectures of embedded systems (ES2)	**2 SWS**	**Lecture**	**Khdr, Henkel**
Exams					
ST 2026	**7500037**	VL: Design and architectures of embedded systems (ES2)			**Henkel**
WT 26/27	**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.

T 5.36 Module component: Digital Marketing [T-WIWI-112693]

Coordinators: Prof. Dr. Ann-Kristin Kupfer
Organisation: KIT Department of Business and Economics
Part of: M-WIWI-106258 - Digital Marketing

Type	Credits	Grading	Term offered	Version
Examination of another type	4,5 CP	graded	Each summer term	1

Courses					
ST 2026	**2571185**	Digital Marketing	**2 SWS**	**Lecture /** 🗣	**Kupfer**
ST 2026	**2571186**	Digital Marketing Exercise	**1 SWS**	**Practice /** 🗣	**Schmitt, Cinar, Kupfer**
Exams					
ST 2026	**7900064**	Digital Marketing			**Kupfer**
WT 26/27	**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

T 5.37 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 26/27	**2400050**	Distributed Computing	**2 SWS**	**Lecture /** 🗣	**Streit, Schnepf, Gudu**
Exams					
WT 26/27	**7500322**	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.

Modeled Prerequisites
The following conditions have to be fulfilled:
1. The module component T-INFO-101298 - Distributed Computing must not have been started.

Recommendations
Knowledge in the area of computer networks helpful.

T 5.38 Module component: Economic Decision Making [T-WIWI-114174]

Coordinators: Prof. Dr. Benjamin Scheibehenne
Organisation: KIT Department of Business and Economics
Part of: 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	2

Courses					
WT 26/27	**2500059**	Economic Decision Making	**3 SWS**	**Lecture / Practice /** 🗣	**Scheibehenne**
Exams					
WT 26/27	**7900173**	Economic Decision Making			**Scheibehenne**

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

Assessment
Alternative exam assessment. The grading includes the following aspects:

- A written exam (60 minutes)
- A presentation during the exercise
- In-class assignments (requires regular attendance)

The scoring system for the grading will be announced at the beginning of the course.

Prerequisites
Due to the interactive nature of the class, the number of participants is limited to 30 students. Registration via the WiWi Portal is required for participation in the class. Further information on participant selection will be provided in the WiWi Portal.

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. The class will take place twice a week during the first half of the wintersemester. The exam will take place before Christmas.

Workload
135 hours

T 5.39 Module component: Edge-AI in Software and Sensor Applications [T-INFO-114258]

Coordinators: Dr. Victor Pankratius
Organisation: KIT Department of Informatics
Part of: M-INFO-107234 - Edge-AI in Software and Sensor Applications

Type	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each term	1

Courses					
ST 2026	**2400006**	EdgeAI in Software and Sensor Applications	**2 SWS**	**Lecture /**	**Pankratius**
WT 26/27	**2400124**	EdgeAI in Software and Sensor Applications	**2 SWS**	**Lecture /**	**Pankratius**
Exams					
ST 2026	**7500196**	Edge-AI in Software and Sensor Applications			**Pankratius**
WT 26/27	**7500303**	Edge-AI in Software and Sensor Applications			**Pankratius**

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
Basic studies in computer science

Recommendations
Knowledge of e.g. cognitive systems, software engineering, algorithms, computer networks & structures, low-power design is helpful.

T 5.40 Module component: Embedded Machine Learning Lab [T-INFO-111549]

Coordinators: Prof. Dr.-Ing. Jörg Henkel
Organisation: KIT Department of Informatics
Part of: M-INFO-105775 - Embedded Machine Learning Lab

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

Courses					
ST 2026	**2400295**	Embedded Machine Learning Lab	**4 SWS**	**Practical course /** 🗣	**Henkel, Ahmed, Dietrich, Khdr**
WT 26/27	**2400295**	Embedded Machine Learning Lab	**4 SWS**	**Practical course /** 🗣	**Henkel, Ahmed, Dietrich**
Exams					
ST 2026	**7500321**	Embedded Machine Learning Lab			**Henkel**
WT 26/27	**7500295**	Embedded Machine Learning Lab			**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 applicable, a written paper. The written paper, presentations and practical work are weighted according to the course.

Prerequisites
None.

Recommendations
This lab requires a basic (theoretic) knowledge about neural networks and training. Further knowledge of Linux environments and Python is strongly advised since they will be intensively used in the lab and are the de-facto industry standard for machine learning research.

T 5.41 Module component: Empirical Software Engineering [T-INFO-115054]

Coordinators: Raziyeh Dehghani
Organisation: KIT Department of Informatics
Part of: M-INFO-107685 - Empirical Software Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each term	1

Courses					
WT 26/27	**2424156**	Empirical Software Engineering	**2 SWS**	**Lecture /** 🗣	**Koziolek, Dehghani, Kaplan**
Exams					
ST 2026	**7500053**	Empirical Software Engineering			**Gerking**
ST 2026	**7500372**	Empirical Software Engineering			**Koziolek**
WT 26/27	**7500312**	Empirical Software Engineering			**Koziolek**

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

Assessment
The assessment is carried out as an oral examination, lasting approx. 30 minutes in accordance with Section 4 (2) No. 2 SPO.

Prerequisites
None.

Recommendations
Familiarity with statistical analysis methods is highly recommended.

T 5.42 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	Term offered	Version
Oral examination	3 CP	graded	Each winter term	1

Courses					
WT 26/27	**2400186**	Engineering Self-Adaptive Systems	**2 SWS**	**Lecture**	**Mirandola**
Exams					
WT 26/27	**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.

T 5.43 Module component: Entrepreneurship [T-WIWI-102864]

Coordinators: Prof. Dr. Orestis Terzidis
Organisation: KIT Department of Business and Economics
Part of: M-ETIT-105073 - Student Innovation Lab

Type	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each term	2

Courses					
ST 2026	**2545001**	Entrepreneurship	**2 SWS**	**Lecture /**	**Terzidis, Dang**
WT 26/27	**2545001**	Entrepreneurship	**2 SWS**	**Lecture /**	**Terzidis, Dang**
Exams					
ST 2026	**7900002**	Entrepreneurship			**Terzidis**
ST 2026	**7900192**	Entrepreneurship			**Terzidis**
ST 2026	**7900376**	Entrepreneurship			**Terzidis**
ST 2026	**7900377**	Entrepreneurship			**Terzidis**
WT 26/27	**7900045**	Entrepreneurship			**Terzidis**
WT 26/27	**7900229**	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

T 5.44 Module component: EU Data Protection Law [T-INFO-113887]

Coordinators: Gustavo Gil Gasiola
Organisation: KIT Department of Informatics
Part of: M-INFO-107030 - EU Data Protection Law

Type	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each winter term	1

Courses					
WT 26/27	**2424019**	EU Data Protection Law	**2 SWS**	**Lecture /** 🗣	**Gil Gasiola**
Exams					
WT 26/27	**7500378**	EU Data Protection Law			**Zufall**

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

Assessment
The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 60 minutes.

Prerequisites
None

Additional Information
Competency Goals:

Students are able to comprehend the EU data protection regulation, including the General Data Protection Regulation and related EU data regulations.

They know the foundations of data protection rules, including fundamental concepts (e.g., “personal data”, “processing”, “data subject”). They are also familiar with the principles of personal data processing (lawfulness, limited purpose, transparency, accountability) as well as the rights of the data subject.

They can identify the main obligations of the controller and the processor.

Students understand the conditions for the transfer of personal data to third countries.

They can identify the other regulations that govern data in the European Union.

Students are able to read and understand legal text related to data regulation.

They can understand and solve simple data protection cases.

Content:

The General Data Protection Regulation (GDPR) of the European Union is a milestone in protecting individuals from the unlawful use of their data. In a data-driven society, economy, and government, this protection has become essential to guarantee fundamental rights. In addition to its direct impact on the legal systems of all Member States, the GDPR has a major influence on third countries that have adopted similar regulations (e.g. Switzerland, Argentina, Brazil, South Africa, and many others). In this way, the EU Data Protection Regulation has established itself as the “gold standard” of data protection, providing guidance to address the challenges posed by new technologies and new ways of creating, using and sharing personal data. Understanding the structure of data protection in the EU is therefore essential to grasp its impact on individual rights, public administration, business models, and even technological development.
This lecture aims to provide a structured overview of the EU Data Protection Regulation, and to offer tools to understand the regulatory structure of the EU Data Regulation. The lecture will cover the following topics:

- Introduction to EU law
- Development of the EU data protection regulation
- Legal structure of data protection in the EU
- Role of national and sectoral laws
- Data protection as fundamental right
- Principles of data protection
- Lawfulness of personal data processing
- Anonymization and pseudonymization of personal data
- Special categories of personal data
- Rights of the data subject
- Transfer of personal data to third countries
- Responsibility of the controller and the processor
- Security of personal data and personal data breach
- Open Data Directive
- Data Governance Act
- Data Act

Workload

- Attendance time to the lectures = 15 x 90 min = 22 h 30 min
- Self-study during the semester = 47 h 30 min
- Preparation for the exam = 20 h
- Total = 90 h

T 5.45 Module component: EU-Law [T-INFO-115479]

Coordinators: TT-Prof. Dr. Frederike Zufall
Organisation: KIT Department of Informatics
Part of: M-INFO-108019 - EU-Law

Type	Credits	Grading	Term offered	Expansion	Version
Oral examination	3 CP	graded	Each winter term	1 semesters	1

Assessment
Depending on the number of attending students, the assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting approximately 20 minutes or as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 120 minutes. The type of assessment will be announced at least six weeks before the end of the course.

Recommendations
Students are advised to have the EU Treaties and other relevant legal texts at hand (e.g. Blackstone's EU Treaties & Legislation or online at https://eur-lex.europa.eu/collection/eu-law/treaties/treaties-force.html).

T 5.46 Module component: Explainable Artificial Intelligence [T-INFO-112774]

Coordinators: TT-Prof. Dr. Rudolf Lioutikov
Organisation: KIT Department of Informatics
Part of: M-INFO-106302 - Explainable Artificial Intelligence

Type	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each summer term	1

Courses					
ST 2026	**2400128**	Explainable Artificial Intelligence	**2 SWS**	**Lecture /** 🗣	**Lioutikov**
Exams					
ST 2026	**7500359**	Explainable Artificial Intelligence			**Lioutikov**
WT 26/27	**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.

T 5.47 Module component: Fine-Grained Complexity Theory & Algorithms [T-INFO-113391]

Coordinators: Prof. Dr.-Ing. Marvin Künnemann-Goos
Organisation: KIT Department of Informatics
Part of: M-INFO-106644 - Fine-Grained Complexity Theory & Algorithms

Type	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Irregular	1

Courses					
ST 2026	**2400152**	Fine-Grained Complexity Theory & Algorithms	**4 SWS**	**Lecture / Practice /** 🗣	**Künnemann-Goos**
WT 26/27	**2400104**	Fine-grained Algorithm Design and Engineering	**4 SWS**	**Practical course /** 🗣	**Künnemann-Goos, Angrick, Gokaj**
Exams					
ST 2026	**7500346**	Fine-Grained Complexity Theory & Algorithms			**Künnemann-Goos**
WT 26/27	**7500042**	Fine-Grained Algorithm Design and Engineering			**Künnemann-Goos**

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 20-30 minutes.

Prerequisites
None.

Recommendations
Basic knowledge of theoretical computer science and algorithm design is recommended.

T 5.48 Module component: Geometric Deep Learning [T-INFO-112662]

Coordinators: Jun.-Prof. Dr. Jan Stühmer
Organisation: KIT Department of Informatics
Part of: M-INFO-106237 - Geometric Deep Learning

Type	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Each winter term	2

Courses					
WT 26/27	**2400179**	Geometric Deep Learning	**4 SWS**	**Lecture / Practice /** 🗣	**Stühmer, Berndt**
Exams					
ST 2026	**7500374**	Geometric Deep Learning			**Stühmer**
WT 26/27	**7500338**	Geometric Deep Learning			**Stühmer**

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 about the foundations of machine learning, group theory and linear algebra useful but not required.

T 5.49 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	Irregular	1

Exams			
WT 26/27	**75722**	Graph partitioning and graph clustering in theory and practice	**Sanders**

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 5.50 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	Irregular	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 5.51 Module component: Graph Theory [T-MATH-102273]

Coordinators: Prof. Dr. Maria Aksenovich
Organisation: KIT Department of Mathematics
Part of: M-MATH-101336 - Graph Theory

Type	Credits	Grading	Term offered	Version
Written examination	9 CP	graded	Irregular	3

Courses					
WT 26/27	**0104500**	Graph Theory	**4 SWS**	**Lecture**	**Aksenovich, Liu**
WT 26/27	**0104510**	Tutorial for 0104500 (Graph Theory)	**2 SWS**	**Practice**	**Aksenovich, Liu**
Exams					
ST 2026	**7700108**	Graph Theory			**Aksenovich**

Prerequisites
None

T 5.52 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.

Modeled Prerequisites
The following conditions have to be fulfilled:
1. The module M-INFO-100749 - Introduction to Bioinformatics for Computer Scientists must have been passed.

T 5.53 Module component: Hardware Modeling and Simulation [T-ETIT-100672]

Coordinators: Dr.-Ing. Jens Becker
Prof. Dr.-Ing. Jürgen Becker

Organisation: KIT Department of Electrical Engineering and Information Technology

Part of: M-ETIT-100449 - Hardware Modeling and Simulation

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

Courses					
WT 26/27	**2311608**	Hardware Modeling and Simulation	**2 SWS**	**Lecture /**	**Becker, Becker**
WT 26/27	**2311610**	Tutorial for 2311608 Hardware Modeling and Simulation	**1 SWS**	**Practice /**	**Sotiropoulos**
Exams					
ST 2026	**7311608**	Hardware Modeling and Simulation			**Becker, Becker**
WT 26/27	**7311608**	Hardware Modeling and Simulation			**Becker, Becker**

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

Assessment
Achievement is examined in the form of a written examination lasting 120 minutes.

Prerequisites
none

T 5.54 Module component: Hardware Synthesis and Optimization [T-ETIT-113922]

Coordinators: Prof. Dr.-Ing. Jürgen Becker
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-106963 - Hardware Synthesis and Optimization

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

Courses					
ST 2026	**2311619**	Hardware Synthesis and Optimization	**3 SWS**	**Lecture /**	**Becker**
ST 2026	**2311621**	Tutorial for 2311619 Hardware Synthesis and Optimization	**1 SWS**	**Practice /**	**Schmidt**
Exams					
ST 2026	**7311619**	Hardware Synthesis and Optimisation			**Becker**
WT 26/27	**7311619**	Hardware Synthesis and Optimisation			**Becker**

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

Assessment
The examination takes place within the framework of an oral overall examination (approx. 30 minutes).
The module grade is the grade of the oral exam.

Prerequisites
none

T 5.55 Module component: Hardware-efficient Artificial Intelligence [T-INFO-114628]

Coordinators: Prof. Dr.-Ing. Jörg Henkel
Dr. Martin Rapp
Organisation: KIT Department of Informatics
Part of: M-INFO-107448 - Hardware-efficient Artificial Intelligence

Type	Credits	Grading	Term offered	Expansion	Version
Oral examination	3 CP	graded	Each winter term	1 semesters	3

Courses					
WT 26/27	**2400232**	Hardware-efficient Artificial Intelligence	**2 SWS**	**Lecture**	**Rapp**
Exams					
WT 26/27	**7500406**	Hardware-efficient Artificial Intelligence			**Henkel**

Assessment
The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) approx. 30 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 approx.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
A basic understanding of deep learning concepts and neural networks is expected; familiarity with hardware architectures and embedded systems is helpful but not required.

T 5.56 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 2026	**2400159**	HRI and Social Robotics	**4 SWS**	**Lecture / Practice /** 🗣	**Bruno, Maure**
Exams					
ST 2026	**7500101**	HRI and Social Robotics			**Bruno**
WT 26/27	**7500390**	HRI and Social Robotics - Post Exam			**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.

T 5.57 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 2026	**2400159**	HRI and Social Robotics	**4 SWS**	**Lecture / Practice / 🗣**	**Bruno, Maure**
Exams					
ST 2026	**7500358**	HRI and Social Robotics - Exercises			**Bruno**
WT 26/27	**7500399**	HRI and Social Robotics - Pass (Post-Exam)			**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.

T 5.58 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 2026	**24659**	Human-Computer-Interaction	**2 SWS**	**Lecture /**	**Beigl**
Exams					
ST 2026	**7500048**	Human-Computer-Interaction			**Beigl**
ST 2026	**7500390**	Human Computer Interaction			**Riedel**
WT 26/27	**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.

Modeled Prerequisites
The following conditions have to be fulfilled:
1. The module component T-INFO-114193 - Human-Computer-Interaction Pass must have been passed.

T 5.59 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
Prerequisite for: T-INFO-114192 - Human-Computer-Interaction

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

Courses					
ST 2026	**2400095**	Human-Computer-Interaction	**1 SWS**	**Practice /**	**Beigl**
Exams					
ST 2026	**7500121**	Human-Computer-Interaction Pass			**Beigl**
ST 2026	**7500387**	Human Computer Interaction Pass			**Riedel**

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 5.60 Module component: Humanoid Robots - Locomotion and Whole-Body Control [T-INFO-113395]

Coordinators: Prof. Dr. Katja Mombaur
Organisation: KIT Department of Informatics
Part of: M-INFO-106649 - Humanoid Robots - Locomotion and Whole-Body Control

Type	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Each term	1

Courses					
ST 2026	**2400135**	Humanoid Robots – Locomotion and Whole-Body Control	**4 SWS**	**Lecture /** 🗣	**Mombaur, Große Sundrup**
Exams					
ST 2026	**7500160**	Humanoid Robots - Locomotion and Whole-Body Control			**Mombaur**

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

The grade of the course is given based on the performance in in an individual programming project on the topic of humanoid robots, which consists of the definition and solution of the project itself as well as a subsequent oral presentation in a block event and the submission of a written report. Project work starts in the exercise slots during the second half of the term and ends during the lecture free time.

As a prerequisite for the enrollment in the project, the students must regularly and successfully participate in the exercises and present their results for the exercise sheets during the first part of the term, according to the modalities announced at the beginning of the course.
Both components can be completed in the same group of two students. Withdrawal is possible until 2 weeks after enrollment in the project.
Active participation in the class is expected from all students and is a necessary requirement for the course.

Prerequisites
- Completion of module Robotics 1 or corresponding knowledge required.
- Programing skills

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

Additional Information
Limitation to 30 participants

T 5.61 Module component: Humanoid Robots - Locomotion and Whole-Body Control -Pass [T-INFO-114282]

Coordinators: Prof. Dr. Katja Mombaur
Organisation: KIT Department of Informatics
Part of: M-INFO-106649 - Humanoid Robots - Locomotion and Whole-Body Control

Type	Credits	Grading	Term offered	Version
Coursework (oral)	0 CP	pass/fail	Each term	1

Courses					
ST 2026	**2400135**	Humanoid Robots – Locomotion and Whole-Body Control	**4 SWS**	**Lecture /** 🗣	**Mombaur, Große Sundrup**
Exams					
ST 2026	**7500364**	Humanoid Robots - Locomotion and Whole-Body Control -Pass			**Mombaur**

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

Assessment
The assessment is carried out in form of course work (German Studienleistung, § 4 Abs. 3 SPO).

The grade of the course is given based on the performance in in an individual programming project on the topic of humanoid robots, which consists of the definition and solution of the project itself as well as a subsequent oral presentation in a block event and the submission of a written report. Project work starts in the exercise slots during the second half of the term and ends during the lecture free time.

As a prerequisite for the enrollment in the project, the students must regularly and successfully participate in the exercises and present their results for the exercise sheets during the first part of the term, according to the modalities announced at the beginning of the course.
Both components can be completed in the same group of two students. Withdrawal is possible until 2 weeks after enrollment in the project.
Active participation in the class is expected from all students and is a necessary requirement for the course.

Prerequisites
- Completion of module Robotics 1 or corresponding knowledge required.
- Programing skills

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

Additional Information
Limitation to 30 participants

T 5.62 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 26/27	**2400048**	Humanoid Robots - Seminar	**2 SWS**	**Seminar / 🗣**	**Asfour**
Exams					
WT 26/27	**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.

T 5.63 Module component: Information, Science and Responsibility - Current Ethical Challenges in IT [T-INFO-112148]

Coordinators: Dr.-Ing. Angelika Kaplan
Organisation: KIT Department of Informatics
Part of: M-INFO-107254 - Interdisciplinary Qualifications

Type	Credits	Grading	Term offered	Version
Coursework	2 CP	pass/fail	Each summer term	1

Courses					
ST 2026	**2400094**	Ethics of IT	**2 SWS**	**Lecture /**	**Reussner, Bagattini**
Exams					
ST 2026	**7500338**	Ethics in Informatics			**Reussner**

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

T 5.64 Module component: Information, Science and Responsibility - Current Ethical Challenges of IT [T-INFO-111839]

Coordinators: Dr.-Ing. Angelika Kaplan
Organisation: KIT Department of Informatics
Part of: M-INFO-107254 - Interdisciplinary Qualifications

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

Courses					
ST 2026	**2400094**	Ethics of IT	**2 SWS**	**Lecture /**	**Reussner, Bagattini**
Exams					
ST 2026	**7500210**	Ethics in Informatics			**Reussner**

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

T 5.65 Module component: Innovation Lab [T-ETIT-110291]

Coordinators: Prof. Dr.-Ing. Sören Hohmann
Prof. Dr. Werner Nahm
Prof. Dr.-Ing. Eric Sax
Prof. Dr. Wilhelm Stork
Prof. Dr.-Ing. Thomas Zwick

Organisation: KIT Department of Electrical Engineering and Information Technology

Part of: M-ETIT-105073 - Student Innovation Lab

Type	Credits	Grading	Term offered	Expansion	Version
Examination of another type	9 CP	graded	Each term	2 semesters	1

Courses					
ST 2026	**2303192**	Innovation Lab	**2 SWS**	**Project /** 🗣	**Hohmann, Zwick, Sax, Stork, Terzidis**
WT 26/27	**2303192**	Innovation Lab	**2 SWS**	**Project /** 🗣	**Hohmann, Zwick, Sax, Stork, Nahm, Schmalen, Rost**
Exams					
ST 2026	**7303192**	Innovation Lab			**Hohmann, Zwick, Stork, Sax, Nahm**
WT 26/27	**7303192**	Innovation Lab			**Hohmann, Zwick, Stork, Sax, Nahm**

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

Assessment
Success control takes place in the form of other types of examination and includes:

- Submission of a Technical Report (approx. 15-20 pages) with requirements list and system architecture
- Submission of the reflection of the Gantt Plans (approx. 8-12 pages)
- Presentation of the high-fidelity prototype (approx. 15 min.)

Prerequisites
none

T 5.66 Module component: International Entrepreneurship and Brand Development [T-WIWI-114893]

Coordinators: Prof. Dr. Ann-Kristin Kupfer
Prof. Dr. Orestis Terzidis
Organisation: KIT Department of Business and Economics
Part of: M-WIWI-106258 - Digital Marketing

Type	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	see Annotations	1

Courses					
WT 26/27	**2572189**	International Entrepreneurship and Brand Development	**4 SWS**	**Block / 🗣**	**Terzidis, Kupfer**
Exams					
WT 26/27	**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.

Additional Information
Please contact the Marketing and Sales Research Group for further information.

Workload
180 hours

T 5.67 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

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 26/27	**2424104**	Internet of Everything	**2 SWS**	**Lecture /** 🗣	**Zitterbart, Hildenbrand, Mahrt, Neumeister**
Exams					
ST 2026	**7500071**	Internet of Everything			**Zitterbart**
ST 2026	**7500397**	Internet of Everything for Retakers			**Zitterbart**
ST 2026	**7500428**	Internet of Everything (Zweitwiederholung)			**Zitterbart**
WT 26/27	**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.

Additional Information
Offered for the last time in WS 26/27!!!!!

T 5.68 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 26/27	**2400055**	Introduction to Bioinformatics for Computer Scientists	**2 SWS**	**Lecture /**	**Stamatakis**
Exams					
ST 2026	**7500330**	Introduction to Bioinformatics for Computer Scientists			**Stamatakis**
WT 26/27	**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 5.69 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 26/27	**2400010**	IT Security	**4 SWS**	**Lecture / Practice / 🗣**	**Müller-Quade, Wressnegger, Martin, Gharibyar**
Exams					
ST 2026	**7500025**	IT Security (Nachklausur)			**Müller-Quade, Wressnegger, Strufe**
WT 26/27	**7500038**	IT Security			**Müller-Quade, Strufe, Wressnegger**

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

Assessment
The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 90 minutes.

Prerequisites
None.

Recommendations
Students should be familiar with the content of the compulsory lecture "Informationssicherheit".

T 5.70 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 26/27	**2400150**	Lab Project: Speech Translation	**4 SWS**	**Practical course /** 🗣	**Niehues, Dinh**
Exams					
WT 26/27	**7500350**	Lab Project: Speech Translation			**Niehues**

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

Prerequisites
None.

Recommendations
Students should have understood the theoretical principles as introduced in the lectures Deep Learning or Machine Translation.

T 5.71 Module component: Introduction to Quantum Machine Learning [T-INFO-115215]

Coordinators: Dr. Eileen Kühn
Organisation: KIT Department of Informatics
Part of: M-INFO-107821 - Introduction to Quantum Machine Learning

Type	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each summer term	1

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.

T 5.72 Module component: Localization of Mobile Agents [T-INFO-115014]

Coordinators: Prof. Dr.-Ing. Uwe Hanebeck
Organisation: KIT Department of Humanities and Social Sciences
KIT Department of Informatics
Part of: M-INFO-107663 - Localization of Mobile Agents

Type	Credits	Grading	Term offered	Expansion	Version
Oral examination	6 CP	graded	Each summer term	1 semesters	3

Courses					
ST 2026	**24613**	Localization of Mobile Agents	**3 SWS**	**Lecture / Practice /**	**Kim, Hanebeck, Frisch**
Exams					
ST 2026	**7500482**	Localization of Mobile Agents			**Hanebeck**

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

Assessment
The assessment is carried out as an oral examination, lasting 15-30 minutes in accordance with Section 4 (2) No. 2 SPO. Participants can contact the chair at any time to arrange an appointment for the oral examination. (§ 4 Abs. 2 Nr. 2 SPO)

Prerequisites
T-INFO-115015 Digital exercise must be successfully completed before exam.

Modeled Prerequisites
The following conditions have to be fulfilled:
1. The module component T-INFO-115015 - Localization of Mobile Agents - Pass must have been started.

Recommendations
Knowledge of a higher-level programming language with mature libraries for scientific and numerical computing (e.g., Julia, Matlab, Python) is an advantage.

T 5.73 Module component: Localization of Mobile Agents - Pass [T-INFO-115015]

Coordinators: Prof. Dr.-Ing. Uwe Hanebeck
Organisation: KIT Department of Informatics
Part of: M-INFO-107663 - Localization of Mobile Agents

Type	Credits	Grading	Term offered	Expansion	Version
Coursework	0 CP	pass/fail	Each summer term	1 semesters	1

Courses					
ST 2026	**24613**	Localization of Mobile Agents	**3 SWS**	**Lecture / Practice /**	**Kim, Hanebeck, Frisch**
Exams					
ST 2026	**7500483**	Localization of Mobile Agents - Exercise			**Hanebeck**

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

Assessment
The assessment is carried out in form of course work (German Studienleistung, § 4 Abs. 3 SPO). Students must complete a digital exercise in Ilias which is ungraded. The digital exercise can be repeated as often as desired.

Prerequisites
None.

Recommendations
Knowledge of a higher-level programming language with mature libraries for scientific and numerical computing (e.g., Julia, Matlab, Python) is an advantage.

T 5.74 Module component: Logic Programming [T-INFO-115318]

Coordinators: Prof. Dr. Sebastian Erdweg
Organisation: KIT Department of Informatics
Part of: M-INFO-107906 - Logic Programming

Type	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Irregular	1

Courses					
WT 26/27	**2400195**	Logic programming	**4 SWS**	**Lecture / Practice /**	**Erdweg, Dormann**
Exams					
WT 26/27	**7500361**	Logic Programming			**Erdweg**

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

Assessment
The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 120 minutes.

Prerequisites
None.

Recommendations
- Knowledge of programming semantics is helpful but not required.
- Knowledge of logic inference systems is helpful but not required.

T 5.75 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 26/27	**2400161**	Logical Foundations of Cyber-Physical Systems	**4 SWS**	**Lecture /** 🗣	**Platzer**
Exams					
WT 26/27	**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 5.76 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 2026	**2424672**	Low Power Design	**2 SWS**	**Lecture /**	**Henkel, Nassar, Khdr**
Exams					
ST 2026	**7500200**	VL: Low Power Design			**Henkel**
WT 26/27	**7500139**	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.

T 5.77 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 2026	**2400018**	Machine Learning – Foundations and Algorithms	**4 SWS**	**Lecture / Practice / 🗣**	**Neumann**
Exams					
ST 2026	**7500215**	Machine Learning - Foundations and Algorithms			**Neumann**
WT 26/27	**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 5.78 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 2026	**2400008**	Machine Learning for the Natural Sciences	**2 SWS**	**Lecture /**	**Friederich**
Exams					
ST 2026	**7500211**	Machine Learning for Natural Sciences			**Friederich**
ST 2026	**7500426**	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 5.79 Module component: Machine Learning for Natural Sciences - Pass [T-INFO-113917]

Coordinators: Prof. Dr. Pascal Friederich
Organisation: KIT Department of Informatics
Part of: M-INFO-106959 - Machine Learning for Natural Sciences

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

Courses					
ST 2026	**2400034**	Exercise for Machine Learning for the Natural Sciences	**2 SWS**	**Lecture / Practice /** 💮	**Friederich, Torresi, Neubert, Eberhard, Schlöder, Metni, Teufel**
Exams					
ST 2026	**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 5.80 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 summer term	2

Courses					
ST 2026	**2400003**	Machine Learning in Climate and Environmental Sciences	**4 SWS**	**Lecture / Practice /** 🗣	**Nowack**
Exams					
ST 2026	**7500302**	Machine Learning in Climate and Environmental Sciences			**Nowack**

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

Assessment
The assessment of the lectures is likely carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 60-120 minutes (exact duration to be confirmed).

Depending on the class size, this might be changed to an oral examination (lasting around 20 minutes, § 4 Abs. 2 No. 2 SPO). The exact type of assessment will be confirmed at least six weeks prior to the assessment.

Prerequisites
No strict prerequisites but several strong recommendations (see below).

Modeled Prerequisites
The following conditions have to be fulfilled:
1. The module component T-INFO-113085 - Machine Learning in Climate and Environmental Sciences - Pass must have been started.

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 5.81 Module component: Machine Learning in Climate and Environmental Sciences - Pass [T-INFO-113085]

Coordinators: TT-Prof. Dr. Peer Nowack
Organisation: KIT Department of Informatics
Part of: M-INFO-106470 - Machine Learning in Climate and Environmental Sciences

Type	Credits	Grading	Term offered	Version
Coursework	0 CP	pass/fail	Each summer term	2

Courses					
ST 2026	**2400003**	Machine Learning in Climate and Environmental Sciences	**4 SWS**	**Lecture / Practice /** 🗣	**Nowack**
Exams					
ST 2026	**7500388**	Machine Learning in Climate and Environmental Sciences - Pass			**Nowack**

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

Assessment
The assessment is carried out in form of course work (German Studienleistung, § 4 Abs. 3 SPO). Students must regularly submit exercise sheets. The number of exercise sheets and the scale for passing will be announced at the beginning of the course. The assessment 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 5.82 Module component: Market Research [T-WIWI-107720]

Coordinators: Prof. Dr. Martin Klarmann
Organisation: KIT Department of Business and Economics
Part of: M-WIWI-106258 - Digital Marketing

Type	Credits	Grading	Term offered	Version
Written examination	4,5 CP	graded	Each summer term	3

Courses					
ST 2026	**2571150**	Market Research	**2 SWS**	**Lecture /** 🗣	**Klarmann**
ST 2026	**2571151**	Market Research Tutorial	**1 SWS**	**Practice /** 🗣	**Klarmann**
Exams					
ST 2026	**7900015**	Market Research			**Klarmann**
WT 26/27	**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.

T 5.83 Module component: Master's Thesis [T-INFO-113697]

Coordinators: Prof. Dr.-Ing. Anne Koziolek
Organisation: KIT Department of Informatics
Part of: M-INFO-106828 - Master's Thesis

Type	Credits	Grading	Term offered	Version
Final Thesis	30 CP	graded	Each term	1

Assessment
The Master's thesis is reglenented in § 14 and § 19 of the SPO23 Master of Computer Science. The presentation should take place no later than four weeks after submission of the Master's thesis.

The Master's thesis is assessed in the form of a report. An overall assessment (including the presentation) must be written.

The presentation should take place no later than four weeks after submission of the Master's thesis. The presentation may also take place before submission.

Prerequisites
A prerequisite for admission to the Master's thesis is that students have generally already acquired 60 credit points, of which at least 15 credit points must come from one of the two specialization subjects. The application for admission to the Master's thesis must be submitted no later than three months after taking the last module examination.

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

This thesis requires confirmation by the examination office.

T 5.84 Module component: Media Management [T-WIWI-112711]

Coordinators: Prof. Dr. Ann-Kristin Kupfer
Organisation: KIT Department of Business and Economics
Part of: M-WIWI-106258 - Digital Marketing

Type	Credits	Grading	Term offered	Version
Examination of another type	4,5 CP	graded	see Annotations	1

Courses					
WT 26/27	**2572192**	Media Management	**2 SWS**	**Lecture /** 🗣	**Kupfer**
WT 26/27	**2572193**	Media Management Exercise	**1 SWS**	**Practice /** 🗣	**Schmitt**
Exams					
ST 2026	**7900004**	Media Management			**Kupfer**
WT 26/27	**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.

Additional Information
Please note that the lecture and exam will not be offered during the 2026/27 winter term.

Workload
135 hours

T 5.85 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 26/27	**2400015**	Mobile Communication	**2 SWS**	**Lecture**	**Waldhorst, Mahrt**
Exams					
ST 2026	**7500073**	Mobile Communication			**Waldhorst, Zitterbart**
ST 2026	**7500349**	Mobile Communication			**Waldhorst, Zitterbart**
WT 26/27	**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 5.86 Module component: Mobile Communications [T-ETIT-112127]

Coordinators: Prof. Dr.-Ing. Peter Rost
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-105971 - Mobile Communications

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 26/27	**2310523**	Mobile Communications	**2 SWS**	**Lecture /**	**Rost**
WT 26/27	**2310524**	Exercises for 2310523 Mobile Communications	**1 SWS**	**Practice /**	**Rost**
Exams					
ST 2026	**7310524-1**	Mobile Communications			**Rost**
WT 26/27	**7310524-1**	Mobile Communications			**Rost**

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

Assessment
The success control takes place in the form of an oral examination lasting approx. 25 minutes. Before the examination, there is a preparation phase of 15 minutes in which preparatory tasks are solved.

Prerequisites
none

T 5.87 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 26/27	**2424657**	Model-Driven Software Development	**2 SWS**	**Lecture /** 🗣	**Burger**
Exams					
ST 2026	**7500016**	Model Driven Software Development			**Burger, Reussner**
WT 26/27	**7500086**	Model Driven Software Development			**Reussner, Burger**

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 5.88 Module component: Modern Methods in Combinatorics [T-MATH-113911]

Coordinators: Prof. Dr. Maria Aksenovich
Organisation: KIT Department of Mathematics
Part of: M-MATH-106957 - Modern Methods in Combinatorics

Type	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Irregular	1

Assessment
Oral examination (approx. 30 min)

Prerequisites
None

Workload
180 hours

T 5.89 Module component: Motion in Human and Machine - Seminar [T-INFO-105140]

Coordinators: Prof. Dr.-Ing. Tamim Asfour
Organisation: KIT Department of Informatics
Part of: M-INFO-102555 - Motion in Human and Machine - Seminar

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

Courses					
ST 2026	**2400063**	Motion in Human and Machine	**3 SWS**	**Seminar / 🗣**	**Asfour**
Exams					
ST 2026	**7500272**	Motion in Man and Machine - seminar			**Asfour**
ST 2026	**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 report of about two pages and a video presentation of about five minutes.

Prerequisites
None.

Recommendations
Programming skills in C++, Python or Matlab are recommended.

Attendance of the lectures Robotics I – Introduction to Robotics, Robotics II – Humanoid Robotics, Robotics III – Sensors and Perception in Robotics, Mechano-Informatics and Robotics and Wearable Robot Technologies is recommended

Additional Information
This interdisciplinary seminar is conducted in cooperation with the University of Stuttgart and the University of Tübingen.

T 5.90 Module component: Multimodal Artificial Intelligence [T-INFO-115041]

Coordinators: Prof. Dr. Jan Niehues
Prof. Dr.-Ing. Rainer Stiefelhagen
Organisation: KIT Department of Informatics
Part of: M-INFO-107676 - Multimodal Artificial Intelligence

Type	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each summer term	2

Courses					
ST 2026	**2400141**	Multimodal Artificial Intelligence	**4 SWS**	**Lecture /** 🗣	**Niehues, Stiefelhagen**
Exams					
ST 2026	**7500402**	Multimodal Artificial Intelligence			**Niehues, Stiefelhagen**
WT 26/27	**7500210**	Multimodal Artificial Intelligence			**Stiefelhagen**

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

Assessment
The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) approx. 60 minutes.

Prerequisites
None.

Modeled Prerequisites
The following conditions have to be fulfilled:
1. The module component T-INFO-114220 - Advanced Artificial Intelligence must not have been started.

T 5.91 Module component: Nano- and Quantum Electronics [T-ETIT-111232]

Coordinators: Prof. Dr. Sebastian Kempf
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-105604 - Nano- and Quantum Electronics

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

Courses					
ST 2026	**2312668**	Nano- and Quantum Electronics	**3 SWS**	**Lecture /** 🗣	**Kempf**
ST 2026	**2312670**	Tutorial for 2312668 Nano- and Quantum Electronics	**1 SWS**	**Practice /** 🗣	**Kempf, Mitarbeiter*innen**
Exams					
ST 2026	**7312668**	Nano- and Quantum Electronics			**Kempf**
WT 26/27	**7312668**	Nano- and Quantum Electronics			**Kempf**

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

Assessment
The assessment of success takes place in the form of a written examination lasting 120min. The grade corresponds to the result of the written examination.

Prerequisites
none

Recommendations
Successful completion of the modules "Superconductivity for Engineers" and „Einführung in die Quantentheorie für Elektrotechniker“ is recommended.

T 5.92 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 26/27	**2400147**	Natural Language Processing	**4 SWS**	**Lecture / 🗣**	**Niehues, Liu, Züfle**
Exams					
ST 2026	**7500223**	Natural Language Processing			**Niehues**
WT 26/27	**7500286**	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.

T 5.93 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 26/27	**2424187**	Natural Language Processing and Software Engineering	**2 SWS**	**Lecture /** 🗣	**Hey, Koziolek, Keim**
Exams					
ST 2026	**7500185**	Natural Language Processing and Software Engineering			**Koziolek, Hey**
ST 2026	**7543231**	Natural Language Processing and Software Engineering			**Hey, Keim**
WT 26/27	**7543231**	Natural Language Processing and Software Engineering			**Hey, Keim**

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

Assessment
The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting 25 minutes.

Prerequisites
None.

T 5.94 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 2026	**24601**	Network Security: Architectures and Protocols	**2 SWS**	**Lecture /** 🗣	**Baumgart, Bless, Zitterbart**
Exams					
ST 2026	**7500040**	Network Security: Architectures and Protocols			**Zitterbart, Bless, Baumgart**
ST 2026	**7500072**	Network Security: Architectures and Protocols			**Zitterbart, Bless, Baumgart**
ST 2026	**7500429**	Network Security: Architectures and Protocols for Retakers			**Zitterbart, Bless, Baumgart**
WT 26/27	**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 5.95 Module component: Next Generation Internet [T-INFO-101321]

Coordinators: Dr.-Ing. Roland Bless
Prof. Dr. Martina Zitterbart
Organisation: KIT Department of Informatics
Part of: M-INFO-100784 - Next Generation Internet

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each summer term	1

Courses					
ST 2026	**24674**	Next Generation Internet	**2 SWS**	**Lecture /**	**Bless**
Exams					
ST 2026	**7500074**	Next Generation Internet			**Bless, Zitterbart**
ST 2026	**7500427**	Next Generation Internet for RETAKERS			**Bless, Zitterbart**
WT 26/27	**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.

T 5.96 Module component: Online Concepts for Karlsruhe City Retailers [T-WIWI-111848]

Coordinators: Prof. Dr. Ann-Kristin Kupfer
Organisation: KIT Department of Business and Economics
Part of: M-WIWI-106258 - Digital Marketing

Type	Credits	Grading	Term offered	Version
Examination of another type	3 CP	graded	Each summer term	2

Courses					
ST 2026	**2571184**	Online concepts for Karlsruhe city retailers	**2 SWS**	**Others / 🗣**	**Kupfer**
Exams					
ST 2026	**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

T 5.97 Module component: Optical Engineering [T-ETIT-100676]

Coordinators: Prof. Dr. Wilhelm Stork
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-100456 - Optical Engineering

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Exams			
WT 26/27	**7311629**	Optical Engineering	**Stork**

Assessment
Achievement will be examined in an oral examination (approx. 20 minutes)

Prerequisites
none

T 5.98 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

Exams			
ST 2026	**7500038**	VL: Optimization and synthesis of embedded systems (ES1)	**Henkel**
WT 26/27	**7500085**	VL: Optimization and synthesis of embedded systems (ES1)	**Henkel**

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

Prerequisites
None.

Recommendations
Knowledge of computer structures is helpful.

The prerequisites, if any, are explained in more detail in the module description.

T 5.99 Module component: Optimization Methods for Machine Learning and Engineering [T-INFO-110809]

Coordinators: Prof. Dr.-Ing. Jürgen Beyerer
Julius Pfrommer

Organisation: KIT Department of Informatics

Part of: M-INFO-105329 - Optimization Methods for Machine Learning and Engineering

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

Courses					
WT 26/27	**2400280**	Optimization Methods for Machine Learning and Engineering	**2 SWS**	**Lecture /**	**Pfrommer, Beyerer**
WT 26/27	**2400281**	Optimization Methods for Machine Learning and Engineering	**1 SWS**	**Practice /**	**Pfrommer, Beyerer**
Exams					
ST 2026	**7500329**	Optimization Methods for Machine Learning and Engineering			**Beyerer**
WT 26/27	**7500279**	Optimization Methods for Machine Learning and Engineering			**Beyerer**

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

Assessment
The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 60 minutes.

Depending on the number of participants, it will be announced six weeks before the examination (Section 6 (3) SPO) whether the assessment will take the form of an oral examination of approx.

- in the form of an oral examination of approx. 30 minutes in accordance with § 4 Para. 2 No. 2 SPO **or**

- in the form of a written examination in accordance with § 4 Para. 2 No. 1 SPO

takes place.

Prerequisites
None.

T 5.100 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	3

Courses					
WT 26/27	**2400053**	Parallel Algorithms	**3 SWS**	**Lecture /** 🗣	**Sanders, Uhl, Laupichler**
Exams					
ST 2026	**7500378**	Parallel Algorithms			**Sanders**
WT 26/27	**7575489**	Parallel Algorithms			**Sanders**

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

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

Prerequisites
None.

Modeled Prerequisites
The following conditions have to be fulfilled:
1. The module component T-INFO-101333 - Parallel Algorithms must not have been started.

Recommendations
Knowledge from lectures such as Algorithms I/II is recommended.

T 5.101 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
Coursework	1 CP	pass/fail	Each winter term	2

Exams			
WT 26/27	**7500163**	Parallel Algorithms Pass	**Sanders**

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.

Prerequisites
None.

Modeled Prerequisites
The following conditions have to be fulfilled:
1. The module component T-INFO-111857 - Parallel Algorithms Pass must not have been started.

Recommendations
Knowledge from lectures such as Algorithms I/II is recommended.

T 5.102 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	Term offered	Version
Oral examination	6 CP	graded	Irregular	1

Courses					
ST 2026	**2400178**	Parameterized Algorithms	**4 SWS**	**Lecture / Practice /**	**Bläsius**
Exams					
ST 2026	**7500421**	Parameterized Algorithms			**Bläsius**

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

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

Prerequisites
None.

Recommendations
Basic knowledge of algorithms and data structures (e.g. from the lectures Algorithms 1 + 2) is helpful.

T 5.103 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	Term offered	Version
Coursework	0 CP	pass/fail	Irregular	1

Courses					
ST 2026	**2400178**	Parameterized Algorithms	**4 SWS**	**Lecture / Practice /** 🗣	**Bläsius**
Exams					
ST 2026	**7500421**	Parameterized Algorithms			**Bläsius**
ST 2026	**7500422**	Parameterized Algorithms - Pass			**Bläsius**

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

A total of two repetitions are possible.

Prerequisites
None.

Recommendations
Basic knowledge of algorithms and data structures (e.g. from the lectures Algorithms 1 + 2) is helpful.

T 5.104 Module component: Participatory Technology Design [T-INFO-114199]

Coordinators: Prof. Dr. Kathrin Gerling
Organisation: KIT Department of Informatics
Part of: M-INFO-107170 - Participatory Technology Design

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

Courses					
WT 26/27	**2400189**	Participatory Technology Design (V/Ü)	**4 SWS**	**Lecture / Practice**	**Gerling**
Exams					
ST 2026	**7500375**	Participatory Technology Design (Re-Exam)			**Gerling**
WT 26/27	**7500307**	Participatory Technology Design (Exam)			**Gerling**

Assessment
The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 90 minutes.

Prerequisites
None.

Recommendations
Knowledge of the basics of human-machine interaction is helpful.

T 5.105 Module component: Participatory Technology Design - Pass [T-INFO-114200]

Coordinators: Prof. Dr. Kathrin Gerling
Organisation: KIT Department of Informatics
Part of: M-INFO-107170 - Participatory Technology Design

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

Courses					
WT 26/27	**2400189**	Participatory Technology Design (V/Ü)	**4 SWS**	**Lecture / Practice**	**Gerling**
Exams					
WT 26/27	**7500278**	Participatory Technology Design (Exercise)			**Gerling**

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO). A total of two repetitions are possible.

Prerequisites
None.

Recommendations
Knowledge of the basics of human-machine interaction is helpful.

T 5.106 Module component: Photorealistic Rendering [T-INFO-115210]

Coordinators: Prof. Dr.-Ing. Carsten Dachsbacher
Organisation: KIT Department of Informatics
Part of: M-INFO-107817 - Photorealistic Rendering

Type	Credits	Grading	Term offered	Version
Oral examination	5 CP	graded	Each summer term	1

Courses					
WT 26/27	**2400180**	Photorealistic Image Synthesis	**2 SWS**	**Lecture /** 🗣	**Schudeiske, Dachsbacher**
Exams					
WT 26/27	**7500203**	Fotorealistic Rendering			**Dachsbacher**

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

Assessment
Assessment takes the form of an oral examination, generally lasting 25 minutes, in accordance with § 4 (2) No. 2 of the Study Regulations.

Prerequisites
None.

Recommendations
Recommendation: the ***Computergraphik*** lecture (24081).

T 5.107 Module component: Post-quantum Cryptography from Lattices [T-INFO-114987]

Coordinators: Prof. Dr. Jörn Müller-Quade
Organisation: KIT Department of Informatics
Part of: M-INFO-107642 - Post-quantum Cryptography from Lattices

Type	Credits	Grading	Term offered	Expansion	Version
Oral examination	3 CP	graded	Irregular	1 semesters	1

Courses					
ST 2026	**2400076**	Post-quantum Cryptography from Lattices	**2 SWS**	**Lecture /** 🗣	**Klooß, Kühn, Brede**
Exams					
ST 2026	**7500380**	Post-quantum Cryptography from Lattices			**Klooß**
WT 26/27	**7500380**	Post-quantum Cryptography from Lattices			**Klooß**

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

Assessment
The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) approx. 45 minutes.

Prerequisites
None.

Recommendations
Basic familiarity with cryptography as introduced in the module “Theoretische Grundlagen der Kryptographie” is recommended, in particular, familiarity with security notions for basic primitives (IND-CPA, EUF-CMA) and security reductions (including hybrid arguments and guessing).

T 5.108 Module component: Practical Course: Advanced Software Development Tools [T-INFO-115130]

Coordinators: Prof. Dr.-Ing. Ina Schaefer
Organisation: KIT Department of Informatics
Part of: M-INFO-107739 - Practical Course: Advanced Software Development Tools

Type	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Each term	1

Exams			
ST 2026	**7500062**	Practical Course: Advanced Software Development Tools	**Schaefer**

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

A written paper (or implementation and documentation) must be prepared and a presentation given. Withdrawal is possible within two weeks of the topic being assigned.

Prerequisites
None.

Additional Information
The course can also be taken in German by arrangement.

T 5.109 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	Irregular	1

Courses					
ST 2026	**2400068**	Advanced Topics in High Performance Computing, Data Management and Analytics	**3 SWS**	**Practical course**	**Streit, Farhadi**
WT 26/27	**2400043**	Advanced Topics in High Performance Computing, Data Management and Analytics	**3 SWS**	**Practical course**	**Farhadi, Streit**
Exams					
ST 2026	**7500269**	Practical Course: Advanced Topics in High Performance Computing, Data Management and Analytics			**Streit**
WT 26/27	**7500345**	Practical Course: Advanced Topics in High Performance Computing, Data Management and Analytics			**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 5.110 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 2026	**2400082**	AI for climate and weather predictions	**3 SWS**	**Practical course /** 🗣	**Nowack, Amiramjadi**
WT 26/27	**2400064**	AI for climate and weather predictions	**2 SWS**	**Practical course /** 🗣	**Nowack, Amiramjadi**
Exams					
ST 2026	**7500385**	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.

T 5.111 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 term	1

Courses					
ST 2026	**2400117**	Application Security Lab	**4 SWS**	**Practical course /** 🗣	**Müller-Quade, Wressnegger, Sperrle, Gharibyar**
WT 26/27	**2400114**	Application Security Lab	**4 SWS**	**Practical course /** 🗣	**Müller-Quade, Mechler, Noppel, Wressnegger, Gharibyar**
Exams					
ST 2026	**7500119**	Application Security Lab			**Müller-Quade, Wressnegger**
WT 26/27	**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 5.112 Module component: Practical Course: Artificial Intelligence & Security Lab (AISEC-Lab) [T-INFO-113760]

Coordinators: Prof. Dr. Christian Wressnegger
Organisation: KIT Department of Informatics
Part of: M-INFO-106867 - Practical Course: Artificial Intelligence & Security Lab (AISEC-Lab)

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

Courses					
ST 2026	**24002**	Practical Course: Artificial Intelligence & Security (AISEC-Lab)	**4 SWS**	**Practical course /** 🗣	**Wressnegger, Zhao**
Exams					
ST 2026	**7500096**	Practical Course: Artificial Intelligence & Security (AISEC-Lab)			**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).

At least one assignment from each unit must be successfully completed (comparable results to other students).

Prerequisites
None.

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

T 5.113 Module component: Practical Course: Building PETs [T-INFO-114550]

Coordinators: Daniel Schadt
Prof. Dr. Thorsten Strufe
Organisation: KIT Department of Informatics
Part of: M-INFO-107412 - Practical Course: Building PETs

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

Courses					
WT 26/27	**2400056**	Practical Course: Building PETs	**4 SWS**	**Practical course /** 🗣	**Strufe**
Exams					
WT 26/27	**7500270**	Practical Course: Building PETs			**Strufe**

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 students must hand in the source code of their programs to be examined. Additionally, each student must explain their solutions to the tasks. An overall grade is awarded.

Prerequisites
None.

Recommendations
Familiarity with a programming language and a HTTP library is recommended.

T 5.114 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 2026	**2400104**	Practical Course: Chip Design I	**4 SWS**	**Practical course /** 🗣	**Tahoori**
WT 26/27	**2400216**	Practical Course: Chip Design I	**4 SWS**	**Practical course /** 🗣	**Tahoori**
Exams					
ST 2026	**7500234**	Practical Course: Chip Design I			**Tahoori**
WT 26/27	**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 5.115 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 2026	**2400107**	Practical Course: Chip Design II	**4 SWS**	**Practical course /** 🗣	**Tahoori**
WT 26/27	**2400219**	Practical Course: Chip Design II	**4 SWS**	**Practical course /** 🗣	**Tahoori**
Exams					
ST 2026	**7500169**	Practical Course: Chip Design II			**Tahoori**
WT 26/27	**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 5.116 Module component: Practical Course: Continuous Software Engineering [T-INFO-115043]

Coordinators: Prof. Dr.-Ing. Anne Koziolek
Organisation: KIT Department of Informatics
Part of: M-INFO-107677 - Practical Course: Continuous Software Engineering

Type	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Each term	1

Courses					
WT 26/27	**2400105**	Practical Course: Continuous Software Engineering		**Practical course**	**Koziolek**
Exams					
ST 2026	**7500243**	Practical Course: Continuous Software Engineering			**Koziolek**

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO), in the form of predominantly practical tasks and a final presentation.

Prerequisites
None.

Recommendations
Solid programming skills are required in order to successfully complete the lab course within the specified workload.

Additional Information
In earlier semesters, this course was named „Praktikum: Werkzeuge für agile Modellierung “.

T 5.117 Module component: Practical Course: Customized Embedded Processor Design [T-INFO-115314]

Coordinators: Prof. Dr.-Ing. Jörg Henkel
Organisation: KIT Department of Informatics
Part of: M-INFO-107897 - Practical Course: Customized Embedded Processor Design

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

Exams			
ST 2026	**7500203**	Lab: Customized Embedded Processor Design	**Henkel**

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 applicable, a written paper. The written paper, presentations and practical work are weighted depending on the course.

Prerequisites
None.

T 5.118 Module component: Practical Course: Designing and Conducting Experimental Studies [T-INFO-115341]

Coordinators: Prof. Dr.-Ing. Michael Beigl
Organisation: KIT Department of Informatics
Part of: M-INFO-107919 - Practical Course: Designing and Conducting Experimental Studies

Type	Credits	Grading	Term offered	Expansion	Version
Examination of another type	6 CP	graded	Each term	1 semesters	1

Courses					
WT 26/27	**240007**	Praktical Course: Designing and Conducting Experimental Studies	**4 SWS**	**Practical course /** 🗣	**Beigl, Riedel, Ramesh, Zitz, Breitling**

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. 20 pages), Presentation (duration approx. 20 min.), Practical training (protocols)

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.

Recommendations
Recommendation: The student should be familiar with the content of the course “Human Computer Interaction” or similar.

Additional Information
Nach Rücksprache kann der Leistungsnachweis auch auf Deutsch erbracht werden.

T 5.119 Module component: Practical Course: Engineering Approaches to Software Development [T-INFO-115044]

Coordinators: Prof. Dr. Ralf Reussner
Organisation: KIT Department of Informatics
Part of: M-INFO-107678 - Practical Course: Engineering Approaches to Software Development

Type	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Each term	1

Courses					
ST 2026	**24908**	Practical Course Engineering Approaches to Software Development	**4 SWS**	**Practical course /** 🗣	**Reussner**
WT 26/27	**2400093**	Practical Course: Engineering Approaches to Software Development	**4 SWS**	**Practical course**	**Reussner**
Exams					
ST 2026	**7500184**	Practical Course Engineering Approaches to Software Development			**Burger, Reussner**

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO), in the form of predominantly practical tasks and a final presentation.

Prerequisites
None.

Recommendations
Solid programming skills are required in order to successfully complete the lab course within the specified workload.

Additional Information
In earlier semesters, this course was named „Praktikum Ingenieursmäßige Software-Entwicklung “.

T 5.120 Module component: Practical Course: Fine-grained Algorithm Design and Engineering [T-INFO-113635]

Coordinators: Prof. Dr.-Ing. Marvin Künnemann-Goos
Organisation: KIT Department of Informatics
Part of: M-INFO-106784 - Practical Course: Fine-grained Algorithm Design and Engineering

Type	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Irregular	1

Courses					
WT 26/27	**2400104**	Fine-grained Algorithm Design and Engineering	**4 SWS**	**Practical course /** 🗣	**Künnemann-Goos, Angrick, Gokaj**
Exams					
WT 26/27	**7500042**	Fine-Grained Algorithm Design and Engineering			**Künnemann-Goos**

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 performance is evaluated, which includes the quality of the produced results, the project report and the presentation.

Prerequisites
None.

Recommendations
- Basic knowledge of algorithms and data structures is assumed.
- Knowledge of fine-grained complexity is helpful, but not required.

T 5.121 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 2026	**2400106**	FPGA Programming	**4 SWS**	**Practical course /** 🗣	**Tahoori**
WT 26/27	**2400106**	FPGA Programming	**4 SWS**	**Practical course /** 🗣	**Tahoori**
Exams					
ST 2026	**7500087**	Practical Course FPGA Programming			**Tahoori**
WT 26/27	**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.

T 5.122 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 2026	**24911**	Practical course General-Purpose Computation on Graphics Processing Units	**2 SWS**	**Practical course /** 🗣	**Lerzer, Klepikov, Dachsbacher, Dereviannykh**
WT 26/27	**2424297**	Practical course General-Purpose Computation on Graphics Processing Units	**2 SWS**	**Practical course /** 🗣	**Klepikov, Lerzer, Dachsbacher**
Exams					
ST 2026	**7500134**	Practical-course General-Purpose Computation on Graphics Processing Units			**Dachsbacher**
WT 26/27	**7500470**	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.

T 5.123 Module component: Practical Course: Human-Centred Robotics [T-INFO-113393]

Coordinators: Prof. Dr. Katja Mombaur
Organisation: KIT Department of Informatics
Part of: M-INFO-106646 - Practical Course: Human-Centred Robotics

Type	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Each term	1

Courses					
ST 2026	**2400149**	Practical course: Human-Centred Robotics	**4 SWS**	**Practical course /** 🗣	**Mombaur, Lee**
WT 26/27	**2400193**	Practical Course: Human-Centred Robotics Projects	**4 SWS**	**Practical course /** 🗣	**Mombaur, Lee**
Exams					
ST 2026	**7500168**	Practical Course: Human-Centred Robotics			**Mombaur**
WT 26/27	**7500387**	Practical Course: Human-Centred Robotics			**Mombaur**

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

This includes the preparation of a project report (ca. 10 pages and an oral presentation with slides and hardware demonstration (30 Min + 15 min questions). Students may withdraw from the examination during the first two weeks after the topic has been communicated.

Prerequisites
Programming skills are required.

Recommendations
Knowledge in Robotics (e.g. from the class Robotics 1 and follow-ups) are very helpful.

Additional Information
Limited number of projects and participants. Specific project topics will be different each term and will be announced in a presentation during the first semester week.

T 5.124 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					
ST 2026	**2400216**	Interactive Theorem Proving	**2 SWS**	**Practical course /** 🗣	**Erdweg, Xu, Lego**
WT 26/27	**2400229**	"Practical Course: Interactive Theorem Proving"	**2 SWS**	**Practical course /** 🗣	**Beckert, Stübinger, Färber**
Exams					
ST 2026	**7500320**	Practical Course: Interactive Theorem Proving			**Erdweg**
WT 26/27	**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

T 5.125 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 2026	**2424304**	Internet of Things (IoT) Lab	**4 SWS**	**Practical course /**	**Henkel, Mentzos, Tobar**
WT 26/27	**2424304**	Internet of Things (IoT) Lab	**4 SWS**	**Practical course /**	**Mentzos, Henkel, Tobar**
Exams					
ST 2026	**7500187**	Lab: Internet of Things (IoT)			**Henkel**
WT 26/27	**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.

T 5.126 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 summer term	2

Courses					
ST 2026	**2424811**	Low Power Design and Embedded Systems	**4 SWS**	**Practical course /**	**Henkel, Khdr, Sikal, Mentzos**
Exams					
ST 2026	**7500158**	Lab: Low Power Design and Embedded Systems			**Henkel**
WT 26/27	**7500104**	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.

T 5.127 Module component: Practical Course: Machine Learning and Intelligent Systems [T-INFO-115259]

Coordinators: Prof. Dr.-Ing. Uwe Hanebeck
Organisation: KIT Department of Informatics
Part of: M-INFO-107845 - Practical Course: Machine Learning and Intelligent Systems

Type	Credits	Grading	Term offered	Version
Examination of another type	8 CP	graded	Each term	1

Courses					
WT 26/27	**2424281**	Practical Course Machine Learning and Intelligent Systems	**4 SWS**	**Practical course /** 🗣	**Hanebeck**

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 assessment consists of a written report, three presentations, and an assessment of the scientific work and implementation work carried out during the course.

Prerequisites
None.

T 5.128 Module component: Practical Course: Mathematical and Computational Methods in Robotics and AI [T-INFO-114911]

Coordinators: Prof. Dr. Katja Mombaur
Organisation: KIT Department of Informatics
Part of: M-INFO-107609 - Practical Course: Mathematical and Computational Methods in Robotics and AI

Type	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Each term	2

Courses					
ST 2026	**2400202**	Practical Course: Mathematical and Computational Methods in Robotics & AI	**4 SWS**	**Practical course /** 🗣	**Mombaur, Große Sundrup**
WT 26/27	**2400181**	Practical Course: Mathematical and Computational Methods in Robotics & AI	**4 SWS**	**Practical course /** 🗣	**Mombaur, Große Sundrup**
Exams					
ST 2026	**7500306**	Practical Course: Mathematical and Computational Methods in Robotics and AI			**Mombaur**
WT 26/27	**7500388**	Practical Course: Mathematical and Computational Methods in Robotics and AI			**Mombaur**

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

This includes the preparation of a project report (ca. 10 pages and an oral presentation (30 Min + 15 min questions). Students may withdraw from the examination during the first two weeks after the topic has been communicated.

Prerequisites
Programming skills

Recommendations
Basic mathematical knowledge will be helpful, depending on topic. For Projects in the context of robotics, knowledge of robotics is recommended, but not strictly necessary.

Additional Information
Limited number of projects and participants. Specific project topics will be different each term and will be announced in a presentation during the first semester week or can be indivdually agreed upon with people supervising the practical. Students can propose topics on their own as well.

T 5.129 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 summer term	2

Courses					
ST 2026	**2400091**	Practical Course: Model-Driven Software Development	**4 SWS**	**Practical course /** 🗣	**Burger**
Exams					
ST 2026	**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 5.130 Module component: Practical Course: Movement and Technology [T-INFO-113394]

Coordinators: Prof. Dr. Katja Mombaur
Organisation: KIT Department of Informatics
Part of: M-INFO-106648 - Practical Course: Movement and Technology

Type	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Each summer term	2

Courses					
ST 2026	**2400151**	Practical Course: Movement and Technology	**4 SWS**	**Practical course /** 🗣	**Mombaur, Lau**
Exams					
ST 2026	**7500171**	Practical Course: Movement and Technology			**Mombaur**

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

This includes the preparation of a project report (ca. 10 pages and an oral presentation of the project topics and results with slides. Students may withdraw from the examination during the first two weeks after the topic has been communicated.

Prerequisites
Programming skills are required.

Recommendations
Knowledge in Robotics (e.g. from the class Robotics 1 and follow-ups) are very helpful.

Programming skills.

Additional Information
Limited number of projects and participants. Specific project topics will be different each term and will be announced in a presentation during the first semester week.

T 5.131 Module component: Practical Course: Natural Language Dialog Systems [T-INFO-114206]

Coordinators: Prof. Dr. Jan Niehues
Organisation: KIT Department of Informatics
Part of: M-INFO-107177 - Practical Course: Natural Language Dialog Systems

Type	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Irregular	1

Courses					
ST 2026	**2400187**	Praktikum Natural Language Dialog Systems	**2 SWS**	**Practical course /** 🗣	**Niehues, Koneru**
Exams					
ST 2026	**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 5.132 Module component: Practical Course: Neural Network Acceleration on FPGAs [T-INFO-113122]

Coordinators: Dr.-Ing. Dennis Gnad
Prof. Dr. Mehdi Baradaran Tahoori

Organisation: KIT Department of Informatics

Part of: M-INFO-106503 - Practical Course: Neural Network Acceleration on FPGAs

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

Courses					
ST 2026	**2400205**	Neural Network Acceleration on FPGAs	**4 SWS**	**Practical course /** 🗣	**Tahoori**
WT 26/27	**2400205**	Practical Course: Neural Network Acceleration on FPGAs	**4 SWS**	**Practical course /** 🗣	**Tahoori**
Exams					
ST 2026	**7500054**	Practical Course: Neural Network Acceleration on FPGAs			**Tahoori**
WT 26/27	**7500222**	Practical Course: Neural Network Acceleration on FPGAs			**Tahoori**

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

A presentation must be given.
The module grade is composed of 80 % of the performance in the internship and 20 % of the presentation.

Prerequisites
None.

Recommendations
Elementary knowledge in hardware design and/or neural networks are required.
Intermediate or advanced knowledge in at least one of the aspects is recommended.

T 5.133 Module component: Practical Course: Performance Engineering in C++ and Rust [T-INFO-115280]

Coordinators: Dr. Ragnar Groot Koerkamp
Nikolai Maas
Organisation: KIT Department of Informatics
Part of: M-INFO-107865 - Practical Course: Performance Engineering in C++ and Rust

Type	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Irregular	1

Courses					
WT 26/27	**2400204**	Practical Course: Performance Engineering in C++ and Rust	**4 SWS**	**Practical course /**	**Sanders, Williams, Groot Koerkamp, Borowitz, Maas**

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++ or Rust. An overall grade is awarded.

Prerequisites
None.

Modeled Prerequisites
The following conditions have to be fulfilled:
1. The module component T-INFO-106992 - Lab: Efficient Parallel C++ must not have been started.
2. The module component T-INFO-114228 - Practical Course: Efficient Parallel C++ must not have been started.

Recommendations
At least basic knowledge of the C++ language *or* Rust language is necessary for participation in the course. Students should be able to implement given algorithms.

T 5.134 Module component: Practical Course: Programming Language Design and Implementation [T-INFO-115486]

Coordinators: Prof. Dr. Sebastian Erdweg
Organisation: KIT Department of Informatics
Part of: M-INFO-108020 - Practical Course: Programming Language Design and Implementation

Type	Credits	Grading	Term offered	Expansion	Version
Examination of another type	6 CP	graded	Irregular	1 semesters	1

Courses					
WT 26/27	**2400248**	Programming Language Design and Implementation	**2 SWS**	**Practical course /** 🗣	**Erdweg**
Exams					
WT 26/27	**7500294**	Practical Course: Programming Language Design and Implementation			**Erdweg**

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO). Students are graded on the developed language implementation during the project phase, along with a presentation on their completed project (duration approx. 20min). Students may withdraw from the examination until two weeks after the projects have been assigned. The assessment can be repeated once.

Prerequisites
None.

Recommendations
Very good programming skills.

T 5.135 Module component: Practical Course: Real-world Vulnerability Discovery and Exploits [T-INFO-113350]

Coordinators: Prof. Dr. Christian Wressnegger
Organisation: KIT Department of Informatics
Part of: M-INFO-106627 - Practical Course: Real-world Vulnerability Discovery and Exploits

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

Courses					
ST 2026	**241337**	Practical Course: Real-world Vulnerability Discovery and Exploits	**2 SWS**	**Practical course /** 🗣	**Wressnegger**
WT 26/27	**241337**	Practical Course: Real-world Vulnerability Discovery and Exploits	**4 SWS**	**Practical course /** 🗣	**Wressnegger**
Exams					
ST 2026	**7500376**	Practical Course: Real-world Vulnerability Discovery and Exploits			**Wressnegger**
WT 26/27	**7500383**	Practical Course: Real-world Vulnerability Discovery and Exploits			**Wressnegger**

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

Prerequisites
None.

Recommendations
Application security internship

T 5.136 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 2026	**24870**	Robotics - Practical Course	**4 SWS**	**Practical course /** 🗣	**Asfour**
Exams					
ST 2026	**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.

T 5.137 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 26/27	**2400252**	Practical Course: Route Planning	**4 SWS**	**Practical course /** 🗣	**Bläsius, Zündorf, Feilhauer, Steil**
WT 26/27	**2424305**	Practical Course in Algorithm Design	**4 SWS**	**Practical course /** 🗣	**Feilhauer, Bläsius, Zündorf**
Exams					
WT 26/27	**7500072**	Practical Course in Algorithm Design			**Ueckerdt**
WT 26/27	**7500314**	Practical Course: Route Planning			**Bläsius**

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO)

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 5.138 Module component: Practical Course: Security, Usability and Society [T-INFO-110990]

Coordinators: Prof. Dr. Thorsten Strufe
Organisation: KIT Department of Informatics
Part of: M-INFO-105453 - Practical Course: Security, Usability and Society

Type	Credits	Grading	Term offered	Version
Examination of another type	4 CP	graded	Irregular	1

Courses					
ST 2026	**2512554**	Practical Course: Security, Usability and Society	**3 SWS**	**Practical course /**	**Volkamer, Strufe, Hennig, Länge, Fallahi, Hilt, Reimer, Algedri, Mack**
WT 26/27	**2512554**	Praktikum Security, Usability and Society (Bachelor)	**3 SWS**	**Practical course /**	**Volkamer, Strufe, Berens, Fallahi, Ballreich, Hennig, Länge, Hilt, Algedri, Mack, Matheis, Reimer**
WT 26/27	**2512555**	Praktikum Security, Usability and Society (Master)	**3 SWS**	**Practical course /**	**Volkamer, Strufe, Berens, Fallahi, Ballreich, Hennig, Länge, Hilt, Mack, Matheis, Algedri, Reimer**
Exams					
ST 2026	**7500322**	Practical Course: Security, Usability and Society			**Strufe**
ST 2026	**7900029**	Practical lab Security, Usability and Society (Bachelor)			**Volkamer, Strufe**
ST 2026	**7900178**	Practical Lab Security, Usability and Society (Master)			**Volkamer, Strufe**
WT 26/27	**7500304**	Practical Course: Security, Usability and Society			**Strufe**
WT 26/27	**7900116**	Advanced Lab Security, Usability and Society (Bachelor)			**Volkamer**
WT 26/27	**7900307**	Advanced Lab Security, Usability and Society (Master)			**Volkamer**

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 5.139 Module component: Practical Course: Smart Energy System [T-INFO-112030]

Coordinators: Dr.-Ing. Richard Jumar
Organisation: KIT Department of Informatics
Part of: M-INFO-105955 - Practical Course: Smart Energy System

Type	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Each term	1

Courses					
ST 2026	**2400170**	Laboratory: Smart Energy System Lab	**4 SWS**	**Practical course /** 🗣	**Hagenmeyer, Waczowicz, Jumar, Aghaei Attar**
WT 26/27	**2400230**	Lab Course: Smart Energy System Lab	**4 SWS**	**Practical course /** 🗣	**Hagenmeyer, Jumar, Aghaei Attar**
Exams					
ST 2026	**7500318**	Practical Course: Smart Energy System Lab			**Hagenmeyer**
WT 26/27	**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).

An overall grade is awarded which consists of:
40% 10 min presentation (per team) + 5 min of discussion
60% Write up in the style of a research paper of around 5-6 pages (for solo participants) or 7-8 pages (for teams of two)
The students may redraw from the examination before the end of the first laboratory week. The assessment can be repeated once.

Prerequisites
None.

Recommendations
- Knowledge of the fundamentals of energy informatics is a prerequisite.
- Knowledge of the fundamentals of electrical engineering and energy technology is required.
- Knowledge of the basics of mechatronics, data analysis and signal processing is helpful.
- Knowledge of power systems or power electronics is helpful.

T 5.140 Module component: Practical Course: Software Development and Application of Mobile, Bio-Inspired Robots [T-MACH-113854]

Coordinators: Prof. Dr.-Ing. Arne Rönnau
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106904 - Practical Course: Software Development and Application of Mobile, Bio-Inspired Robots

Type	Credits	Grading	Term offered	Expansion	Version
Examination of another type	6 CP	graded	Each winter term	1 semesters	1

Courses					
WT 26/27	**2121342**	Practical Course: Software Development and Application of Mobile, Bio-Inspired Robots	**4 SWS**	**Practical course /** 🗣	**Rönnau**
Exams					
WT 26/27	**76-T-MACH-113854**	Practical Course: Software Development and Application of Mobile, Bio-Inspired Robots			**Rönnau**

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.

Code must be generated, a written report prepared and a presentation given.

Prerequisites
None

Recommendations
Knowledge of the basics of robotics from Robotics 1 is helpful. Basic knowledge of C++ or Python and Linux is a prerequisite.

Additional Information
The course is offered in English.

Workload
180 hours

T 5.141 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 2026	**2424902**	Practical course GPU-Computing	**4 SWS**	**Practical course /** 🗣	**Lerzer, Klepikov, Dereviannykh, Dachsbacher**
WT 26/27	**2424283**	Practical course GPU-Computing	**4 SWS**	**Practical course /** 🗣	**Klepikov, Lerzer, Dachsbacher**
Exams					
ST 2026	**7500125**	Practical Course GPU-Computing			**Dachsbacher**
WT 26/27	**7500110**	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.

T 5.142 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 2026	**2400009**	Practical Introduction in Hardware Security	**4 SWS**	**Lecture / Practice /** 🗣	**Tahoori, Gnad**
WT 26/27	**2400033**	Practical Introduction to Hardware Security	**4 SWS**	**Lecture / Practice /** 🗣	**Gnad, Tahoori**
Exams					
ST 2026	**7500224**	Practical Introduction to Hardware Security			**Tahoori**
WT 26/27	**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”

T 5.143 Module component: Practical SAT Solving [T-INFO-114262]

Coordinators: Dr. Tomas Balyo
Dr. Ashlin Iser
Prof. Dr. Peter Sanders
Dr. Dominik Schreiber

Organisation: KIT Department of Informatics

Part of: M-INFO-107238 - Practical SAT Solving

Type	Credits	Grading	Term offered	Version
Oral examination	5 CP	graded	Irregular	1

Courses					
ST 2026	**2400218**	Practical SAT Solving	**3 SWS**	**Lecture / Practice**	**Sanders, Iser, Schreiber**
Exams					
ST 2026	**7500415**	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 5.144 Module component: Practice of Research (Methods, 1st Semester) [T-INFO-115231]

Coordinators: Prof. Dr. Bernhard Beckert
Organisation: KIT Department of Informatics
Part of: M-INFO-107829 - Practice of Research (Methods, 1st Semester)

Type	Credits	Grading	Term offered	Version
Coursework	2 CP	pass/fail	Each term	1

Assessment
Progress is assessed through the following examination components:

- Other types of performance assessments (Section 4(2)(3) of the SPO) in the form of work to be completed during the semester, namely
- written assignments,
- short presentations,
- discussions on the course content.

The number and content of the required assignments will be announced at the beginning of the semester.

Prerequisites
None.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module M-INFO-107831 - Practice of Research (Project, 1st Semester) must have been started.

Additional Information
Registration for this module is only possible in conjunction with registration for the module “Practice of Research (Project, 1st Semester)”; see there.

T 5.145 Module component: Practice of Research (Methods, 2nd Semester) [T-INFO-115232]

Coordinators: Prof. Dr. Bernhard Beckert
Organisation: KIT Department of Informatics
Part of: M-INFO-107830 - Practice of Research (Methods, 2nd Semester)

Type	Credits	Grading	Term offered	Version
Coursework	2 CP	pass/fail	Each term	1

Assessment
Progress is assessed through the following examination components:

- Other types of performance assessments (§4 Abs.2 Nr.3 der SPO) in the form of work to be completed during the semester, namely
- written assignments,
- short presentations,
- discussions on the course content.

The number and content of the required assignments will be announced at the beginning of the semester.

Prerequisites
None.

Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module M-INFO-107832 - Practice of Research (Project, 2nd Semester) must have been started.

Additional Information
Registration for this module is only possible in conjunction with registration for the module “Practice of Research (Methods, 1st Semester)”; see there.

T 5.146 Module component: Practice of Research (Project, 1st Semester) - Oral Exam [T-INFO-115235]

Coordinators: Prof. Dr. Bernhard Beckert
Organisation: KIT Department of Informatics
Part of: M-INFO-107831 - Practice of Research (Project, 1st Semester)

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

Assessment
Progress assessments take the form of the following examination components
- Other types of progress assessments (§4 Abs. 2 Nr. 2 of the SPO) in the form of work to be completed during the semester, namely
◦ written assignments,
◦ project presentations,
◦ a discussion of the project's content,
◦ the completion of the preparatory work required for the respective project. The
number and content of the required tasks will be announced at the beginning of the first semester.

The final grade for the module is calculated from the weighted partial grades of the individual examination components. In this context:
- the written assignments together account for 1/3,
- the project presentations together account for 1/3,
- the oral exam accounts for 1/3.

Prerequisites
None.

T 5.147 Module component: Practice of Research (Project, 1st Semester) - Presentation [T-INFO-115233]

Coordinators: Prof. Dr. Bernhard Beckert
Organisation: KIT Department of Informatics
Part of: M-INFO-107831 - Practice of Research (Project, 1st Semester)

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

Assessment
Assessment takes the form of an alternative type of assessment in accordance with §4 Abs. 2 Nr. 3 of the SPO.

Assignments to be completed during the semester:
◦ Project presentations,
◦ a discussion of the project's content. The
number and content of the assignments will be announced at the beginning of the semester.

The final grade for the module is calculated from the weighted partial grades of the individual examination components. In this context:
- the written assignments together account for 1/3,
- the project presentations together account for 1/3,
- the oral exam accounts for 1/3.

Prerequisites
None.

T 5.148 Module component: Practice of Research (Project, 1st Semester) - Project Proposal [T-INFO-115234]

Coordinators: Prof. Dr. Bernhard Beckert
Organisation: KIT Department of Informatics
Part of: M-INFO-107831 - Practice of Research (Project, 1st Semester)

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

Assessment
Assessment takes the form of an alternative type of assessment in accordance with §4 Abs. 2 Nr. 3 of the SPO.

Assignments to be completed during the semester:

◦ written assignments,
◦ completion of the preparatory work required for the respective project. The number and content of the required work will be announced at the beginning of the first semester.

The final grade for the module is calculated from the weighted partial grades of the individual examination components. In this context:
- the written assignments together account for 1/3,
- the project presentations together account for 1/3,
- the oral exam accounts for 1/3.

Prerequisites
None.

T 5.149 Module component: Practice of Research (Project, 2nd Semester) - Oral Exam [T-INFO-115236]

Coordinators: Prof. Dr. Bernhard Beckert
Organisation: KIT Department of Informatics
Part of: M-INFO-107832 - Practice of Research (Project, 2nd Semester)

Type	Credits	Grading	Term offered	Version
Oral examination	3 CP	graded	Each term	1

Assessment
Assessment is conducted in accordance with §4 Abs. 2 Nr. 2 of the SPO in the form of an oral exam (typically 30 minutes).

The final grade for the module is calculated from the weighted partial grades of the individual module components. In this context, the written assignments together account for
1/3 of the total grade (T-INFO-T-INFO-115238), the project presentations together have a weight of 1/3 (T-INFO-115237), and the oral exam has a weight of 1/3 (T-INFO-115236).

Prerequisites
None.

T 5.150 Module component: Practice of Research (Project, 2nd Semester) - Presentation [T-INFO-115237]

Coordinators: Prof. Dr. Bernhard Beckert
Organisation: KIT Department of Informatics
Part of: M-INFO-107832 - Practice of Research (Project, 2nd Semester)

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

Assessment
Assessment takes the form of an alternative type of assessment in accordance with §4 Abs. 2 Nr. 3 of the SPO.

Assignments to be completed during the semester:
◦ Project presentations,
◦ a discussion of the project's content. The number and content of the assignments will be announced at the beginning of the semester.

The final grade for the module is calculated from the weighted partial grades of the individual module components. In this context, the written assignments together account for 1/3 of the total grade (T-INFO-T-INFO-115238), the project presentations together have a weight of 1/3 (T-INFO-115237), and the oral exam has a weight of 1/3 (T-INFO-115236).

Prerequisites
None.

T 5.151 Module component: Privacy Enhancing Technologies [T-INFO-110989]

Coordinators: Prof. Dr. Thorsten Strufe
Organisation: KIT Department of Informatics
Part of: M-INFO-105452 - Privacy Enhancing Technologies

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

Courses					
ST 2026	**2400088**	Privacy Enhancing Technologies	**4 SWS**	**Lecture / Practice /** 🗣	**Strufe, Guerra Balboa**
Exams					
ST 2026	**7500112**	Privacy Enhancing Technologies			**Strufe**
WT 26/27	**7500308**	Privacy Enhancing Technologies			**Strufe**

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 5.152 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	Irregular	1

Courses					
WT 26/27	**2400153**	Probability and Computing	**3 SWS**	**Lecture / Practice /** 🗣	**Sanders, Walzer, Hermann**
Exams					
WT 26/27	**7500376**	Probability and Computing			**Bläsius, Sanders**

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

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

Prerequisites
None.

Recommendations
Basic knowledge of algorithms and data structures (e.g. from the lectures Algorithms 1 + 2) as well as basic knowledge of probability theory (e.g. from the lecture Introduction to Stochastics) are helpful.

T 5.153 Module component: Public International Law [T-INFO-113381]

Coordinators: TT-Prof. Dr. Frederike Zufall
Organisation: KIT Department of Informatics
Part of: M-INFO-107029 - Public International Law with an Economic Law Focus

Type	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each summer term	2

Courses					
ST 2026	**2400172**	Public International Law with an Economic Law Focus	**2 SWS**	**Lecture / 🗣**	**Kasper-Schöniger**
Exams					
ST 2026	**7500182**	Public International Law with an Economic Law Focus			**Zufall**
WT 26/27	**7500066**	Public International Law			**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.

T 5.154 Module component: Reading Group [T-INFO-102051]

Coordinators: Prof. Dr. Ralf Reussner
Organisation: KIT Department of Informatics
Part of: M-INFO-107254 - Interdisciplinary Qualifications

Type	Credits	Grading	Term offered	Version
Coursework (oral)	1 CP	pass/fail	Each term	1

T 5.155 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 26/27	**2400163**	Reinforcement Learning		**Lecture / Practice /**	**Neumann, Lioutikov**
Exams					
ST 2026	**7500221**	Reinforcement Learning			**Neumann, Lioutikov**
WT 26/27	**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.

T 5.156 Module component: Reliable Computing I [T-INFO-101387]

Coordinators: Prof. Dr. Mehdi Baradaran Tahoori
Organisation: KIT Department of Informatics
Part of: M-INFO-100850 - Reliable Computing I

Type	Credits	Grading	Term offered	Version
Oral examination	3 CP	graded	Irregular	1

Courses					
WT 26/27	**2424071**	Reliable Computing I	**2 SWS**	**Lecture /**	**Tahoori**
Exams					
ST 2026	**7500027**	Reliable Computing I			**Tahoori**
WT 26/27	**7500167**	Reliable Computing 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.

T 5.157 Module component: Research Focus Class: Blockchain & Cryptocurrencies [T-INFO-113400]

Coordinators: Prof. Dr. Hannes Hartenstein
Organisation: KIT Department of Informatics
Part of: M-INFO-106654 - Research Focus Class: Blockchain & Cryptocurrencies

Type	Credits	Grading	Term offered	Version
Coursework	3 CP	pass/fail	Irregular	1

Courses					
ST 2026	**2400184**	Research Focus Class: Blockchain & Cryptocurrencies Seminar	**2 SWS**	**Seminar /** 🗣	**Hartenstein, Spiesberger, Grundmann**
ST 2026	**2400185**	Research Focus Class: Blockchain & Cryptocurrencies	**1 SWS**	**Lecture /** 🗣	**Hartenstein, Spiesberger, Grundmann**
Exams					
ST 2026	**7500386**	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.

T 5.158 Module component: Research Focus Class: Blockchain & Cryptocurrencies - Seminar [T-INFO-113401]

Coordinators: Prof. Dr. Hannes Hartenstein
Organisation: KIT Department of Informatics
Part of: M-INFO-106654 - Research Focus Class: Blockchain & Cryptocurrencies

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

Courses					
ST 2026	**2400184**	Research Focus Class: Blockchain & Cryptocurrencies Seminar	**2 SWS**	**Seminar /** 🗣	**Hartenstein, Spiesberger, Grundmann**
ST 2026	**2400185**	Research Focus Class: Blockchain & Cryptocurrencies	**1 SWS**	**Lecture /** 🗣	**Hartenstein, Spiesberger, Grundmann**
Exams					
ST 2026	**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.

T 5.159 Module component: Research Practical Course on Behavior Foundation Models [T-INFO-115118]

Coordinators: TT-Prof. Dr. Rudolf Lioutikov
Organisation: KIT Department of Informatics
Part of: M-INFO-107728 - Research Practical Course on Behavior Foundation Models

Type	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Each summer term	1

Courses					
ST 2026	**2400139**	Research Practical Course on Behavior Foundation Models	**4 SWS**	**Practical course /** 🗣	**Lioutikov**
Exams					
ST 2026	**7500266**	Research Practical Course on Behavior Foundation Models			**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.

Modeled Prerequisites
The following conditions have to be fulfilled:
1. The module component T-INFO-112772 - Research Practical Course: Interactive Learning must not have been started.

Recommendations
We highly recommend to take this research project in combination with the Seminar on Behavior Foundation Models.

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 5.160 Module component: Research Practical Course: Artificial Intelligence & Security [T-INFO-113759]

Coordinators: Prof. Dr. Christian Wressnegger
Organisation: KIT Department of Informatics
Part of: M-INFO-106866 - Research Practical Course: Artificial Intelligence & Security

Type	Credits	Grading	Term offered	Version
Examination of another type	6 CP	graded	Each term	1

Courses					
WT 26/27	**24042**	Research Lab: Artificial Intelligence & Security	**4 SWS**	**Practical course /**	**Wressnegger**
Exams					
ST 2026	**7500367**	Research Practical Course: Artificial Intelligence & Security			

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

Prerequisites
None.

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

T 5.161 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 26/27	**2400142**	Forschungspraktikum: Explainable Artificial Intelligence	**4 SWS**	**Practical course /** 🗣	**Lioutikov, Li, Mattes**
Exams					
WT 26/27	**7500360**	Research Practical Course: Explainable Artificial Intelligence			**Lioutikov**

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO). The overall impression is evaluated. The following partial aspects are included in the grading: Term paper (approx. 10 pages), Presentation (duration approx. 20 min.), Practical training (protocols)

Presentation on the chosen topic at the end of the semester and written paper.

Prerequisites
None

Recommendations
We recommend taking this Praktikum after attending the “Explainable Artificial Intelligence” lecture in the summer semester.

We highly recommend to take this research project in combination with the “Explainable Artificial Intelligence” seminar.

• Experience in Machine Learning is recommended, e.g. through prior coursework.
◦ The Computer Science Department offers several great lectures e.g., “Maschinelles Lernen - Grundlagen und Algorithmen” and “Deep Learning ”
• A good mathematical background will be beneficial
• Python experience is recommended
• We might use the PyTorch deep learning library In the exercises. Some prior knowledge in this is helpful but not necessary.

Additional Information
It is only possible to resign within two weeks after assignment of the topic.

T 5.162 Module component: Research Project (Project, 2nd Semester) - Scientific Report [T-INFO-115238]

Coordinators: Prof. Dr. Bernhard Beckert
Organisation: KIT Department of Informatics
Part of: M-INFO-107832 - Practice of Research (Project, 2nd Semester)

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

Assessment
Assessment takes the form of an alternative type of assessment in accordance with §4 Abs. 2 Nr. 3 of the SPO.

Requirements to be fulfilled during the semester:

◦ written assignments,
◦ completion of the preparatory work required for the respective project. The
number and content of the required work will be announced at the beginning of the semester.

The final grade for the module is calculated from the weighted partial grades of the individual module components. In this context, the written assignments together account for
1/3 of the total grade (T-INFO-T-INFO-115238), the project presentations together have a weight of 1/3 (T-INFO-115237), and the oral exam has a weight of 1/3 (T-INFO-115236).

Prerequisites
None.

T 5.163 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 26/27	**2400091**	Deep Learning for Robotics	**4 SWS**	**Practical course /** 🗣	**Neumann**
Exams					
WT 26/27	**7500305**	Research Project Deep Learning for Robotics			**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.

T 5.164 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 2026	**2400049**	Research Project: Generative AI for Autonomous Agents	**4 SWS**	**Practical course /** 🗣	**Neumann**
Exams					
ST 2026	**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.

T 5.165 Module component: Resilient Networking [T-INFO-111209]

Coordinators: Prof. Dr. Thorsten Strufe
Organisation: KIT Department of Informatics
Part of: M-INFO-105591 - Resilient Networking

Type	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Each winter term	1

Courses					
WT 26/27	**2400134**	Resilient Networking	**4 SWS**	**Lecture / Practice /**	**Strufe**
Exams					
ST 2026	**7500249**	Resilient Networking			**Strufe**
WT 26/27	**7500302**	Resilient Networking			**Strufe**

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
Basics from cryptography and computer networks are helpful.

T 5.166 Module component: Robotic Intelligence: Navigation and Mobile Manipulation [T-MACH-114952]

Coordinators: Prof. Dr.-Ing. Arne Rönnau
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-107621 - Robotic Intelligence: Navigation and Mobile Manipulation

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

Courses					
ST 2026	**2121333**	Robotic Intelligence: Navigation and Mobile Manipulation	**2 SWS**	**Lecture / 🗣**	**Rönnau**
ST 2026	**2121334**	Robotic Intelligence: Navigation and Mobile Manipulation (Exercise)	**1 SWS**	**Practice / 🗣**	**Rönnau**
WT 26/27	**2121333**	Robotic Intelligence: Navigation and Mobile Manipulation	**2 SWS**	**Lecture / 🗣**	**Rönnau**
WT 26/27	**2121334**	Robotic Intelligence: Navigation and Mobile Manipulation (Exercise)	**1 SWS**	**Practice / 🗣**	**Rönnau**
Exams					
ST 2026	**76-T-MACH-114952**	Robotic Intelligence: Navigation and Mobile Manipulation			**Rönnau**
ST 2026	**76-T-MACH-114952-mdl**	Robotic Intelligence: Navigation and Mobile Manipulation			**Rönnau**
WT 26/27	**76-T-MACH-114952**	Robotic Intelligence: Navigation and Mobile Manipulation			**Rönnau**

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

Assessment
Written exam: duration 60 minutes. If the written exam is passed, a grade bonus can be achieved by successfully completing the exercises.

Prerequisites
The partial performance "T-MACH-114034 - Robotic Intelligence for Mobile Systems" must not have been started.

Additional Information
The course is offered in English.

Workload
180 hours

T 5.167 Module component: Robotic Intelligence: Perception and Scene Understanding [T-MACH-114813]

Coordinators: Prof. Dr.-Ing. Arne Rönnau
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-107558 - Robotic Intelligence: Perception and Scene Understanding

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

Courses					
WT 26/27	**2121331**	Robotic Intelligence: Perception and Scene Understanding	**2 SWS**	**Lecture /** 🗣	**Rönnau**
WT 26/27	**2121332**	Robotic Intelligence: Perception and Scene Understanding (Exercise)	**1 SWS**	**Practice /** 🗣	**Rönnau**
Exams					
ST 2026	**76-T-MACH-114813**	Robotic Intelligence: Perception and Scene Understanding			**Rönnau**
WT 26/27	**76-T-MACH-114813**	Robotic Intelligence: Perception and Scene Understanding			**Rönnau**

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

Assessment
Written exam: duration 60 minutes. A grade bonus can be achieved by successfully completing the exercises.

Prerequisites
"T-MACH-114034 - Robotic Intelligence for Mobile Systems" must not have started.

Additional Information
The course is offered in English.

Workload
180 hours

T 5.168 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 26/27	**2424152**	Robotics I - Introduction to Robotics	**4 SWS**	**Lecture / 🗣**	**Asfour, Mombaur**
Exams					
ST 2026	**7500218**	Robotics I - Introduction to Robotics			**Asfour**
WT 26/27	**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.

T 5.169 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 2026	**2400074**	Robotics II: Humanoid Robotics	**2 SWS**	**Lecture /** 🗣	**Asfour**
Exams					
ST 2026	**7500086**	Robotics II: Humanoid Robotics			**Asfour**
WT 26/27	**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 lecture on Robotics I – Introduction to Robotics is recommended

T 5.170 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 2026	**2400067**	Robotics III: Sensors and Perception in Robotics	**2 SWS**	**Lecture /** 🗣	**Asfour, Triebel**
Exams					
ST 2026	**7500242**	Robotics III - Sensors and Perception in Robotics			**Asfour**
WT 26/27	**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
Having visited the lectures on Robotics I – Introduction to Robotics is recommended.

T 5.171 Module component: Robotics Institute Germany - Lecture Series [T-INFO-114895]

Coordinators: Prof. Dr.-Ing. Tamim Asfour
TT-Prof. Dr. Barbara Bruno
Prof. Dr. Jan Niehues

Organisation: KIT Department of Informatics

Part of: M-INFO-107598 - Robotics Institute Germany - Lecture Series

Type	Credits	Grading	Term offered	Expansion	Version
Oral examination	3 CP	graded	Each winter term	1 semesters	1

Courses					
WT 26/27	**2400246**	RIG Lecture Series	**2 SWS**	**Lecture /**	**Bruno, Niehues, Asfour**
Exams					
ST 2026	**7500420**	Robotics Institute Germany - Lecture Series			**Bruno, Asfour**
WT 26/27	**7500401**	Robotics Institute Germany - Lecture Series			**Bruno, Asfour**

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

Assessment
Depending on the number of attending students, the assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting approx. 20 minutes or as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting approx. 120 minutes. The art of assessment will be announced at least six weeks before the end of the course. The default type of examination is oral.

Prerequisites
None.

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

T 5.172 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 2026	**2400194**	Sampling Methods for Machine Learning	**3 SWS**	**Lecture / Practice /**	**Hanebeck, Frisch**
Exams					
ST 2026	**7500391**	Sampling Methods for Machine Learning			**Hanebeck**
WT 26/27	**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)

Modeled Prerequisites
The following conditions have to be fulfilled:
1. The module component T-INFO-114134 - Sampling Methods for Machine Learning - Pass must have been started.

Recommendations
Knowledge of a higher programming language with sophisticated libraries for scientific-numerical computing (e.g. Julia, Matlab, Python) is advantageous.

T 5.173 Module component: Sampling Methods for Machine Learning - Pass [T-INFO-114134]

Coordinators: Prof. Dr.-Ing. Uwe Hanebeck
Organisation: KIT Department of Informatics
Part of: M-INFO-107090 - Sampling Methods for Machine Learning

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

Courses					
ST 2026	**2400194**	Sampling Methods for Machine Learning	**3 SWS**	**Lecture / Practice /**	**Hanebeck, Frisch**
Exams					
ST 2026	**7500392**	Sampling Methods for Machine Learning - Pass			**Hanebeck**
WT 26/27	**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

T 5.174 Module component: Scalable Graph and Sparse Matrix Algorithms for Learning [T-INFO-115282]

Coordinators: Prof. Dr. Henning Meyerhenke
Organisation: KIT Department of Informatics
Part of: M-INFO-107867 - Scalable Graph and Sparse Matrix Algorithms for Learning

Type	Credits	Grading	Term offered	Expansion	Version
Oral examination	5 CP	graded	Irregular	1 semesters	1

Courses					
WT 26/27	**2400188**	Scalable Graph and Sparse Matrix Algorithms for Learning	**3 SWS**	**Lecture /** 🗣	**Meyerhenke**

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

Assessment
The assessment takes the form of an oral examination lasting approx. 30 minutes in accordance with § 4 Abs. 2 No. 2 of the Examination Regulations (SPO). A programming exercise must be completed as a prerequisite for the exam.

Prerequisites
None.

Recommendations
Basic knowledge of graph algorithms, linear algebra, and C++.

T 5.175 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	6 CP	graded	Each winter term	2

Courses					
WT 26/27	**2400009**	Scientific Methods to Design and Analyze Secure Decentralized Systems	**4 SWS**	**Lecture / Practice /** 🗣	**Hartenstein, Jacob**
Exams					
ST 2026	**7500081**	Scientific Methods to Design and Analyze Secure Decentralized Systems			**Hartenstein**
WT 26/27	**7500050**	Scientific Methods to Design and Analyze Secure Decentralized Systems			**Hartenstein**

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
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 5.176 Module component: Self-Booking-HOC-SPZ-FORUM-PEBA-Graded [T-INFO-111475]

Coordinators: Lena Coerdt
Organisation: KIT Department of Informatics
Part of: M-INFO-107254 - Interdisciplinary Qualifications

Type	Credits	Grading	Term offered	Version
Examination of another type	2 CP	graded	Each term	1

Self Service Assignment of Supplementary Studies
This module component can be used for self service assignment of grades acquired from the following study providers:

- House of Competence
- Sprachenzentrum
- Studium Generale. Forum Wissenschaft und Gesellschaft (FORUM) (ehem. ZAK)
- Personalentwicklung und Berufliche Ausbildung

Additional Information
Interdisciplinary qualifications (IQ) completed at the House-of-Competence (HoC),
at the Zentrum für Angewandte Kulturwissenschaften (ZAK) or at the Sprachenzentrum (SpZ)
can be assigned in self-service.

First, select a partial accomplishment named "self-assignment" in your study schedule
and second, assign an IQ-achievement via the tab "IQ achievements".

T 5.177 Module component: Self-Booking-HOC-SPZ-FORUM-PEBA-Graded [T-INFO-115028]

Coordinators: Lena Coerdt
Organisation: KIT Department of Informatics
Part of: M-INFO-107254 - Interdisciplinary Qualifications

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

Self Service Assignment of Supplementary Studies
This module component can be used for self service assignment of grades acquired from the following study providers:

- House of Competence
- Sprachenzentrum
- Studium Generale. Forum Wissenschaft und Gesellschaft (FORUM) (ehem. ZAK)
- Personalentwicklung und Berufliche Ausbildung

Additional Information
Interdisciplinary qualifications (IQ) completed at the House-of-Competence (HoC),
at the Zentrum für Angewandte Kulturwissenschaften (ZAK) or at the Sprachenzentrum (SpZ)
can be assigned in self-service.

First, select a partial accomplishment named "self-assignment" in your study schedule
and second, assign an IQ-achievement via the tab "IQ achievements".

T 5.178 Module component: Self-Booking-HOC-SPZ-FORUM-PEBA-Graded [T-INFO-115027]

Coordinators: Lena Coerdt
Organisation: KIT Department of Informatics
Part of: M-INFO-107254 - Interdisciplinary Qualifications

Type	Credits	Grading	Term offered	Version
Examination of another type	2 CP	graded	Each term	1

Self Service Assignment of Supplementary Studies
This module component can be used for self service assignment of grades acquired from the following study providers:

- House of Competence
- Sprachenzentrum
- Studium Generale. Forum Wissenschaft und Gesellschaft (FORUM) (ehem. ZAK)
- Personalentwicklung und Berufliche Ausbildung

Additional Information
Interdisciplinary qualifications (IQ) completed at the House-of-Competence (HoC),
at the Zentrum für Angewandte Kulturwissenschaften (ZAK) or at the Sprachenzentrum (SpZ)
can be assigned in self-service.

First, select a partial accomplishment named "self-assignment" in your study schedule
and second, assign an IQ-achievement via the tab "IQ achievements".

T 5.179 Module component: Self-Booking-HOC-SPZ-FORUM-PEBA-Graded [T-INFO-111474]

Coordinators: Lena Coerdt
Organisation: KIT Department of Informatics
Part of: M-INFO-107254 - Interdisciplinary Qualifications

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

Self Service Assignment of Supplementary Studies
This module component can be used for self service assignment of grades acquired from the following study providers:

- House of Competence
- Sprachenzentrum
- Studium Generale. Forum Wissenschaft und Gesellschaft (FORUM) (ehem. ZAK)
- FORUM (ehem. ZAK) Begleitstudium
- Personalentwicklung und Berufliche Ausbildung

Additional Information
Interdisciplinary qualifications (IQ) completed at the House-of-Competence (HoC),
at the Zentrum für Angewandte Kulturwissenschaften (ZAK) or at the Sprachenzentrum (SpZ)
can be assigned in self-service.

First, select a partial accomplishment named "self-assignment" in your study schedule
and second, assign an IQ-achievement via the tab "IQ achievements".

T 5.180 Module component: Self-Booking-HOC-SPZ-FORUM-PEBA-Graded [T-INFO-111476]

Coordinators: Lena Coerdt
Organisation: KIT Department of Informatics
Part of: M-INFO-107254 - Interdisciplinary Qualifications

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

Self Service Assignment of Supplementary Studies
This module component can be used for self service assignment of grades acquired from the following study providers:

- House of Competence
- Sprachenzentrum
- Studium Generale. Forum Wissenschaft und Gesellschaft (FORUM) (ehem. ZAK)
- Personalentwicklung und Berufliche Ausbildung

Additional Information
Interdisciplinary qualifications (IQ) completed at the House-of-Competence (HoC),
at the Zentrum für Angewandte Kulturwissenschaften (ZAK) or at the Sprachenzentrum (SpZ)
can be assigned in self-service.

First, select a partial accomplishment named "self-assignment" in your study schedule
and second, assign an IQ-achievement via the tab "IQ achievements".

T 5.181 Module component: Self-Booking-HOC-SPZ-FORUM-PEBA-ungraded [T-INFO-115077]

Coordinators: Lena Coerdt
Organisation: KIT Department of Informatics
Part of: M-INFO-107254 - Interdisciplinary Qualifications

Type	Credits	Grading	Term offered	Version
Coursework	4 CP	pass/fail	Each term	1

Self Service Assignment of Supplementary Studies
This module component can be used for self service assignment of grades acquired from the following study providers:

- House of Competence
- Sprachenzentrum
- Studium Generale. Forum Wissenschaft und Gesellschaft (FORUM) (ehem. ZAK)
- Personalentwicklung und Berufliche Ausbildung

Additional Information
Interdisciplinary qualifications (IQ) completed at the House-of-Competence (HoC),
at the Zentrum für Angewandte Kulturwissenschaften (ZAK) or at the Sprachenzentrum (SpZ)
can be assigned in self-service.

First, select a partial accomplishment named "self-assignment" in your study schedule
and second, assign an IQ-achievement via the tab "IQ achievements".

T 5.182 Module component: Self-Booking-HOC-SPZ-FORUM-PEBA-ungraded [T-INFO-111479]

Coordinators: Lena Coerdt
Organisation: KIT Department of Informatics
Part of: M-INFO-107254 - Interdisciplinary Qualifications

Type	Credits	Grading	Term offered	Version
Coursework	3 CP	pass/fail	Each term	1

Self Service Assignment of Supplementary Studies
This module component can be used for self service assignment of grades acquired from the following study providers:

- House of Competence
- Sprachenzentrum
- Studium Generale. Forum Wissenschaft und Gesellschaft (FORUM) (ehem. ZAK)
- Personalentwicklung und Berufliche Ausbildung

Additional Information
Interdisciplinary qualifications (IQ) completed at the House-of-Competence (HoC),
at the Zentrum für Angewandte Kulturwissenschaften (ZAK) or at the Sprachenzentrum (SpZ)
can be assigned in self-service.

First, select a partial accomplishment named "self-assignment" in your study schedule
and second, assign an IQ-achievement via the tab "IQ achievements".

T 5.183 Module component: Self-Booking-HOC-SPZ-FORUM-PEBA-ungraded [T-INFO-115030]

Coordinators: Lena Coerdt
Organisation: KIT Department of Informatics
Part of: M-INFO-107254 - Interdisciplinary Qualifications

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

Self Service Assignment of Supplementary Studies
This module component can be used for self service assignment of grades acquired from the following study providers:

- House of Competence
- Sprachenzentrum
- Studium Generale. Forum Wissenschaft und Gesellschaft (FORUM) (ehem. ZAK)
- Personalentwicklung und Berufliche Ausbildung

Additional Information
Interdisciplinary qualifications (IQ) completed at the House-of-Competence (HoC),
at the Zentrum für Angewandte Kulturwissenschaften (ZAK) or at the Sprachenzentrum (SpZ)
can be assigned in self-service.

First, select a partial accomplishment named "self-assignment" in your study schedule
and second, assign an IQ-achievement via the tab "IQ achievements".

T 5.184 Module component: Self-Booking-HOC-SPZ-FORUM-PEBA-ungraded [T-INFO-115029]

Coordinators: Lena Coerdt
Organisation: KIT Department of Informatics
Part of: M-INFO-107254 - Interdisciplinary Qualifications

Type	Credits	Grading	Term offered	Version
Coursework	2 CP	pass/fail	Each term	1

Self Service Assignment of Supplementary Studies
This module component can be used for self service assignment of grades acquired from the following study providers:

- House of Competence
- Sprachenzentrum
- Studium Generale. Forum Wissenschaft und Gesellschaft (FORUM) (ehem. ZAK)
- Personalentwicklung und Berufliche Ausbildung

Additional Information
Interdisciplinary qualifications (IQ) completed at the House-of-Competence (HoC),
at the Zentrum für Angewandte Kulturwissenschaften (ZAK) or at the Sprachenzentrum (SpZ)
can be assigned in self-service.

First, select a partial accomplishment named "self-assignment" in your study schedule
and second, assign an IQ-achievement via the tab "IQ achievements".

T 5.185 Module component: Self-Booking-HOC-SPZ-FORUM-PEBA-Ungraded [T-INFO-111478]

Coordinators: Lena Coerdt
Organisation: KIT Department of Informatics
Part of: M-INFO-107254 - Interdisciplinary Qualifications

Type	Credits	Grading	Term offered	Version
Coursework	2 CP	pass/fail	Each term	1

Self Service Assignment of Supplementary Studies
This module component can be used for self service assignment of grades acquired from the following study providers:

- House of Competence
- Sprachenzentrum
- Studium Generale. Forum Wissenschaft und Gesellschaft (FORUM) (ehem. ZAK)
- Personalentwicklung und Berufliche Ausbildung

Additional Information
Interdisciplinary qualifications (IQ) completed at the House-of-Competence (HoC),
at the Zentrum für Angewandte Kulturwissenschaften (ZAK) or at the Sprachenzentrum (SpZ)
can be assigned in self-service.

First, select a partial accomplishment named "self-assignment" in your study schedule
and second, assign an IQ-achievement via the tab "IQ achievements".

T 5.186 Module component: Self-Booking-HOC-SPZ-FORUM-PEBA-Ungraded [T-INFO-111477]

Coordinators: Lena Coerdt
Organisation: KIT Department of Informatics
Part of: M-INFO-107254 - Interdisciplinary Qualifications

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

Self Service Assignment of Supplementary Studies
This module component can be used for self service assignment of grades acquired from the following study providers:

- House of Competence
- Sprachenzentrum
- Studium Generale. Forum Wissenschaft und Gesellschaft (FORUM) (ehem. ZAK)
- Personalentwicklung und Berufliche Ausbildung

Additional Information
Interdisciplinary qualifications (IQ) completed at the House-of-Competence (HoC),
at the Zentrum für Angewandte Kulturwissenschaften (ZAK) or at the Sprachenzentrum (SpZ)
can be assigned in self-service.

First, select a partial accomplishment named "self-assignment" in your study schedule
and second, assign an IQ-achievement via the tab "IQ achievements".

T 5.187 Module component: Seminar Dependable Computing [T-INFO-105577]

Coordinators: Prof. Dr. Mehdi Baradaran Tahoori
Organisation: KIT Department of Informatics
Part of: M-INFO-102662 - Seminar Dependable Computing

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

Courses					
ST 2026	**2400030**	Dependable Computing	**2 SWS**	**Seminar /**	**Tahoori**
WT 26/27	**2400030**	Dependable Computing	**2 SWS**	**Seminar /**	**Tahoori**
Exams					
ST 2026	**7500118**	Seminar Dependable Computing			**Tahoori**
WT 26/27	**7500152**	Seminar Dependable Computing			**Tahoori**

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

A written paper must be prepared and a presentation given. Withdrawal is possible within two weeks of the topic being assigned.
The module grade is made up of 50% of the presentation and 50% of the written paper.

Prerequisites
None.

Recommendations
Knowledge of "Dependable Computing" and "Fault Tolerant Computing" and computer architecture is helpful.

T 5.188 Module component: Seminar for Practical Course: Machine Learning and Intelligent Systems [T-INFO-115260]

Coordinators: Prof. Dr.-Ing. Uwe Hanebeck
Organisation: KIT Department of Informatics
Part of: M-INFO-107846 - Seminar for Practical Course: Machine Learning and Intelligent Systems

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

Courses					
WT 26/27	**2400067**	Seminar for Practical Course: Machine Learning and Intelligent Systems	**2 SWS**	**Seminar / 🗣**	**Hanebeck**

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 assessment consists of a written paper-style report, a presentation, and an assessment of the scientific work carried out during the seminar.

Prerequisites
None.

T 5.189 Module component: Seminar in Privacy [T-INFO-114268]

Coordinators: Prof. Dr. Thorsten Strufe
Organisation: KIT Department of Informatics
Part of: M-INFO-107242 - Seminar in Privacy

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

Courses					
ST 2026	**2400087**	Seminar in Privacy	**2 SWS**	**Seminar / 🗣**	**Strufe, Guerra Balboa**
Exams					
ST 2026	**7500323**	Seminar in Privacy			**Strufe**

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

A written paper must be prepared and a presentation given; in addition, preliminary papers must be submitted and commented on in a peer review between fellow students. Withdrawal is possible within two weeks of the topic being assigned.

Prerequisites
None.

Recommendations
Fundamentals of IT security, computer networks and distributed systems are required

T 5.190 Module component: Seminar on Behavior Foundation Models [T-INFO-115119]

Coordinators: TT-Prof. Dr. Rudolf Lioutikov
Organisation: KIT Department of Informatics
Part of: M-INFO-107729 - Seminar on Behavior Foundation Models

Type	Credits	Grading	Term offered	Version
Written examination	3 CP	graded	Each summer term	1

Courses					
ST 2026	**2400136**	Seminar on Behavior Foundation Models	**2 SWS**	**Seminar / 🗣**	**Lioutikov**
Exams					
ST 2026	**7500270**	Seminar on Behavior Foundation Models			**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.

Modeled Prerequisites
The following conditions have to be fulfilled:
1. The module component T-INFO-112773 - Seminar: Interactive Learning must not have been started.

Recommendations
We highly recommend to take this seminar in combination with the Research Practical Course on Behavior Foundation Models (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.

T 5.191 Module component: Seminar Radiation Protection in Medicine [T-ETIT-115253]

Coordinators: PD Dr. Bastian Breustedt
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-107839 - Seminar Radiation Protection in Medicine

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

Courses					
WT 26/27	**2305290**	Seminar Radiation Protection in Medicine	**2 SWS**	**Seminar / 🗣**	**Breustedt**
Exams					
ST 2026	**7305294**	Dosimetry of Ionising Radiation			**Breustedt**

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

Assessment
The examination consists of a written handout (approx. 2-3 pages) and an oral presentation (approx. 25-35 min.) of the students work. Considered will be the quality of the contents, the style of the presentation, the quality and content of the handout. The overall impression is rated.

Prerequisites
none

T 5.192 Module component: Seminar: Advanced Topics in Natural Language Processing [T-INFO-114433]

Coordinators: Prof. Dr. Jan Niehues
Organisation: KIT Department of Informatics
Part of: M-INFO-107353 - Seminar: Advanced Topics in Natural Language Processing

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

Courses					
ST 2026	**2400217**	Advanced Topics in Natural Language Processing	**2 SWS**	**Seminar**	**Niehues**
WT 26/27	**2400074**	Advanced Topics in Natural Language Processing	**2 SWS**	**Seminar**	**Niehues, Li**
Exams					
ST 2026	**00037**	Advanced Topics in Natural Language Processing			**Niehues**
WT 26/27	**7500267**	Seminar Advanced Topics in Natural Language Processing			**Niehues**

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

A written paper must be prepared and a presentation given. Withdrawal is possible within two weeks of the topic being assigned.

Prerequisites
None.

Modeled Prerequisites
The following conditions have to be fulfilled:
1. The module component T-INFO-105653 - Seminar Advanced Topics in Machine Translation must not have been started.

Recommendations
Knowledge from the lectures Machine Translation and Cognitive Systems

T 5.193 Module component: Seminar: Advanced Topics on SAT Solving [T-INFO-114231]

Coordinators: Dr. Ashlin Iser
Prof. Dr. Peter Sanders

Organisation: KIT Department of Informatics

Part of: M-INFO-107209 - Seminar: Advanced Topics on SAT Solving

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

Courses					
WT 26/27	**2400020**	Advanced Topics in SAT Solving	**2 SWS**	**Seminar / 🗣**	**Sanders, Iser, Schreiber**

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

A presentation must be given. Withdrawal is possible within two weeks of the topic being assigned.

Prerequisites
None.

Recommendations
Knowledge of the basics from "SAT Solving in Practice" is helpful.

T 5.194 Module component: Seminar: Algorithm Engineering [T-INFO-112312]

Coordinators: Prof. Dr. Peter Sanders
Organisation: KIT Department of Informatics
Part of: M-INFO-106086 - Seminar: Algorithm Engineering

Type	Credits	Grading	Term offered	Version
Examination of another type	4 CP	graded	Irregular	1

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

A written paper must be prepared and a presentation given. Withdrawal is possible within two weeks of the topic being assigned.

Prerequisites
None.

Recommendations
Knowledge of algorithms is an advantage. Exemplary lectures are Algorithms I, Algorithms II, Algorithm Engineering and Parallel Algorithms.

T 5.195 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

Courses					
ST 2026	**2400259**	Seminar: Artificial Intelligence for Energy Systems		**Seminar / 🗣**	**Schäfer**
WT 26/27	**2400175**	Seminar: Artificial Intelligence for Energy Systems	**2 SWS**	**Seminar / 🗣**	**Schäfer**
Exams					
ST 2026	**7500425**	Seminar: Artificial Intelligence for Energy Systems			**Schäfer**
WT 26/27	**7500354**	Seminar: Artificial Intelligence for Energy Systems			**Schäfer**

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), 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 5.196 Module component: Seminar: Bionic Algorithms and Robot Technologies [T-MACH-113842]

Coordinators: Prof. Dr.-Ing. Arne Rönnau
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-106902 - Seminar: Bionic Algorithms and Robot Technologies

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

Courses					
ST 2026	**2121343**	Seminar: Bionic Algorithms and Robot Technologies	**2 SWS**	**Seminar / 🗣**	**Rönnau**
WT 26/27	**2121343**	Seminar: Bionic Algorithms and Robot Technologies	**2 SWS**	**Seminar / 🗣**	**Rönnau**
Exams					
ST 2026	**76-T-MACH-113842**	Seminar: Bionic Algorithms and Robot Technologies			**Rönnau**
WT 26/27	**76-T-MACH-113842**	Seminar: Bionic Algorithms and Robot Technologies			**Rönnau**

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

Assessment
Success is assessed through the preparation of a written seminar paper and its presentation as an examination of a different kind.

Prerequisites
None

Recommendations
Attending the lecture "Biologically Inspired Robots" is helpful.

Additional Information
The course is offered in English.

Workload
90 hours

T 5.197 Module component: Seminar: Continuous Software Engineering [T-INFO-110794]

Coordinators: Prof. Dr.-Ing. Anne Koziolek
Organisation: KIT Department of Informatics
Part of: M-INFO-105309 - Seminar: Continuous Software Engineering

Type	Credits	Grading	Term offered	Version
Examination of another type	4 CP	graded	Each summer term	2

Courses					
ST 2026	**2400166**	Seminar Continuous Software Engineering	**2 SWS**	**Seminar**	**Koziolek**
WT 26/27	**2400108**	Continuous Software Engineering	**2 SWS**	**Seminar**	**Koziolek**
Exams					
ST 2026	**7500395**	Seminar: Continuous Software Engineering			**Koziolek**
WT 26/27	**7500243**	Seminar: Continuous Software Engineering			**Koziolek**

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).
- the preparation of a written paper (50%)
- the assessment of two seminar papers as part of a peer review (10%)
- the preparation of presentation slides and giving a presentation (20%)
- punctuality of submissions (20%)

Prerequisites
None.

T 5.198 Module component: Seminar: Critical Topics in AI [T-INFO-113915]

Coordinators: Prof. Dr. Pascal Friederich
Organisation: KIT Department of Informatics
Part of: M-INFO-106958 - Seminar: Critical Topics in AI

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

Courses					
ST 2026	**2400215**	Seminar: Critical topics in AI	**2 SWS**	**Seminar /** 🗣	**Friederich, Torresi, Neubert, Schlöder, Metni**
WT 26/27	**2400231**	Seminar: Critical topics in AI	**2 SWS**	**Seminar /** 💮	**Friederich, Torresi, Neubert, Schlöder, Metni**
Exams					
ST 2026	**7500408**	Seminar: Critical topics in AI			**Friederich**

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO). The following partial aspects are included in the grading: Term paper (approx. 10-15 pages), presentation (duration 30+15 min.). The grading scale will be announced in the course. Students may redraw from the examination during the first two weeks after the topic has been communicated. The assessment can be repeated once.

Prerequisites
Basic knowledge in AI and Machine Learning, e.g.
• BA Informatics: Introduction to artificial intelligence

Recommendations
Interest in social topics and research questions is required

T 5.199 Module component: Seminar: Current Trends in Theoretical Computer Science [T-INFO-114091]

Coordinators: Prof. Dr.-Ing. Marvin Künnemann-Goos
Organisation: KIT Department of Informatics
Part of: M-INFO-107027 - Seminar: Current Trends in Theoretical Computer Science

Type	Credits	Grading	Term offered	Version
Examination of another type	4 CP	graded	Irregular	1

Courses					
ST 2026	**2400101**	Current Trends in Theoretical Computer Science		**Seminar / 🗣**	**Künnemann-Goos**
Exams					
ST 2026	**7500411**	Seminar: Current Trends in Theoretical Computer Science			**Künnemann-Goos**

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) and consists of the overall impression during the seminar, including the presentation as session leader and a scientific report at the end of the seminar.

Prerequisites
None.

Recommendations
Basic knowledge of theoretical computer science and algorithm design is recommended.

T 5.200 Module component: Seminar: Deep Learning for Robotics [T-INFO-114204]

Coordinators: Prof. Dr. Gerhard Neumann
Organisation: KIT Department of Informatics
Part of: M-INFO-107175 - Seminar: Deep Learning for Robotics

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

Courses					
WT 26/27	**2400099**	Deep Learning for Robotics	**2 SWS**	**Seminar / 🗣**	**Neumann**
Exams					
WT 26/27	**7500306**	Seminar: Deep Learning for Robotics			**Neumann**

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

Presentation on the chosen topic at the end of the semester and written elaboration
Withdrawal is possible within two weeks of the topic being assigned.

Prerequisites
None.

Recommendations
Attendance of the lecture "Machine Learning - Fundamentals and Algorithms" is recommended.

T 5.201 Module component: Seminar: Embedded Systems I [T-INFO-114255]

Coordinators: Prof. Dr.-Ing. Jörg Henkel
Organisation: KIT Department of Informatics
Part of: M-INFO-107231 - Seminar: Embedded Systems I

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

Courses					
ST 2026	**2400129**	Internet of Things		**Seminar /**	**Henkel**
ST 2026	**2400137**	Embedded Machine Learning		**Seminar /**	**Henkel, Sikal, Khdr, Ahmed, Demirdag, Mentzos**
ST 2026	**2400148**	Embedded Security and Architectures		**Seminar /**	**Henkel, Nassar, Khdr, Sikal, Tobar, Alsharkawy, Dietrich**
WT 26/27	**2400092**	Internet of Things		**Seminar /**	**Henkel**
WT 26/27	**2400137**	Embedded Machine Learning Seminar		**Seminar /**	**Sikal, Ahmed, Dietrich, Demirdag, Henkel, Khdr, Mentzos**
WT 26/27	**2400148**	Embedded Security and Architectures		**Seminar /**	**Nassar, Khdr, Sikal, Henkel, Alsharkawy, Tobar**
Exams					
ST 2026	**7500332**	CES - Seminar: Internet of Things			**Henkel**
ST 2026	**7500335**	CES - Seminar: Machine Learning			**Henkel**
ST 2026	**7500336**	CES - Seminar: Embedded Systems: Architectures and Technologies, Embedded Security and Architectures			**Henkel**
WT 26/27	**7500132**	Seminar: Performance Optimization for Multicore Chips			**Henkel**
WT 26/27	**7500137**	Seminar: Future Computer Architectures			**Henkel**
WT 26/27	**7500140**	Seminar: Low Power Design for Embedded Systems			**Henkel**
WT 26/27	**7500157**	Seminar: Reconfigurable embedded systems			**Henkel**
WT 26/27	**7500159**	Seminar: Security in Internet of Things (IoT)			**Henkel**
WT 26/27	**7500184**	Seminar: Machine Learning on On-Chip Systems			**Henkel**
WT 26/27	**7500185**	Seminar: Approximate Computing for Efficient Machine Learning			**Henkel**
WT 26/27	**7500221**	Seminar: Approximate Computing			**Henkel**
WT 26/27	**7500346**	CES - Seminar: Embedded Systems: Architectures and Technologies			**Henkel**
WT 26/27	**7500347**	CES - Seminar: Internet of Things			**Henkel**
WT 26/27	**7500349**	CES - Seminar: Embedded Machine Learning			**Henkel**

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).A written paper must be prepared and a presentation given. Withdrawal is possible within two weeks of the topic being assigned.

Prerequisites
None.

Recommendations
Knowledge of IoT and embedded systems

T 5.202 Module component: Seminar: Embedded Systems II [T-INFO-114256]

Coordinators: Prof. Dr.-Ing. Jörg Henkel
Organisation: KIT Department of Informatics
Part of: M-INFO-107232 - Seminar: Embedded Systems II

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

Courses					
ST 2026	**2400129**	Internet of Things		**Seminar /**	**Henkel**
ST 2026	**2400137**	Embedded Machine Learning		**Seminar /**	**Henkel, Sikal, Khdr, Ahmed, Demirdag, Mentzos**
ST 2026	**2400148**	Embedded Security and Architectures		**Seminar /**	**Henkel, Nassar, Khdr, Sikal, Tobar, Alsharkawy, Dietrich**
Exams					
ST 2026	**7500332**	CES - Seminar: Internet of Things			**Henkel**
ST 2026	**7500335**	CES - Seminar: Machine Learning			**Henkel**
ST 2026	**7500336**	CES - Seminar: Embedded Systems: Architectures and Technologies, Embedded Security and Architectures			**Henkel**

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO). A written paper must be prepared and a presentation given. Withdrawal is possible within two weeks of the topic being assigned.

Prerequisites
None.

Modeled Prerequisites
The following conditions have to be fulfilled:
1. The module component T-INFO-114256 - Seminar: Embedded Systems II must not have been started.

Recommendations
Knowledge of IoT and embedded systems

Additional Information
This is identical to the module 'Seminars: Embedded Systems I' and enables participation in a second seminar at the CES Chair.

T 5.203 Module component: Seminar: Exoskeletons & Motion Capture [T-INFO-113892]

Coordinators: Prof. Dr. Katja Mombaur
Organisation: KIT Department of Informatics
Part of: M-INFO-106927 - Seminar: Exoskeletons & Motion Capture

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

Courses					
WT 26/27	**2400187**	Seminar: Exoskeletons & Motion Capture	**2 SWS**	**Seminar / 🗣**	**Mombaur, Lau**
Exams					
WT 26/27	**7500161**	Seminar: Exoskeletons & Motion Capture			**Mombaur**

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

This includes the preparation of a term paper in form of a scientific paper (6 pages double column) an oral presentation with slides (30 Min + 15 Min discussion) . Students may redraw from the examination during the first two weeks after the topic has been communicated.

Participation in the block seminar is mandatory.
Students have to actively participate in all discussions.

Prerequisites
None.

Recommendations
Knowledge in Robotics (e.g. from the class Robotics 1 and follow-ups) is helpful

T 5.204 Module component: Seminar: Explainable Artificial Intelligence [T-INFO-113115]

Coordinators: TT-Prof. Dr. Rudolf Lioutikov
Organisation: KIT Department of Informatics
Part of: M-INFO-106497 - Seminar: Explainable Artificial Intelligence

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

Courses					
WT 26/27	**2400143**	Seminar: Explainable Artificial Intelligence	**2 SWS**	**Seminar / 🗣**	**Lioutikov, Mattes, Li**
Exams					
WT 26/27	**7500384**	Seminar: Explainable Artificial Intelligence			**Lioutikov**

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

Presentation on the chosen topic at the end of the semester and written paper.

Prerequisites
None.

Recommendations
We recommend taking this research project after attending the “Explainable Artificial Intelligence” lecture in the summer semester.

We highly recommend to take this seminar in combination with the “Explainable Artificial Intelligence” research project (Forschungspraktikum).

- Experience in Machine Learning is recommended, e.g. through prior coursework.
  - The Computer Science Department offers several great lectures e.g., “Maschinelles Lernen - Grundlagen und Algorithmen” and “Deep Learning ”
- A good mathematical background will be beneficial
- Python experience is recommended
- We will use the PyTorch deep learning library. Some prior knowledge in this is helpful but not necessary.

Additional Information
It is only possible to resign within two weeks after assignment of the topic.

T 5.205 Module component: Seminar: Exploring Robotics - Insights from Science Fiction, Research and Society [T-INFO-113398]

Coordinators: TT-Prof. Dr. Barbara Bruno
Organisation: KIT Department of Informatics
Part of: M-INFO-106651 - Seminar: Exploring Robotics - Insights from Science Fiction, Research and Society

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

Courses					
ST 2026	**2400161**	Exploring Robotics: Insights from Science Fiction, Research and Society	**2 SWS**	**Seminar / 🗣**	**Bruno, Maure, Yang**
Exams					
ST 2026	**7500110**	Seminar: Exploring Robotics - Insights from Science Fiction, Research and Society			**Bruno**

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

The overall impression is evaluated. The following partial aspects are included in the grading: Term paper (approx. 6 pages in double-column format), Presentation (duration approx. 10+10 min.).

Prerequisites
None.

Recommendations
Knowledge of the content of modules Robotics I - Introduction to Robotics, Robotics II: Humanoid Robotics, Robotics III - Sensors and Perception in Robotics is helpful.

T 5.206 Module component: Seminar: Failing Forward: Robotics, Critical Reading and the Making of Good Research [T-INFO-114604]

Coordinators: TT-Prof. Dr. Barbara Bruno
Organisation: KIT Department of Informatics
Part of: M-INFO-107436 - Seminar: Failing Forward: Robotics, Critical Reading and the Making of Good Research

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

Courses					
WT 26/27	**2400194**	Failing Forward: Robotics, Critical Reading and the Making of Good Research - Seminar	**2 SWS**	**Seminar / 🗣**	**Bruno, Maure, Neef**
Exams					
WT 26/27	**7500389**	Seminar: Failing Forward: Robotics, Critical Readig and the Making of Good Research			**Bruno**

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO). The overall impression is evaluated. The following partial aspects are included in the grading: Term paper (approx. 6 pages in double-column format), Presentation (duration approx. 10+10 min.).

Prerequisites
None.

Modeled Prerequisites
The following conditions have to be fulfilled:
1. The module component T-INFO-113116 - Seminar: Human-Robot Interaction must not have been started.

T 5.207 Module component: Seminar: Fine-Grained Complexity Theory & Algorithms [T-INFO-113392]

Coordinators: Prof. Dr.-Ing. Marvin Künnemann-Goos
Organisation: KIT Department of Informatics
Part of: M-INFO-106645 - Seminar: Fine-Grained Complexity Theory & Algorithms

Type	Credits	Grading	Term offered	Version
Examination of another type	4 CP	graded	Irregular	1

Courses					
ST 2026	**2400153**	Fine-Grained Complexity Theory & Algorithms	**2 SWS**	**Seminar / 🗣**	**Künnemann-Goos**
Exams					
ST 2026	**7500352**	Seminar: Fine-Grained Complexity Theory & Algorithms			**Künnemann-Goos**

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) and consists of a presentation and a scientific report.

Prerequisites
None.

Recommendations
Basic knowledge of theoretical computer science and algorithm design is recommended.

Concurrent or previous attendance of the lecture “Fine-Grained Complexity Theory & Algorithms” is helpful, but not required. This seminar can be attended independently.

T 5.208 Module component: Seminar: Hot Topics in Artificial Intelligence & Security 1 [T-INFO-113761]

Coordinators: Prof. Dr. Christian Wressnegger
Organisation: KIT Department of Informatics
Part of: M-INFO-106868 - Seminar: Hot Topics in Artificial Intelligence & Security 1

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

Courses					
WT 26/27	**24004**	Seminar: Hot Topics in Security of Machine Learning	**2 SWS**	**Seminar /** 🗣	**Wressnegger, Zhao**
WT 26/27	**24005**	Seminar: Hot Topics in Cyber-Physical Systems Security	**2 SWS**	**Seminar /** 🗣	**Wressnegger**
Exams					
WT 26/27	**7500359**	Seminar: Hot Topics in Security of Machine Learning			**Wressnegger**

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

A written paper must be prepared and a presentation given. One repetition is possible.

Prerequisites
None.

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

T 5.209 Module component: Seminar: Hot Topics in Artificial Intelligence & Security 2 [T-INFO-113762]

Coordinators: Prof. Dr. Christian Wressnegger
Organisation: KIT Department of Informatics
Part of: M-INFO-106869 - Seminar: Hot Topics in Artificial Intelligence & Security 2

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

Courses					
ST 2026	**24003**	Seminar: Hot Topics in Machine Learning for Computer Security	**2 SWS**	**Seminar / 🗣**	**Wressnegger**
WT 26/27	**24004**	Seminar: Hot Topics in Security of Machine Learning	**2 SWS**	**Seminar / 🗣**	**Wressnegger, Zhao**
WT 26/27	**24005**	Seminar: Hot Topics in Cyber-Physical Systems Security	**2 SWS**	**Seminar / 🗣**	**Wressnegger**
Exams					
ST 2026	**7500198**	Seminar: Hot Topics in Machine Learning for Computer Security			**Wressnegger**

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

A written elaboration must be prepared and a presentation must be given. Withdrawal is possible within two weeks after assignment of the topic. One repetition is possible.

Prerequisites
None.

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

T 5.210 Module component: Seminar: Hot Topics in Bioinformatics [T-INFO-101287]

Coordinators: Prof. Dr. Alexandros Stamatakis
Organisation: KIT Department of Informatics
Part of: M-INFO-100750 - Seminar: Hot Topics in Bioinformatics

Type	Credits	Grading	Term offered	Version
Examination of another type	3 CP	graded	Each summer term	2

Courses					
ST 2026	**2400011**	Hot Topics in Bioinformatics	**2 SWS**	**Seminar / 🗣**	**Stamatakis**
Exams					
ST 2026	**7500014**	Seminar: Hot Topics in Bioinformatics			**Stamatakis**

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO). (Weighting of presentation and written report: 50% each)

Prerequisites
The exam in Introduction to Bioinformatics for Computer Scientists must have been passed in one of the preceding semesters.

Modeled Prerequisites
The following conditions have to be fulfilled:
1. The module M-INFO-100749 - Introduction to Bioinformatics for Computer Scientists must have been passed.

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 5.211 Module component: Seminar: Hot Topics in Decentralized Systems [T-INFO-109922]

Coordinators: Prof. Dr. Hannes Hartenstein
Organisation: KIT Department of Informatics
Part of: M-INFO-104891 - Seminar: Hot Topics in Decentralized Systems

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

Exams			
ST 2026	**7500297**	Seminar: Hot Topics in Decentralized Systems	**Hartenstein**

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

A written paper must be prepared and a presentation given. Withdrawal is possible within two weeks of the topic being assigned.

Prerequisites
None.

Recommendations
Knowledge of the basics of IT security management for networked systems and the basic security module is helpful.

T 5.212 Module component: Seminar: Hot Topics in Explainable Artificial Intelligence (XAI) [T-INFO-112917]

Coordinators: Prof. Dr. Christian Wressnegger
Organisation: KIT Department of Informatics
Part of: M-INFO-106392 - Seminar: Hot Topics in Explainable Artificial Intelligence (XAI)

Type	Credits	Grading	Term offered	Version
Examination of another type	4 CP	graded	Each summer term	2

Courses					
ST 2026	**24005**	Seminar: Hot Topics in Explainable Artificial Intelligence (XAI)	**2 SWS**	**Seminar / 🗣**	**Wressnegger, Noppel**
Exams					
ST 2026	**7500225**	Seminar: Hot Topics in Explainable Artificial Intelligence (XAI)			**Wressnegger**

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

A written paper (seminar paper) must be prepared and a presentation must be given.

Prerequisites
None.

T 5.213 Module component: Seminar: Information Systems [T-INFO-115055]

Coordinators: Prof. Dr.-Ing. Klemens Böhm
Organisation: KIT Department of Informatics
Part of: M-INFO-107686 - Seminar: Information Systems

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

Courses					
ST 2026	**2400131**	Advances in Data Science	**2 SWS**	**Seminar / 🗣**	**Böhm, Matteucci, Friederich**
Exams					
ST 2026	**7500100**	Seminar Information Systems			**Böhm**
WT 26/27	**7500055**	Seminar Information Systems			**Reimann**

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

Assessment
Success is assessed by preparing a written seminar paper and presenting it as a graded assessment of a different kind in accordance with Section 4 (2) No. 3 SPO. The seminar grade corresponds to the written performance, but can be lowered or raised by up to two grade levels by the presentation performance. If the seminar paper is discontinued after the topic has been issued, the seminar is assessed with a grade of 5.0.

The coursework is passed if the written paper and the presentations have each been passed individually; regular attendance at the sessions and active participation in the content-related discussions are also required to pass.

Prerequisites
None.

Recommendations
Lectures of the Chair of Information Management Systems that match the topic of the seminar are strongly recommended.

T 5.214 Module component: Seminar: Interpretability and Causality in Machine Learning [T-INFO-114237]

Coordinators: Jun.-Prof. Dr. Jan Stühmer
Organisation: KIT Department of Informatics
Part of: M-INFO-107217 - Seminar: Interpretability and Causality in Machine Learning

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

Courses					
ST 2026	**2400181**	Interpretability and Causality in Machine Learning	**2 SWS**	**Seminar / 🗣**	**Stühmer**
Exams					
ST 2026	**7500319**	Seminar: Interpretability and Causality in Machine Learning			**Stühmer**

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

A written elaboration must be prepared and a presentation must be given. Students may redraw from the examination during the first two weeks after the topic has been communicated. The assessment can be repeated once.

Prerequisites
None.

Recommendations
Attendance of the lecture "Machine Learning - Fundamentals and Algorithms" is recommended.

T 5.215 Module component: Seminar: Law and Legal Studies [T-INFO-114094]

Coordinators: Gustavo Gil Gasiola
Maitrayee Pathak
Organisation: KIT Department of Informatics
Part of: M-INFO-107028 - Seminar: Law and Legal Studies

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

Courses					
ST 2026	**2400171**	Regulating AI: from ethics to law	**2 SWS**	**Seminar / 🗣**	**Gil Gasiola**
ST 2026	**2400177**	Designing Data Governance of Digital Systems	**2 SWS**	**Seminar / 🗣**	**Pathak**
ST 2026	**2400190**	EU Digital Regulatory Framework	**2 SWS**	**Seminar / 🗣**	**Zufall**
WT 26/27	**2400177**	Human vs. Machine: (Un-)Biased Legal Decision-Making?	**2 SWS**	**Seminar / 🗣**	**Holzhausen**
WT 26/27	**2400184**	EU Digital Regulatory Framework	**2 SWS**	**Seminar / 🗣**	**Zufall**
WT 26/27	**2400203**	EU Fundamental Rights and EU Economic Law in Smart Cities	**2 SWS**	**Seminar / 🗣**	**Kasper-Schöniger**
WT 26/27	**2400221**	Digital Platforms on Trial: EU and US Case Law Perspectives	**2 SWS**	**Seminar / 🗣**	**Abhilasha**
Exams					
ST 2026	**7500060**	Seminar: Law and Legal Studies			**Zufall**
WT 26/27	**7500311**	Seminar: Legal Studies I			**Zufall**
WT 26/27	**7500363**	Seminar: Law and Legal Studies			**Zufall**

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

Assessment
Success is assessed by preparing a written seminar paper and its presentation as a different type of examination in accordance with Section 4 (2) No. 3 SPO.

Prerequisites
None.

T 5.216 Module component: Seminar: Machine Learning in Climate and Environmental Sciences [T-INFO-113519]

Coordinators: TT-Prof. Dr. Peer Nowack
Organisation: KIT Department of Informatics
Part of: M-INFO-106719 - Seminar: Machine Learning in Climate and Environmental Sciences

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

Courses					
WT 26/27	**2400207**	Seminar Machine Learning in Climate and Environmental Sciences	**2 SWS**	**Seminar / 🗣**	**Nowack, Amiramjadi**
Exams					
ST 2026	**7500213**	Seminar Machine Learning in Climate and Environmental Sciences			**Nowack**
WT 26/27	**7500071**	Seminar Machine Learning in Climate and Environmental Sciences			**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).

In the form of a written seminar paper and the presentation of the same.

Prerequisites
- Familiarity with machine learning concepts and techniques.
- Basic knowledge of climate and environmental scince is advantageous but not mandatory.

Recommendations
- An interest in climate and environmental sciences topics is a prerequisite.

T 5.217 Module component: Seminar: Neural Networks and Artificial Intelligence [T-INFO-115209]

Coordinators: Prof. Dr. Jan Niehues
Organisation: KIT Department of Informatics
Part of: M-INFO-107816 - Seminar: Neural Networks and Artificial Intelligence

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

Assessment
Progress is assessed through an examination of another type in accordance with § 4(2)(3) of the Study Regulations.

Prerequisites
None.

Recommendations
Advanced Artificial Intelligence

T 5.218 Module component: Seminar: Operating Systems [T-INFO-114230]

Coordinators: Prof. Dr.-Ing. Frank Bellosa
Organisation: KIT Department of Informatics
Part of: M-INFO-107205 - Seminar: Operating Systems

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

Courses					
ST 2026	**24346**	Seminar Hot Topics in Modern Operating Systems	**2 SWS**	**Seminar / 🗣**	**Bellosa, Khalil**
WT 26/27	**2400017**	Hot Topics in Modern Operating Systems	**2 SWS**	**Seminar / 🗣**	**Bellosa, Khalil**
Exams					
ST 2026	**7500165**	Seminar: Operating Systems			**Bellosa**
WT 26/27	**7500223**	Seminar: Operating Systems			**Bellosa**

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), by preparing a written seminar paper and the presentation of the same.

The overall grade is made up of the graded and weighted performance assessments (usually 50 % seminar paper, 50 % presentation). An overall grade is awarded.

Prerequisites
None.

T 5.219 Module component: Seminar: Post-Quantum Cryptography [T-INFO-111200]

Coordinators: Prof. Dr. Jörn Müller-Quade
Organisation: KIT Department of Informatics
Part of: M-INFO-105585 - Seminar: Post-Quantum Cryptography

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

Courses					
ST 2026	**2400002**	Post-Quantum Cryptography	**2 SWS**	**Seminar / 🗣**	**Klooß, Müller-Quade**
WT 26/27	**2400126**	Seminar Post-Quantum Cryptography	**2 SWS**	**Seminar / 🗣**	**Müller-Quade, Kühn, Ottenhues, Klooß**
Exams					
ST 2026	**7500015**	Seminar: Post-Quantum Cryptography			**Müller-Quade**
WT 26/27	**7500327**	Seminar: Post-Quantum Cryptography			**Müller-Quade**

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

A written paper must be prepared and a presentation given. Withdrawal is possible within two weeks of the topic being assigned

Prerequisites
None.

Recommendations
Basic knowledge of IT-Security and cryptography are recommended.

T 5.220 Module component: Seminar: Practical Graph Algorithms [T-INFO-114297]

Coordinators: Prof. Dr. Henning Meyerhenke
Organisation: KIT Department of Informatics
Part of: M-INFO-107264 - Seminar: Practical Graph Algorithms

Type	Credits	Grading	Term offered	Version
Examination of another type	4 CP	graded	Irregular	1

Courses					
ST 2026	**2400196**	Practical Graph Algorithms	**2 SWS**	**Seminar**	**Meyerhenke**
Exams					
ST 2026	**754600002**	Seminar: Practical Graph Algorithms			**Meyerhenke**

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

A written paper must be prepared and a presentation given. Withdrawal is possible within two weeks of the topic being assigned.

Prerequisites
None.

Recommendations
Knowledge of algorithms, in particular graph algorithms, is a clear advantage. Exemplary lectures are Algorithms I and Algorithms II.

T 5.221 Module component: Seminar: Privacy and Security [T-INFO-114236]

Coordinators: Prof. Dr. Thorsten Strufe
Organisation: KIT Department of Informatics
Part of: M-INFO-107216 - Seminar: Privacy and Security

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

Courses					
WT 26/27	**2400118**	Seminar Privacy and Security	**2 SWS**	**Seminar**	**Strufe, Guerra Balboa**
Exams					
WT 26/27	**7500127**	Seminar Privacy and Security			**Strufe**

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

A written paper must be prepared and a presentation given; in addition, preliminary papers must be submitted and commented on in a peer review between fellow students. Withdrawal is possible within two weeks of the topic being assigned.

Prerequisites
None.

Recommendations
Fundamentals of IT security, computer networks and distributed systems are required

T 5.222 Module component: Seminar: Proofs from THE BOOK [T-INFO-106604]

Coordinators: Prof. Dr. Peter Sanders
Organisation: KIT Department of Informatics
Part of: M-INFO-103306 - Seminar: Proofs from THE BOOK

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

Courses					
ST 2026	**2400033**	Seminar: Proofs from THE BOOK	**2 SWS**	**Seminar / 🗣**	**Sanders, Walzer, Lehmann**
WT 26/27	**2400171**	Seminar: Proofs from THE BOOK	**2 SWS**	**Seminar / 🗣**	**Sanders, Walzer, Hermann**
Exams					
ST 2026	**7500301**	Seminar: Proofs from THE BOOK			**Sanders**
WT 26/27	**7500059**	Seminar: Proofs from THE BOOK			**Sanders**

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

The student must present multiple proofs over the course of the semester and moderate the ensuing discussion about those proofs. No written documents are required. Students may redraw from their participation until the end of the second seminar date.

Prerequisites
None.

Recommendations
The German version “Das Buch der Beweise” is available online at the KIT library within the KIT network. The English version “Proofs from THE BOOK” is available as a physical copy at the KIT library. We recommend having a look inside either version before registering for this seminar.

T 5.223 Module component: Seminar: Quantum Information Theory [T-INFO-110904]

Coordinators: Prof. Dr. Jörn Müller-Quade
Organisation: KIT Department of Informatics
Part of: M-INFO-105408 - Seminar: Quantum Information Theory

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

Courses					
ST 2026	**2400085**	Quantum Information Theory	**2 SWS**	**Seminar / 🗣**	**Müller-Quade, Fruböse, Meier, Jiang**
Exams					
ST 2026	**7500267**	Seminar: Quantum Information Theory			**Müller-Quade**

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

A presentation must be given and a written elaboration of exercises must be prepared.
Withdrawal is possible within two weeks of the topic being assigned.

Prerequisites
None.

Recommendations
Basic knowledge of IT-Security and linear algebra are recommended.

T 5.224 Module component: Seminar: Recent Highlights in Algorithms [T-INFO-114201]

Coordinators: TT-Prof. Dr. Thomas Bläsius
Prof. Dr. Peter Sanders
Dr. rer. nat. Torsten Ueckerdt

Organisation: KIT Department of Informatics

Part of: M-INFO-107172 - Seminar: Recent Highlights in Algorithms

Type	Credits	Grading	Term offered	Version
Examination of another type	4 CP	graded	Irregular	1

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO), by preparing a written seminar paper and the presentation of the same

Prerequisites
None.

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

T 5.225 Module component: Seminar: Robot Reinforcement Learning [T-INFO-115349]

Coordinators: Prof. Dr. Gerhard Neumann
Organisation: KIT Department of Informatics
Part of: M-INFO-107926 - Seminar: Robot Reinforcement Learning

Type	Credits	Grading	Term offered	Version
Examination of another type	3 CP	graded	Irregular	2

Courses					
ST 2026	**2400084**	Seminar: Robot Reinforcement Learning	**2 SWS**	**Seminar / 🗣**	**Neumann**
ST 2026	**2400264**	Seminar: Robot Reinforcement Learning	**2 SWS**	**Seminar / 🗣**	**Neumann**
Exams					
ST 2026	**7500277**	Seminar: Robot Reinforcement Learning			**Neumann**
ST 2026	**7500432**	Seminar: Robot Reinforcement Learning			**Neumann**

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

Assessment
Assessment is based on a graded written seminar paper and the presentation of that paper in the form of an examination of another type pursuant to § 4 (2) No. 3 of the SPO.

Prerequisites
None.

T 5.226 Module component: Seminar: Secure Multiparty Computation [T-INFO-111501]

Coordinators: Prof. Dr. Jörn Müller-Quade
Organisation: KIT Department of Informatics
Part of: M-INFO-105761 - Seminar: Secure Multiparty Computation

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

Courses					
WT 26/27	**2400088**	Seminar Secure Multiparty Computation	**2 SWS**	**Seminar / 🗣**	**Jiang, Müller-Quade**
Exams					
WT 26/27	**7500326**	Seminar: Secure Multiparty Computation			**Müller-Quade**

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

A written paper must be prepared and/or a presentation must be given. Withdrawal is possible within two weeks of the topic being assigned.

Prerequisites
None.

Recommendations
Knowledge of the content of the lecture Cryptographic Protocols is assumed.

T 5.227 Module component: Seminar: Software Architecture, Security and Privacy [T-INFO-114260]

Coordinators: Prof. Dr. Ralf Reussner
Organisation: KIT Department of Informatics
Part of: M-INFO-107236 - Seminar: Software Architecture, Security and Privacy

Type	Credits	Grading	Term offered	Version
Examination of another type	4 CP	graded	Irregular	1

Courses					
WT 26/27	**2400060**	Seminar: Software Architecture, Security and Privacy	**2 SWS**	**Seminar / 🗣**	**Reussner, Raabe, Werner, Müller-Quade**
Exams					
WT 26/27	**7500232**	Seminar Data in Software-Intensive Technical Systems – Modeling – Analysis – Protection			**Reussner**

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

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO).

- the preparation of a written paper (50%)
- the assessment of two seminar papers as part of a peer review (10%)
- the preparation of presentation slides and giving a presentation (20%)
- punctuality of submissions (20%)

Prerequisites
None.

T 5.228 Module component: Seminar: Speech-to-Speech Translation [T-INFO-114208]

Coordinators: Prof. Dr. Jan Niehues
Organisation: KIT Department of Informatics
Part of: M-INFO-107179 - Seminar: Speech-to-Speech Translation

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

Courses					
ST 2026	**2400032**	Seminar Speech-to-Speech Translation	**2 SWS**	**Seminar / 🗣**	**Niehues**
Exams					
ST 2026	**7500046**	Seminar Speech-to-Speech Translation			**Waibel, 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 5.229 Module component: Seminar: Type Systems and Static Program Analysis [T-INFO-114955]

Coordinators: Prof. Dr. Sebastian Erdweg
Organisation: KIT Department of Informatics
Part of: M-INFO-107625 - Seminar: Type Systems and Static Program Analysis

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

Courses					
WT 26/27	**2400267**	Type Systems and Static Program Analysis	**2 SWS**	**Seminar /**	**Erdweg, Lego, Marx**

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 write a seminar paper, deliver a presentation, and participate in the discussion. Withdrawal is possible within two weeks after the topic has been assigned.

Prerequisites
None.

Recommendations
Students should be familiar with the foundational knowledge about type systems (e.g., typing rules, type checking, polymorphism) or static program analysis (e.g., data flow, abstract interpretation).

T 5.230 Module component: Service Design Thinking [T-WIWI-102849]

Coordinators: Prof. Dr. Gerhard Satzger
Prof. Dr. Orestis Terzidis
Organisation: KIT Department of Business and Economics
Part of: M-WIWI-101503 - Service Design Thinking

Type	Credits	Grading	Term offered	Version
Examination of another type	9 CP	graded	Irregular	5

Courses					
ST 2026	**2595600**	Service Design Thinking	**2 SWS**	**Lecture /** 🗣	**Osaro, Terzidis, Feldmann**
WT 26/27	**2595600**	Service Design Thinking	**2 SWS**	**Lecture /** 🗣	**Terzidis, Satzger, Osaro, Feldmann**

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

Assessment
Success is assessed in the form of an alternative exam assessment which consists of a case study, workshops, and a final presentation. The weighting of these components for the grade will be announced at the beginning of the course.

Prerequisites
None

Recommendations
This course is held in English – proficiency in writing and communication is required.

Our past students recommend to take this course at the beginning of the masters program.

Additional Information
Due to practical project work as a component of the program, access is limited. The module (as well as the module component) spans two semesters. It starts in September every year and runs until end of June in the subsequent year. Entering the program is only possible at its beginning - after prior application in May/June. For more information on the application process and the program itself are provided in the module component description and the program's website (https://sdtkarlsruhe.de/). Furthermore, the lecturers provide an information event for applicants every year in May.

T 5.231 Module component: SIL Entrepreneurship Project [T-WIWI-110166]

Coordinators: Prof. Dr. Orestis Terzidis
Organisation: KIT Department of Business and Economics
Part of: M-ETIT-105073 - Student Innovation Lab

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

Courses					
ST 2026	**2545082**	SIL Entrepreneurship Project		**Seminar /**	**Mitarbeiter**
WT 26/27	**2545082**	SIL Entrepreneurship Project	**4 SWS**	**Seminar**	**Terzidis**
Exams					
WT 26/27	**7900037**	SIL Entrepreneurship Project			**Terzidis**

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

Assessment
Success is assessed in the form of an alternative exam assessment. The grade results from the evaluation of two seminar papers (each approx. 20 pages). 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 5.232 Module component: Simulation and Optimization in Robotics and Biomechanics [T-INFO-113123]

Coordinators: Prof. Dr. Katja Mombaur
Organisation: KIT Department of Informatics
Part of: M-INFO-106504 - Simulation and Optimization in Robotics and Biomechanics

Type	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Each winter term	6

Courses					
WT 26/27	**2400160**	Simulation and Optimization in Robotics and Biomechanics	**4 SWS**	**Lecture / Practice /** 🗣	**Mombaur, Ackermann**
Exams					
ST 2026	**7500419**	Simulation and Optimization in Robotics and Biomechanics			**Mombaur**
WT 26/27	**7500355**	Simulation and Optimization in Robotics and Biomechanics			**Mombaur**

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

Assessment
The assessment is carried out as an oral examination (§ 4 Abs. 2 No. 1 SPO) lasting up to 30 minutes. It can be repeated once.

As a prerequisite for the participation in the oral exam, students must regularly and successfully participate in the exercises. Students must regularly submit exercise sheets. The number of exercise sheets and the scale for passing will be announced at the beginning of the course.

Prerequisites
T-INFO-114838 – Simulation and Optimization in Robotics and Biomechanics – Pass grade is required. Completion of module Robotics 1 or corresponding knowledge required
Programing skills in C/C++

Modeled Prerequisites
The following conditions have to be fulfilled:
1. You have to fulfill one of 2 conditions:
    1. The module component T-INFO-101465 - Robotics I - Introduction to Robotics must have been passed.
    2. The module component T-INFO-108014 - Robotics I - Introduction to Robotics must have been passed.
2. The following conditions have to be fulfilled:
    1. The module component T-INFO-114838 - Simulation and Optimization in Robotics and Biomechanics - Pass must have been passed.

Additional Information
Limitation to 30 participants

T 5.233 Module component: Simulation and Optimization in Robotics and Biomechanics - Pass [T-INFO-114838]

Coordinators: Prof. Dr. Katja Mombaur
Organisation: KIT Department of Informatics
Part of: M-INFO-106504 - Simulation and Optimization in Robotics and Biomechanics
Prerequisite for: T-INFO-113123 - Simulation and Optimization in Robotics and Biomechanics

Type	Credits	Grading	Term offered	Expansion	Version
Coursework (oral)	0 CP	pass/fail	Each winter term	1 semesters	1

Exams			
WT 26/27	**7500313**	Simulation and Optimization in Robotics and Biomechanics - Pass	**Mombaur**
WT 26/27	**7500355**	Simulation and Optimization in Robotics and Biomechanics	**Mombaur**

Assessment
Success is assessed in the form of coursework in accordance with Section 4 (3) SPO (ungraded exercise certificate).
Exercise sheets must be handed in regularly to pass the course. The specific details will be announced in the lecture.

Additional Information
Participation in the exercise is compulsory and the contents of the exercise are relevant for the examination.

T 5.234 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	4

Courses					
WT 26/27	**2424667**	Software Architecture and Quality	**2 SWS**	**Lecture / 🗣**	**Reussner**
Exams					
ST 2026	**7500021**	Software Architecture and Quality			**Reussner**
ST 2026	**7500396**	Software Architecture and Quality			**Reussner**
WT 26/27	**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 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 approximately 45 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
This lecture and the lectures *Component-Based Software Development* and *Software Architecture* are mutually exclusive.

T 5.235 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 2026	**24076**	Software Engineering II	**4 SWS**	**Lecture /** 🗣	**Reussner, Mirandola, Dehghani**
Exams					
ST 2026	**7500207**	Software Engineering II			**Reussner**
WT 26/27	**7500054**	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 5.236 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 2026	**2400050**	Software Product Line Engineering	**2 SWS**	**Lecture / Practice /** 🗣	**Feichtinger**
Exams					
ST 2026	**7500280**	Software Product Line Engineering			**Feichtinger**
WT 26/27	**7500158**	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 5.237 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
Written examination	3 CP	graded	Each summer term	2

Courses					
ST 2026	**2400059**	Software Security Engineering	**2 SWS**	**Lecture / 🗣**	**Gerking**
Exams					
ST 2026	**7500357**	Software Security Engineering			**Gerking**
WT 26/27	**7500040**	Software Security Engineering			**Gerking**

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

Assessment
The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting approx. 90 minutes.

Prerequisites
None.

Recommendations
Knowledge of Software Engineering I and Software Engineering II is recommended.

T 5.238 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 26/27	**2424164**	Software Evolution	**2 SWS**	**Lecture /**	**Lange**
Exams					
ST 2026	**7500023**	Software-Evolution			**Reussner**
WT 26/27	**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 5.239 Module component: Softwaretest and Quality Management (SQM) [T-INFO-114263]

Coordinators: Prof. Dr.-Ing. Ina Schaefer
Organisation: KIT Department of Informatics
Part of: M-INFO-107239 - Software Test and Quality Management (SQM)

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

Courses					
WT 26/27	**2400112**	Softwaretest and Quality Management (SQM)	**2 SWS**	**Lecture /** 🗣	**Schaefer**
WT 26/27	**2400113**	Softwaretest and Quality Management (SQM) - Exercise	**2 SWS**	**Practice /** 🗣	**Schaefer**
Exams					
ST 2026	**7500180**	Software Test and Quality Management (SQM)			**Schaefer, Heydari Tabar**
WT 26/27	**7500248**	Software Test and Quality Management (SQM)			**Schaefer**

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

Assessment
The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 90 minutes.

Prerequisites
None.

Additional Information
At the end of the course there is also the opportunity to be certified as an "ISTQB - Certified Tester - Foundation Level". A date and the modalities for the exam will be agreed on in the lecture.

T 5.240 Module component: Stochastic Information Processing [T-INFO-115261]

Coordinators: Prof. Dr.-Ing. Uwe Hanebeck
Organisation: KIT Department of Informatics
Part of: M-INFO-107847 - Stochastic Information Processing

Type	Credits	Grading	Term offered	Version
Oral examination	6 CP	graded	Each winter term	1

Courses					
WT 26/27	**2424113**	Stochastic Information Processing	**3 SWS**	**Lecture / Practice /** 🗣	**Hanebeck**

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

Assessment
Success is assessed in the form of an oral examination, usually lasting 15 - 25 minutes in accordance with Section 4 (2) No. 2 SPO.

Prerequisites
None.

Recommendations
Knowledge of the basics of probability theory is helpful.

Additional Information
As a theoretical foundation lecture, "Stochastic Information Processing" is an ideal introduction to the ISAS lectures. Conversely, prior knowledge of "Localization of Mobile Agents" (LMA) [course no. 24613] may nevertheless be helpful depending on the type of learner - more concrete applications are highlighted there. In all of our lectures, the content is always derived and explained in detail from the beginning; it is therefore possible to start with SI or LMA.

T 5.241 Module component: Systems and Software Engineering [T-ETIT-100675]

Coordinators: Prof. Dr.-Ing. Eric Sax
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-100537 - Systems and Software Engineering

Type	Credits	Grading	Term offered	Version
Written examination	6 CP	graded	Each winter term	3

Courses					
WT 26/27	**2311605**	Systems and Software Engineering	**2 SWS**	**Lecture /** 🗣	**Sax**
WT 26/27	**2311607**	Tutoral for 2311605 Systems and Software Engineering	**2 SWS**	**Practice /** 💮	**Stroop, Hagel, Gerdes**
Exams					
ST 2026	**7311605**	Systems and Software Engineering			**Sax**
WT 26/27	**7311605**	Systems and Software Engineering			**Sax**

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

Assessment
Written exam of 90 minutes.

Students are given the opportunity to earn a grade bonus through separate task 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. Bonus points do not expire and remain valid for exams taken at a later date:

The grade is determined by the written exam and the bonus points.

Prerequisites
none

T 5.242 Module component: Systems Engineering for Automotive Electronics [T-ETIT-100677]

Coordinators: Prof. Dr.-Ing. Jürgen Bortolazzi
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-ETIT-100462 - Systems Engineering for Automotive Electronics

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

Courses					
ST 2026	**2311642**	Systems Engineering for Automotive Electronics	**2 SWS**	**Lecture /**	**Bortolazzi**
ST 2026	**2311644**	Tutorial for 2311642 Systems Engineering for Automotive Electronics	**1 SWS**	**Practice /**	**Beck**
Exams					
ST 2026	**7311642**	Systems Engineering for Automotive Electronics			**Bortolazzi**
WT 26/27	**7311642**	Systems Engineering for Automotive Electronics			**Bortolazzi**

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

Prerequisites
none

T 5.243 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 26/27	**2400007**	Telematics	**4 SWS**	**Lecture /** 🗣	**Zitterbart, Helmig, Mahrt, Seehofer**
Exams					
ST 2026	**7500098**	Telematics			**Zitterbart**
WT 26/27	**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 place

- in the form of an oral examination of approx. 30 minutes in accordance with § 4 Para. 2 No. 2 SPO
- or in the form of a written examination in accordance with § 4 Para. 2 No. 1 SPO

Prerequisites
None.

Recommendations
- Contents of the lecture ***Introduction to computer networks***or comparable lectures are a prerequisite.
- Attendance of the module-accompanying ***basic practical course Protocol Engineering*** is recommended.

Additional Information
Offered for the last time in WS 26/27!!!!!

T 5.244 Module component: Testing Digital Systems I [T-INFO-101388]

Coordinators: Prof. Dr. Mehdi Baradaran Tahoori
Organisation: KIT Department of Informatics
Part of: M-INFO-100851 - Testing Digital Systems I

Type	Credits	Grading	Term offered	Version
Oral examination	3 CP	graded	Irregular	1

Exams			
ST 2026	**7500008**	Testing Digital Systems I	**Tahoori**
WT 26/27	**7500039**	Testing Digital Systems 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 5.245 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	Irregular	1

Courses					
ST 2026	**2400014**	Testing Digital Systems II (findet im SS 2026 nicht statt)	**2 SWS**	**Lecture /**	**Tahoori**
Exams					
ST 2026	**7500069**	Testing Digital Systems II			**Tahoori**
WT 26/27	**7500147**	Testing Digital Systems II			**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.

T 5.246 Module component: Text-Indexing [T-INFO-114226]

Coordinators: Prof. Dr. Peter Sanders
Organisation: KIT Department of Informatics
Part of: M-INFO-107202 - Text Indexing

Type	Credits	Grading	Term offered	Version
Oral examination	4 CP	graded	Each winter term	1

Courses					
WT 26/27	**2400005**	Text-Indexing	**3 SWS**	**Lecture /**	**Kurpicz**
Exams					
WT 26/27	**7500537**	Text-Indexing			**Sanders**

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

Assessment
The assessment consists of an oral exam (generally 15 minutes) according to § 4 Abs. 2 Nr. 2 SPO.

The examination takes place in the form of an oral examination and a project/experiment as an examination of success of a different kind.

Weighting: 80% oral examination, 20% 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 5.247 Module component: Text-Indexing Project/Experiment [T-INFO-114227]

Coordinators: Prof. Dr. Peter Sanders
Organisation: KIT Department of Informatics
Part of: M-INFO-107202 - Text Indexing

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

Courses					
WT 26/27	**2400005**	Text-Indexing	**3 SWS**	**Lecture /**	**Kurpicz**
Exams					
WT 26/27	**7500145**	Text-Indexing Project/Experiment			**Sanders**

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

Assessment
The assessment is carried out in form of course work (German Studienleistung, § 4 Abs. 3 SPO). Students must regularly submit exercise sheets. The number of exercise sheets and the scale for passing will be announced at the beginning of the course. The assessment an only be repeated once.

The examination takes place in the form of an oral examination and a project/experiment as an examination of success of another type.

Weighting: 80% oral examination, 20% 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 5.248 Module component: Theory of Satisfiability Algorithms [T-INFO-114982]

Coordinators: Prof. Dr.-Ing. Marvin Künnemann-Goos
Organisation: KIT Department of Informatics
Part of: M-INFO-107639 - Theory of Satisfiability Algorithms

Type	Credits	Grading	Term offered	Expansion	Version
Oral examination	4 CP	graded	Irregular	1 semesters	1

Courses					
ST 2026	**2400077**	Theory of Satisfiability Algorithms	**2 SWS**	**Lecture / Practice / 🗣**	**Künnemann-Goos**
Exams					
ST 2026	**7500410**	Theory of Satisfiability Algorithms			**Künnemann-Goos**

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

Assessment
The assessment is carried out as an oral examination (§ 4 Abs. 2 Nr. 2 SPO) lasting approx. 20-30 minutes.

Prerequisites
None.

Recommendations
Basic knowledge of algorithms and data structures (e.g., Algorithms 1) and theoretical computer science (e.g., TGI) is assumed.

Basic knowledge in the analysis of randomized algorithms may be helpful (e.g., Probability and Computing), but is not a strict requirement.

T 5.249 Module component: Type Systems and Program Analysis [T-INFO-115016]

Coordinators: Prof. Dr. Sebastian Erdweg
Organisation: KIT Department of Informatics
Part of: M-INFO-107664 - Type Systems and Program Analysis

Type	Credits	Grading	Term offered	Expansion	Version
Written examination	6 CP	graded	Irregular	1 semesters	1

Courses					
ST 2026	**2400188**	Type Systems and Static Program Analysis	**2 SWS**	**Lecture /**	**Erdweg, Lego, Greule**
ST 2026	**2400192**	Exercises for the lecture Type Systems and Static Program Analysis	**2 SWS**	**Practice /**	**Erdweg, Lego, Greule**
Exams					
ST 2026	**7500304**	Type Systems and Program Analysis			**Erdweg**

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

Assessment
The assessment is carried out as a written examination (§ 4 Abs. 2 No. 1 SPO) lasting 120 minutes.

Prerequisites
None.

Recommendations
Knowledge of programming semantics is helpful but not required.
Knowledge of logic inference systems is helpful but not required.

T 5.250 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					
WT 26/27	**2424146**	Ubiquitous Computing		**Lecture / Practice**	**Beigl**
Exams					
ST 2026	**7500368**	Ubiquitous Computing			**Beigl**
WT 26/27	**7500342_06.02.2026**	Ubiquitous Computing			**Beigl**
WT 26/27	**7500367_07.11.2025**	Ubiquitous Computing			**Beigl**
WT 26/27	**7500372_05.02.2026**	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 5.251 Module component: User Studies in Human-Robot Interaction [T-INFO-115244]

Coordinators: TT-Prof. Dr. Barbara Bruno
Dr.-Ing. Caterina Neef
Utku Norman

Organisation: KIT Department of Informatics

Part of: M-INFO-107834 - User Studies in Human-Robot Interaction

Type	Credits	Grading	Term offered	Expansion	Version
Examination of another type	6 CP	graded	Each winter term	1 semesters	1

Assessment
The assessment is carried out as an examination of another type (§ 4 Abs. 2 No. 3 SPO) in the form of a supervised, project-based empirical user study in Human-Robot Interaction, covering study design, execution, analysis, and reflection.

The final grade is based on a written research-oriented report in conference paper format and an oral presentation.

The completion of intermediate project milestones during the semester is required as a prerequisite for admission to the final assessment.
The project-based assessment counts for 100% of the final grade.

The assessment can only be repeated once.

Students may withdraw from the examination during the first four weeks after they have been assigned their chosen project topic.

Prerequisites
None.

Recommendations
Participation in the lecture “HRI and Social Robotics” or similar introductory courses is recommended but not required. Familiarization with the lecture content is recommended if the course has not been attended.

Additional Information
Attendance is mandatory, as active participation in discussions, group work, and presentations is required.

T 5.252 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 2026	**2400062**	Wearable Robotic Technologies	**2 SWS**	**Lecture /** 🗣	**Asfour, Beigl**
ST 2026	**5016643**	BUT - Attractive Robot Technologies		**Lecture /** 🗣	**Asfour**
Exams					
ST 2026	**7500219**	Wearable Robotic Technologies			**Asfour, Beigl**
WT 26/27	**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.