Hochschule Karlsruhe

Faculty for Computer Science and Business Information Systems

Module manual

Course of studies Media Computer Science (Bachelor), ER 6

Summer semester 2025

Module Media Computer Science (Bachelor), ER 6

Module Computer Science 1	
Internal number	MINB110
Coordinator	Prof. Dr. Carsten Sinz
Scope	12.0 ECTS points, 12.0 Contact hours
Placement	1st Semester
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	none
Competences	The courses in this module provide fundamental knowledge of programming and theoretical computer science, which are essential skills for every computer scientist. Students acquire basic concepts of object-oriented programming, such as modeling, selecting and creating data structures, implementation, and quality assurance. They also develop essential problem-solving skills by analyzing problems and solving them using programs. In theoretical computer science, fundamental concepts such as formal languages, propositional logic, and formal mathematical automaton models are introduced. They are motivated by their relevance to practical applications in computer science.
Exams	Written Exam 120 Min. (graded)

Lecture Theoretical Computer Science	
Internal number	MINB111.b
Lecturer	Prof. Dr. Heiko Körner
Scope	4.5 ECTS points, 4.0 Contact hours 135 Stunden gesamt, davon 60 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	This course introduces the theory of formal languages. The aim is to convey the Chomsky hierarchy as a level model of differently complex languages. Furthermore, finite automata are introduced as representatives of today's computers and their limitations are pointed out. A further learning objective is the confident application of various proof techniques. The course covers the following areas of theoretical computer science: Boolean logic, formal languages, proof techniques, the Big-O-notation, finite automata, regular languages and expressions, the Chomsky hierarchy, the pumping lemma for regular and context-free languages and the minimisation of finite automata according to the Myhill-Nerode theorem. Pushdown automata, the CYK-algorithm and closure properties of regular and context-free languages are also discussed.

Recommended reading	- Discussion at the blackboard - Lecture notes - Sample solutions for all exercises - D. W. Hoffmann: Theoretical Computer Science, 5th edition. Hanser, 2022 - M. Sipser: Introduction to the Theory of Computation, 3rd edition. Cengage Learning, Inc, 2012
Exams	Module exam
Comments	This course will take place as a pure lecture. Numerous exercises deepen selected areas and will be discussed in tutorials.
Lecture Computer Science 1	
Internal number	MINB1111.a
Lecturer	Prof. Dr. Carsten Sinz
Scope	4.5 ECTS points, 4.0 Contact hours 135 Stunden gesamt, davon 60 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	Students in this course will learn the fundamentals of object-oriented programming using the Java programming language. They will become familiar with basic programming constructs such as variables, types, expressions, control structures, and arrays, enabling them to solve simple problems. Additionally, participants will acquire initial knowledge of object-oriented design and will be introduced to fundamental concepts of object-oriented programming, such as methods, classes, objects, and fields, which they will apply in small programs. Problem-solving paradigms such as divide-and-conquer will be introduced, along with their practical implementation using recursive programs. Besides arrays, students will also become familiar with fundamental data structures such as lists and their implementation, enabling them to use these structures for problem-solving. Furthermore, participants will be introduced to more advanced object-oriented programming concepts, including inheritance, interfaces, information hiding, generic programming, and polymorphism.
Recommended reading	1. Board notes, slides 2. Exercises with solutions 3. Collection of past exams and their solutions 4. Java programs and their documentation as Javadoc 5. Additional Java exercises with solutions for further practice 6. Peter Pepper, "Learning to Program: A Fundamental Introduction with Java", Springer Verlag, 3rd edition, 2007.
Exams	Module exam
Comments	
Lecture Computer Science 1 Laboratory	
Internal number	MINB112

Lecturer	Prof. Dr. Carsten Sinz
Scope	3.0 ECTS points, 4.0 Contact hours 90 Stunden gesamt, davon 60 Stunden Kontaktstudium.
Type/mode	Exercise
Language of instruction	German
Content	In weekly exercises, students deepen their understanding of the practical content covered in the lectures. Initially, they use terminal commands, but later transition to a professional, integrated Java development environment to create, debug, test, and modify programs. Starting with simple calculations in Java using variables, expressions, and control structures, the assignments gradually become more complex, incorporating basic data modeling tasks. By the end, students will have programmed simple games and implemented solutions of mathematical problems, e.g., using approximation methods. In addition to ensuring the correctness and functionality of their programs, students also learn to follow good programming practices and adhere to coding conventions — an essential skill for future work in teams.
Recommended reading	
Exams	Exercise 1 Semester (not graded)
Comments	

Module Media Design	
Internal number	MINB120
Coordinator	Prof. Thomas Hinz
Scope	7.0 ECTS points, 6.0 Contact hours
Placement	1st Semester
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	none
Competences	Students learn the technical basics of media design. They develop design concepts and are able to implement them practically in the context of simple tasks, taking usability and user experience into account when designing user interfaces.
Exams	Individual exams
Lecture Media Design	
Internal number	MINB121
Lecturer	Prof. Thomas Hinz
Scope	3.0 ECTS points, 2.0 Contact hours 90 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	The students become acquainted with the theoretical foundations of media design. This includes knowledge about creativity techniques, design rules and gestalt principles, systems of organisation, micro- and macro typography, colour theory, logos/pictograms/icons as well as grid systems for layouts. Additionally, they gain insights into analog and digital photography and the conception and design of digital media content exemplified through web applications. The students explore the history of design, starting at the dawn of industrialisation and including the seminal design movements of the 19th and 20th centuries as well as contemporary trends in design. This overview enables students to categorise and evaluate different design styles, allowing an integration of the acquired knowledge into their own design processes.
Recommended reading	- M. Jäger: "Grafik und Gestaltung: Mediengestaltung von A bis Z verständlich erklärt", Rheinwerk Verlag, 2014, ISBN 978-3-8362-2513-7 - S. M. Weinschenk: "100 Dinge, die jeder Designer über Menschen wissen muss", Addison-Wesley Verlag, 2011, ISBN 978-3827330994 - M. Pricken: "Kribbeln im Kopf", Schmidt Hermann Verlag, 2010, ISBN 978-3874397971 - T. Rempen, Uwe Stoklossa: "Blicktricks", Schmidt Hermann Verlag, 2005, ISBN 978-3874396813 - C. Berents: "Kleine Geschichte des Design: Von Gottfried Semper bis Philippe Starck", C.H. Beck, 2011, ISBN 978-3406622410

Exams	Concept 1 Semester (graded)
Comments	
Lecture Media Design Excercise	
Internal number	MINB122
Lecturer	Prof. Thomas Hinz
Scope	4.0 ECTS points, 4.0 Contact hours 120 Stunden gesamt, davon 60 Stunden Kontaktstudium.
Type/mode	Exercise
Language of instruction	German
Content	The theoretical knowledge acquired in the lecture is applied practically in exercises and the results are then presented and discussed in plenary sessions. Students acquire the ability to analyse and evaluate designs. They use various professional software tools to realise design solutions.
Recommended reading	lecture materials
Exams	Exercise 1 Semester (not graded)
Comments	

Module Mathematics 1	
Internal number	MINB130
Coordinator	Prof. Dr.-Ing. Astrid Laubenheimer
Scope	8.0 ECTS points, 6.0 Contact hours
Placement	1st Semester
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	none
Competences	Participants learn the mathematical basics from linear algebra, which are often used in computer science. These basics are specifially needed in computer graphics, robotic, cryptography.
Exams	Individual exams
Lecture Mathematics 1	
Internal number	MINB131
Lecturer	M.Sc. Martin Redlof
Scope	5.0 ECTS points, 4.0 Contact hours 150 Stunden gesamt, davon 60 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	The participants should learn basic knowledge of mathematics and especially of linear algebra and acquire the methods to solve smaller mathematical tasks by themselves. In the part on linear algebra we will focus on knowledge needed in computer grafic and 3D simulations. Content of the lectures: Proof methods, relations, euqivalence relations, modulo-calculation, Euklid's algorithm, functions, operations, groups, rings, fields, polynomial rings, finite fields, interpolation, vector spaces, basis, dimension, linear equations, rank, Gauß-Jordan-algorithm, determinant, matrices, linear map, inverse matrices, rotation, translation, scaling, scalarproduct, norm, vectorproduct, orthogonal matrizen, eigenvalues, eigenvectors, homogeneous coordinates.
Recommended reading	Own writings from the blackboard, Exercises and summaries from the internet, Textbook: Peter Stingl: Mathematik für Fachhochschulen, Hanser Verlag, 8. Auflage, 2009, ISBN-10: 3-446-42065-7
Exams	Written Exam 90 Min. (graded)
Comments	Lecture, Exercises, Summary of the solutions in the lecture, Tutorials for further assistance
Lecture Mathematics 1 Laboratory	
Internal number	MINB132
Lecturer	M.Sc. Martin Redlof

Scope	3.0 ECTS points, 2.0 Contact hours 90 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Laboratory Course
Language of instruction	German
Content	Improving the knowledge of the related lectures, basics in computer-algebra systems, mathematical problem solving with computer assistance. With the help of the computer algebra system Maple different, applied mathematical questions from the fields of geometry, curves, interpolation and linear equations will be solved. It will be focussed on matrices and homogenous coordinates, which are an important foundation for computer grafic.
Recommended reading	Short introduction will be given. Exercises distributed in the classes and also available on the internet.
Exams	Exercise 1 Semester (not graded)
Comments	Exercises in the labs with Maple (instructor will be present).

Module Language Competence	
Internal number	MINB140
Coordinator	Prof. Dr.-Ing. Holger Vogelsang
Scope	4.0 ECTS points, 4.0 Contact hours
Placement	1st Semester
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	none
Competences	The learning of a foreign language is an integral component of the in the course of studies communicated key qualification.
Exams	Individual exams
Lecture English	
Internal number	MINB141
Lecturer	Mehrere Dozenten
Scope	4.0 ECTS points, 4.0 Contact hours 120 Stunden gesamt, davon 60 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	English
Content	After a grading test students can deepen their English skills to three grades. The entry level requires the competence grade A2 (basic user) in the six-stage common European reference framework. The first two grades (English for advanced learners 1 and 2) engage besides a recapitulation of grammar mainly in issues of job-oriented common language and cultural studies, e.g. job application letters, descriptions of products and services, business telephone calls, progress of formal and informal conferences, presentations etc. The thus achieved grade complies with 173 points in the TOEFL (computer-based) or the competence grade B2 (independent user) of the European reference framework. In the following grade special language skills (English for science and technics) are leant: In business English the priority is on spoken language and small study groups. At the beginning of the semester each group founds its own company which advances dynamically during the course of the semester. At the same time vocabulary and phrasing in respect of topics like company structures, meetings, negotiation, marketing, production and sale, finances, comprehending of reports and presentations are gone through in order to make the attendees handle the language instruments to cope with each step of the simulation in English. The highlights of the course are a simulated exhibition, a hiring procedure and the group presentation. In technical English the priority is on the learning and practice of a technical basis vocabulary and typical expressions of technical communication.
Recommended reading	Literature depends on grade, PowerPoint presentations, execises, Videos, DVDs

Exams	Written Exam 90 Min. (graded)
Comments	Lecture participation, short talks, discussions

Module Computer Science 2	
Internal number	MINB210
Coordinator	Prof. Dr. Christian Pape
Scope	7.0 ECTS points, 6.0 Contact hours
Placement	2nd Semester
Pre-requisites with regard to content	Computer Science 1
Pre-requisites according to the examination regulations	none
Competences	The students learn about basic algorithms and data structures. They can estimate in which situations specific and complex data types are used, how they work and how much time they take. They are able to prove the correctness of algorithms. In practical assignments the students are enabled to implement various algorithms and data structures.
Exams	Individual exams

Lecture Computer Science 2	
Internal number	MINB211
Lecturer	Prof. Dr. Christian Pape
Scope	5.0 ECTS points, 4.0 Contact hours 150 Stunden gesamt, davon 60 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	The lecture is divided into several parts building on one another: 1. In the first part, students learn to precisely define algorithmic problems, writing algorithms for in pseudocode, estimating the resource consumption of an algorithm and proving its correctness. 2. Building on this, students learn search and sorting methods, apply the skills acquired in the first part to them and are able to select a suitable method for a problem.They learn the lower bound of this problem and how to prove it. 3. In the third part, they acquire detailed knowledge of the structure and implementation of operations of elementary data structures such as queues, lists and binary trees. The students learn typical application examples for these data structures. 4. The fourth part of the lecture focuses on advanced data structures and the associated algorithms, such as hash tables and binary search trees. They learn how search trees can be balanced. 5. In the final part, the lecture deals with the basics of graphs. The students can apply different representations, such as adjacency matrices and adjacency lists. They learn basic algorithms, such as shortest path search, union find and the calculation of minimum spanning trees to real problems.

Recommended reading	- Lecture notes. - Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein: Introduction to Algorithms. Third Edition. MIT Press. - Robert Sedgewick: Algorithms in Java. Addison Wesley. Third Edition.
Exams	Written Exam 60 Min. (graded)
Comments	Weekly exercises for reviewing lecture content and for exam preparation. Simple tasks in the lecture.

Lecture Computer Science 2 Laboratory	
Internal number	MINB212
Lecturer	Prof. Dr. Christian Pape
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Exercise
Language of instruction	German
Content	The students deepen the knowledge acquired in the lecture by implementing and testing selected algorithms in Java. They use standard development environments. The algorithms and data structures to be implemented are used culminating in a final task.
Recommended reading	Assignements and basic source code.
Exams	Exercise 1 Semester (not graded)
Comments	Practical exercise with discussion of solutions

Module Software Project	
Internal number	MINB220
Coordinator	Prof. Dr. Martin Sulzmann
Scope	6.0 ECTS points, 4.0 Contact hours
Placement	2nd Semester
Pre-requisites with regard to content	Computer Science 1
Pre-requisites according to the examination regulations	none
Competences	This course covers programming languages that belong to the C/C++ family of languages including new forms such as Go and Rust. After this course, students will be able to code in C/C++, are able to understand the commonalities and differences to Java and have an understanding of the latest developments such as C++20 plus new forms such as Go and Rust. Lectures introduce concepts via some live coding followed by some lab sessions where students work on smaller practical exercises. Several (online) quizzes allow students to test their knowledge. Content. C/C++ basics. - Functions and basic data types - Pointers and the pitfalls of manual memory management - IO streams and overloading - Subclassing and virtual methods - Templates - C++11 copy/move semantics. Recent extensions and new directions. - C++20 - Go - Rust Written final exam, closed book. Exam questions refer to practical exercises that are covered in the lab.
Exams	Individual exams

Lecture Software Project	
Internal number	MINB221
Lecturer	Prof. Dr. Martin Sulzmann
Scope	3.0 ECTS points, 2.0 Contact hours 90 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German

Content	The students implement projects with an increasing complexity in C++. They have to use generic classes, inheritance, polymorphism, abstract classes and interfaces and concepts for error handling and detection like exceptions and assertions. Additionally they will learn to use elements of the STL and to model the classes and their relationships with UML.
Recommended reading	On the homepage: Project description with a step-by-step instruction, Java script, optional exercise with solutions, books: - Ulrich Breymann, C++ - Einführung und professionelle Programmierung, Hanser-Verlag
Exams	Written Exam 90 Min. (graded)
Comments	Laboratory work
Lecture Software Project Laboratory	
Internal number	MINB222
Lecturers	Dipl. Inf. (FH) Oktavian Gniot Prof. Dr. Martin Sulzmann
Scope	3.0 ECTS points, 2.0 Contact hours 90 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Exercise
Language of instruction	German
Content	
Recommended reading	
Exams	Exercise 1 Semester (not graded)
Comments	

Module Interfacedesign	
Internal number	MINB230
Coordinator	Prof. Daniel Schwarz
Scope	4.0 ECTS points, 3.0 Contact hours
Placement	2nd Semester
Pre-requisites with regard to content	Computer Science 1
Pre-requisites according to the examination regulations	none
Competences	The two lectures on the topic of distributed systems ("Distributed Systems 1" and "Distributed Systems 2") teach both foundational and advanced principles that are illustrated through practical examples of existing paradigms and technologies. Principles treated in this course encompass foundations of goals and classes of distributed systems, as well as their architectures, processes, communication and name systems. Advanced principles include synchronisation, consistency and replicability, error-tolerance and security. The principles introduced in this course are exemplified through the paradigms of web-based systems and component-based systems. This includes sample implementations of individual principles. In addition, the course gives an introduction into the development of corresponding systems using actual technologies as examples.
Exams	Individual exams
Lecture Interfacedesign	
Internal number	MINB231
Lecturer	Prof. Daniel Schwarz
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	This course provides students with the theoretical and applied knowledge about the creation of media-based web applications. This includes the foundations of the markup language HTML and Cascading Style Sheets, how to embed different types of media, as well as the conception, design and programming of responsive web applications.
Recommended reading	Lecture notes, slides (PDF), multiple examples of programs
Exams	Concept 1 Semester (graded)
Comments	Preparation of lecture contents and exam
Lecture Interfacedesign Excercise	
Internal number	MINB232
Lecturer	Prof. Daniel Schwarz

Scope	2.0 ECTS points, 1.0 Contact hours 60 Stunden gesamt, davon 15 Stunden Kontaktstudium.
Type/mode	Exercise
Language of instruction	German
Content	
Recommended reading	
Exams	Exercise 1 Semester (not graded)
Comments	

Module Computer Engineering	
Internal number	MINB240
Coordinator	Prof. Dr. Matthias Wölfel
Scope	5.0 ECTS points, 4.0 Contact hours
Placement	2nd Semester
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	none
Competences	Students will learn the basic concepts of computer engineering. They learn the mathematical concepts of number representation and Boolean algebra, which are required for the analysis and design of hardware circuits. They understand how the basic digital computing elements are constructed and how to combine them into complex switching networks. Furthermore, the students will be able to explain the structure and operation of current standard circuits such as adders or shift registers. Additionally, students are familiar with internal functions of typical processors. They are able to implement the hardware related software parts using the "C" programming languege including the use of typical peripherals. All knowledge gained is reinforced by practical work in the laboratory.
Exams	Individual exams
Lecture Computer Engineering	
Internal number	MINB241
Lecturer	Prof. Dr. Matthias Wölfel
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	On the processor side, the lecture will cover the following, basic processor hardware, processor architecture, addressing modes, instructions, memory mapping, peripherals and bit processing. The special features of the programming languages C / C++ needed for hardware programming will also be covered.
Recommended reading	Powerpoint slide, personal notes, web based exercises and the suggested solution (provided upon request).
Exams	Written Exam 90 Min. (graded)
Comments	The student will be required to come prepared to participate in the lecture and will be expected to be able to develop a summary upon completion of the lecture, all exercises provided for reinforcement will be required to be individual work.
Lecture Digital Technology Laboratory	

Internal number	MINB242
Lecturer	Prof. Daniel Schwarz
Scope	3.0 ECTS points, 2.0 Contact hours 90 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Laboratory Course
Language of instruction	German
Content	Lab experiments will be conducted using: - Digital Circuits - Microcontrollers - Peripherals - Timers and Counters
Recommended reading	Exercises, equipment provided and various manuals and other support material.
Exams	Exercise 1 Semester (not graded)
Comments	All laboratory work will be group work. It will include the conduct of the experiment, demonstration of the required result and be prepared to answer questions on the work and the results. Groups are on their own and are required to come to the laboratory prepared to conduct the exercise. Each group will prepare a final documentation of the exercise.

Module Mathematics 2	
Internal number	MINB250
Coordinator	Prof. Dr.-Ing. Astrid Laubenheimer
Scope	8.0 ECTS points, 6.0 Contact hours
Placement	2nd Semester
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	none
Competences	
Exams	Written Exam 120 Min. (graded)
Lecture Analysis	
Internal number	MINB251.a
Lecturer	Prof. Dr.-Ing. Astrid Laubenheimer
Scope	5.0 ECTS points, 4.0 Contact hours 150 Stunden gesamt, davon 60 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	
Recommended reading	
Exams	Module exam
Comments	
Lecture Statistics	
Internal number	MINB251.b
Lecturer	Prof. Dr. Patrick Baier
Scope	3.0 ECTS points, 2.0 Contact hours 90 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German

Content	The statistics lecture teaches skills in handling and analyzing empirical data, as well as an introduction to probability theory. Students learn to analyze and model data by seeing common statistical methods and models in action, which will enable them to apply static methods to evaluate data themselves. The contents of the lecture include: - Basic concepts of probability calculation - Probability distributions - Independence from random variables conditional probabilities - Excerpts from descriptive and inferential statistics.
Recommended reading	Teschl G. und Teschl S. Mathematik für Informatiker. Band 1 und Band 2. Springer Verlag. Zum Beispiel 3. Auflage 2010.
Exams	Module exam
Comments	

Module System Software	
Internal number	MINB310
Coordinator	Prof. Dr. Thomas Fuchß
Scope	8.0 ECTS points, 6.0 Contact hours
Placement	3rd Semester
Pre-requisites with regard to content	Computer Science 1, Computer Science 2, Software Project
Pre-requisites according to the examination regulations	none
Competences	Having successfully completed the module, students will be able to understand and explain the functions and structures of modern operating systems and how they are embedded in various computer architectures. They will be able to use system-related knowledge to design, develop and implement performant software solutions. In addition, they are able to organize, collaborate on and successfully complete complex programming tasks in a team. They have further developed their technical, social and personal skills as well as their communication skills and self-management.
Exams	Individual exams
Lecture System Software	
Internal number	MINB311
Lecturer	Prof. Dr. Thomas Fuchß
Scope	5.0 ECTS points, 4.0 Contact hours 150 Stunden gesamt, davon 60 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German

Content	The course "System Software" covers the fundamental tasks and functionalities of modern operating systems and enables students to apply these techniques independently and systematically in teams to solve system-level development tasks. The course is divided into four main thematic areas: Fundamentals, Process Management, and Scheduling: - Understanding the relationship between computer architecture and operating systems. - Principles of processor virtualization and limited direct execution. - Scheduling algorithms (e.g., Round-Robin, Shortes-Job-First). File Systems and Persistence: - Requirements and differences in HDDs and SSDs. - Structure and implementation of file systems. - Concepts of free-space management and crash consistency. Memory Virtualization: - Principles of memory segmentation and paging. - Management of page frames and allocation strategies. - Mechanisms for isolation and memory management. Concurrency: Processes and Threads: - Introduction to threads. - Synchronization mechanisms: Mutexes, semaphores, condition variables, monitors. - Patterns for parallel and concurrent programming. In addition, the specific challenges of each topic are discussed, along with common strategies for addressing them. Practical exercises complement the lectures to facilitate the application of theoretical concepts to realistic scenarios.
Recommended reading	Slides, videos, textbooks, and other literature: - Arpaci-Dusseau, Remzi H.; Arpaci-Dusseau, Andrea C. Operating Systems: Three Easy Pieces, (V. 1.10) Arpaci-Dusseau Books, 2023 - Tanenbaum, Andrew S.; Bos, H. Modern Operating Systems (4th Edition) – Pearson, 2014 - Stallings, W. Operating Systems: Internals and Design Principles (8th Edition) – Pearson, 2014
Exams	Written Exam 90 Min. (graded)
Comments	The lecture will take the form of seminars with exercises.

Lecture System Software Laboratory

Internal number	MINB312
Lecturer	Prof. Dr. Carsten Sinz
Scope	3.0 ECTS points, 2.0 Contact hours 90 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Laboratory Course
Language of instruction	German

Content	In the lab, small groups (typically three people) work on multiple tasks related to system-level programming in C and C++. The goal is to familiarize students with the interfaces to the Linux operating system and learn how to practically utilize the functionalities they provide. Topics covered include file systems, processes, communication, memory management, linked data structures, and bit manipulation. The specific tasks for each exercise vary, encompassing, e.g., accelerating (parallelizing) an existing ray tracer using multiple processes, processing image files to produce mosaics, developing a broadcast server for song lyrics, or compressing image data using run-length encoding. The implementations in C and C++ deepen students' skills in working with system libraries, dynamic data structures, bit operations, memory management, and pointers. In addition to the main problem, each task includes several preliminary smaller exercises that guide students toward the final solution.
Recommended reading	Introductory slides on the topic of each exercise. In-depth information on the exercise sheets.
Exams	Laboratory Work 1 Semester (not graded)
Comments	

Module Databases and Communication Networks 1	
Internal number	MINB320
Coordinator	Prof. Dr. Oliver Waldhorst
Scope	8.0 ECTS points, 7.0 Contact hours
Placement	3rd Semester
Pre-requisites with regard to content	Computer Science 1, Computer Science 2
Pre-requisites according to the examination regulations	none
Competences	The module teaches the basics and practical skills in database systems and communication networks. Competence objectives in the field of databases: - Students can model, normalize and implement relational databases. - They are proficient in SQL (DDL, DML, DCL), transaction management, JDBC and OR mapping (Hibernate). - They develop database applications independently and integrate them into programming languages such as Java. - Teamwork and problem-solving skills are encouraged through practice-oriented projects. Competence goals in the area of communication networks: - Students understand the architecture and functionality of networks and analyze protocols such as HTTP, TCP, UDP, IPv4/IPv6. - They plan, configure and evaluate networks, including routing and subnetting. - They implement protocol functions and use tools for network analysis and fault diagnosis. - They are able to analyze and evaluate network performance indicators. The module promotes analytical thinking, practical problem-solving skills and teamwork and provides a foundation for topics such as network security and distributed systems.
Exams	Written Exam 120 Min. (graded)
Lecture Databases 1	
Internal number	MINB321.a
Lecturer	Prof. Dr.-Ing. Holger Vogelsang
Scope	2.5 ECTS points, 2.0 Contact hours 75 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German

Content	The lecture covers the following topics: - Introduction to information systems - Basics of database systems - Database organization - Data models - Database schema - Architecture: 3-tier model, client-server architecture - Current SQL standard (queries, DDL, DML, in particular SQL:2003 with object-oriented extensions, NF2, window functions) - Transactions - JDBC - ER modeling - Mapping entities and relationships to relational data models - Normalization - OR mapping
Recommended reading	- Script - Example databases of the lecture for the common database systems - Exercises - Sample programs - Collection of old exams and their solutions - Edwin Schicker, "Datenbanken und SQL", Springer Vieweg, 2017, ISBN: 978-3834817327 - Gunter Saake, Kai-Uwe Sattler, "Datenbanken - Konzepte und Sprachen", mitp, 2013, ISBN: 978-3286694530
Exams	Module exam
Comments	

Lecture Communication Networks 1

Internal number	MINB321.b
Lecturer	Prof. Dr. Oliver Waldhorst
Scope	2.5 ECTS points, 2.0 Contact hours 75 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German

Content	In this course, students expand their knowledge of communication networks, in particular by taking an in-depth look at the functionalities and challenges of the layers of the Internet protocol stack. After completing the course, they will be able to analyze, evaluate and practically apply advanced mechanisms and protocols in the application layer, transport layer, network layer and security layer. They will be able to identify complex network problems, combine specific solution modules and develop innovative solutions. The lecture covers the following topics: - Transmission of multimedia content in the application layer, e.g. Netflix and Skype, as well as the basics of secure communication such as TLS and secure email. - Transport layer mechanisms, including extensions to TCP such as SACK and CUBIC, as well as new protocols such as QUIC. - Network layer with addressing and routing concepts, including IPv6, Software Defined Networking (SDN) and IPsec. - Data link layer with a focus on VLANs, MPLS and data center networks. The lecture is taught in a flipped classroom format. Students prepare for the classroom sessions independently using lecture slides and explanatory videos. In these sessions, the topics are explored in greater depth through case studies and exercises. Online tests offer students the opportunity for self-assessment and to collect bonus points for the exam. The examination consists of a 60-minute written exam, which is part of the module exam "Databases and Communication Networks 2". The total workload is 75 hours, divided into 25 hours of attendance time, 25 hours of asynchronous learning and 25 hours for exam preparation and follow-up.
Recommended reading	- Slide collection and explanatory videos in the ILIAS system - James Kurose, Keith Ross: Computer Networking - A Top-Down Approach, 8th edition, Pearson, 2021 - Various Internet standards, see https://www.rfc-editor.org - Further information in the lecture
Exams	Module exam
Comments	

Lecture Databases 1 Laboratory

Internal number	MINB322
Lecturers	M.Sc. Amir Bukhari Prof. Dr.-Ing. Holger Vogelsang
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Exercise
Language of instruction	German

Content	The knowledge learned in "Databases 1" is deepened and practiced in group work. The interaction of a database with a higher programming language (Java) is understood. The use of SQL (DCL; DML; DDL), transactions and isolation levels and the avoidance of deadlocks is mastered. A database application for warehouse management will be designed and prototypically implemented. This includes the setup of a DB schema, the design and testing of SQL queries, the use of transactions and transaction levels as well as the programming of queries and transactions with Java using JDBC based on Oracle (the preparation for the laboratory should be done in PostgreSQL or MySQL). Finally, several given verbal facts are analyzed, transferred to an Entity Relationship model, normalized, transferred to a physical schema and finally created in SQL. Finally, the handling of the OR mapper Hibernate is practiced.
Recommended reading	- Script - Sample databases - Programming framework - Edwin Schicker, "Datenbanken und SQL", Springer Vieweg, 2017, ISBN: 978-3834817327 - Gunter Saake, Kai-Uwe Sattler, "Datenbanken - Konzepte und Sprachen", mitp, 2013, ISBN: 978-3286694530
Exams	Exercise 1 Semester (not graded)
Comments	Supervised laboratory with final presentation on the computer, independent work, preparation for follow-up, writing a laboratory report on the tasks.
Lecture Communication Networks 1 Laboratory	
Internal number	MINB323
Lecturer	Prof. Dr. Oliver Waldhorst
Scope	1.0 ECTS points, 1.0 Contact hours 30 Stunden gesamt, davon 15 Stunden Kontaktstudium.
Type/mode	Laboratory Course
Language of instruction	German

Content	In the lab, students apply practical knowledge and skills to consolidate the content of the lecture of the same name. After completing the lab, they will be able to analyze, configure and programmatically implement network protocols in various layers and measure and evaluate the performance of network applications. After successful participation, students will be able to: - explain the functionality of application layer protocols (e.g. SMTP, POP3) and implement them through programming. - implement and evaluate transport layer mechanisms (e.g. stop-and-wait protocol) in unreliable networks. - Plan, configure and analyze networks and subnets, including addressing and routing. - use tools for network analysis and diagnostics (e.g. iperf3, cpunetlog) to measure performance and interpret the results. The laboratory includes the following experiments, which are carried out in teams of 2-4 people: - Experiment 1: Application layer: Configuration and programming of e-mail services (SMTP, POP3) with tools such as Postfix, Dovecot and Java Mail API. - Experiment 2: Transport layer: Implementation of a reliable data transmission protocol based on UDP. Simulation of a faulty communication medium and use of the stop-and-wait protocol. - Experiment 3: Network layer: Network planning and configuration with Mininet, including routing, subnetting and the use of tools such as ping, traceroute and ifconfig. - Experiment 4: Performance measurement: Analysis of network performance in simulated environments with iperf3 and cpunetlog. Investigation of data streams and CPU utilization. The experiments are carried out in a virtual environment as group work. The students document their results and present them at the end. The examination consists of the successful completion of the four laboratory experiments and the presentation of the results. The workload is 30 hours, including 15 hours of attendance time and 15 hours of independent preparation and follow-up work.
Recommended reading	- Collection of slides and explanatory videos on the experiments in the ILIAS system - Documents for the lecture "Communication Networks 1"
Exams	Laboratory Work 1 Semester (not graded)
Comments	

Module Media Project	
Internal number	MINB3305
Coordinator	Prof. Thomas Hinz
Scope	6.0 ECTS points, 5.0 Contact hours
Placement	3rd Semester
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	none
Competences	
Exams	Individual exams
Lecture Media Project	
Internal number	MINB331
Lecturer	Prof. Thomas Hinz
Scope	3.0 ECTS points, 2.0 Contact hours 90 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	Students acquire comprehensive skills in the design of human-machine interfaces and their various forms of interaction. They develop the ability to independently realise complex multimedia projects from conception to prototype implementation. In doing so, they make targeted use of software ergonomic principles and master the methodical design of interactive applications. The focus is on the practical application of transitions and animations for graphical user interfaces as well as the integration of micro-interactions. Students familiarise themselves with various prototyping methods in the context of usability and user experience and are able to apply these in a targeted manner. They develop a sound understanding of current design trends and their characteristic features, which enables them to evaluate and apply these design approaches in a differentiated manner.

Recommended reading	- Lecture materials - A. Hinton, „Understanding Context: Environment, Language, and Information Architecture", O'Reilly and Associates, 2015, ISBN 978-1449323172 - J. Jacobsen, L. Meyer: Praxisbuch Usability und UX: Bewährte Usability- und UX-Methoden praxisnah erklärt, 2024, ISBN-13: 978-3836299039 - J. Semler, K. Tschierschke: App-Design: Das umfassende Handbuch. Alles zur Gestaltung, Usability und User Experience von iOS-, Android- und Web-Apps, 2019, ISBN-13: 978-3836270502 - A. Cooper, R. Reiman, D. Cronin, C. Noessel, „About Face: The Essentials of Interaction Design", John Wiley & Sons, 2014 ISBN 978-1118766576 - D. Wood, „Basics Interactive Design: Interface Design: An introduction to visual communication in UI design", Fairchild Books, 2014, ISBN 978-2940411993 - D. Saffer, „Microinteractions", O'Reilly and Associates, 2013, ISBN 978-1491945926 - I. Pereya: Universal Principles of UX: 100 Timeless Strategies to Create Positive Interactions between People and Technology, 2023, ISBN-13: 978-0760378045
Exams	Concept 1 Semester (graded)
Comments	

Lecture Media Project Excercise	
Internal number	MINB342
Lecturer	Prof. Thomas Hinz
Scope	3.0 ECTS points, 3.0 Contact hours 90 Stunden gesamt, davon 45 Stunden Kontaktstudium.
Type/mode	Exercise
Language of instruction	German
Content	Students can conceptualise multimedia projects based on design tasks and implement them with the help of wireframes, mock-ups and interactive prototypes, justify and present the solutions they have developed.
Recommended reading	lecture materials
Exams	Exercise 1 Semester (not graded)
Comments	

Module Distributed Systems 1	
Internal number	MINB340
Coordinator	Prof. Dr. Christian Zirpins
Scope	4.0 ECTS points, 3.0 Contact hours
Placement	3rd Semester
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	none
Competences	Students acquire comprehensive knowledge of techniques and concepts in distributed systems, particularly in the context of web applications. They understand the general architecture of the Internet and the Web and are able to analyze the requirements of web applications accurately. They can develop interactive web applications using HTML, CSS, and client-side JavaScript, as well as implement server-side code for application services, including authentication, cookies, and session management. In addition, they are able to identify potential security issues such as cross-site scripting and SQL injection and implement appropriate protective measures. These skills enable students to design, develop, and operate complex and secure web applications effectively.
Exams	Individual exams

Lecture Distributed Systems 1 Laboratory	
Internal number	MINB232
Lecturer	Prof. Dr. Christian Zirpins
Scope	2.0 ECTS points, 1.0 Contact hours 60 Stunden gesamt, davon 15 Stunden Kontaktstudium.
Type/mode	Laboratory Course
Language of instruction	German
Content	The lab course covers the practical application of various basic web technologies. The selection of technologies follows the topics of the VS1 lecture. In the laboratory, a complete web application is created in several steps. Each step takes a closer look at a range of web technologies. This will specifically promote skills in understanding and applying Web technologies including the areas of declarative languages such as HTML, CSS, and JSON, client-side and server-side JavaScript programming, and special technologies for single-page applications and REST architectures.

Recommended reading	- Semmy Purewal, "Learning Web App Development", O'Reilly, 1. Auflage, 2014 - David Gourley, Brian Totty, "HTTP: The Definite Guide", O'Reilly, 2002 - Mark Pilgrim, "HTML5 Up and Running", O'Reilly, 2010 (Online: http://diveintohtml5.info) - Marijn Haverbeke, "Eloquent JavaScrip", No Starch Press, 2014 (Online: http://eloquentjavascript.net) - Oliver Ochs, "JavaScript für Enterprise-Entwickler, Professionell programmieren im Browser und auf dem Server", dpunkt, 2012 - Peter Gasston, "The Book of CSS3 - A Developer's Guide to the Future of Web Design", 2nd Edition, No Starch Press, 2014 - Andy Budd, Emil Björklund, "CSS Mastery", Third Edition, Apress, 2016 (Online verfügbar im Hochschulnetz) - Ethan Brown, "Web development with Node and Express", O'Reilly, 2014 - Robert Prediger ; Ralph Winzinger, "Node.js : Professionell hochperformante Software entwickeln", Hanser, 2015 (Online verfügbar im Hochschulnetz) - Additional literature will be announced during the lecture
Exams	Laboratory Work 1 Semester (not graded)
Comments	Basic knowledge of general programming and declarative web languages is required (the latter can be obtained by a limited self-study of the accompanying literature). The course includes 50% supervised presence time (1 SWS) in the LKIT lab and 50% individual work. Proof of achievement is provided by presentation and defense of the solution.
Lecture Distributed Systems 1	
Internal number	MINB341
Lecturer	Prof. Dr. Christian Zirpins
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German

Content	The course provides a practical introduction to the concepts and paradigms of distributed systems using the example of web technologies and application development on the web. This initially involves an introduction of the world wide web with basic protocols such as HTTP and other standards in the context of the Internet. After that an introduction to the design and construction of web applications is provided. This includes firstly the frontend development with HTML5, CSS3 as well as client-side JavaScript and secondly the backend development with server-side JavaScript on the Node.js platform. Interactions between frontend and backend follow modern REST/HTTP and AJAX techniques. In addition, mechanisms for personalization with cookies and sessions as well as to authenticate users are presented. The course closes with a detailed discussion of web application security. Upon completing this lecture class, students will acquire practical skills in the development and deployment of web applications, grounded in an understanding of distributed systems and web technologies. They will learn to proficiently use HTML5, CSS3, and JavaScript for frontend development, alongside server-side development with Node.js, enhancing their ability to create dynamic, full-stack web applications. Additionally, students will gain knowledge in implementing modern REST/HTTP and AJAX techniques for efficient frontend-backend communication, as well as in employing cookies, sessions, and authentication strategies for personalizing user experiences and ensuring application security. This comprehensive skill set will prepare students for a wide range of roles in web development and application design, equipping them with the necessary tools to address current and future challenges in the field.
Recommended reading	- Semmy Purewal, "Learning Web App Development", O'Reilly, 1. Auflage, 2014 - David Gourley, Brian Totty, "HTTP: The Definite Guide", O'Reilly, 2002 - Mark Pilgrim, "HTML5 Up and Running", O'Reilly, 2010 (Online: http://diveintohtml5.info) - Marijn Haverbeke, "Eloquent JavaScrip", No Starch Press, 2014 (Online: http://eloquentjavascript.net) - Peter Gasston, "The Book of CSS3 - A Developer's Guide to the Future of Web Design", 2nd Edition, No Starch Press, 2014 - Andy Budd, Emil Björklund, "CSS Mastery", Third Edition, Apress, 2016 (Online verfügbar im Hochschulnetz) - Ethan Brown, "Web development with Node and Express", O'Reilly, 2014 - Robert Prediger ; Ralph Winzinger, "Node.js : Professionell hochperformante Software entwickeln", Hanser, 2015 (Online verfügbar im Hochschulnetz) - Additional literature will be announced during the lecture
Exams	Written Exam 60 Min. (graded)
Comments	In preparation for individual lecture units, the self-study of basic content is required by means of the accompanying literature (relevant chapters will be announced in the event). Further independent work concerns the follow-up of the lecture contents and the exam preparation.

Module Business Administration and IT Service Management	
Internal number	MINB3505
Coordinator	Prof. Dr. Uwe Haneke
Scope	6.0 ECTS points, 6.0 Contact hours
Placement	3rd Semester
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	none
Competences	
Exams	Written Exam 120 Min. (graded)
Lecture Business Administration	
Internal number	MINB351
Lecturer	Prof. Dr. Uwe Haneke
Scope	4.0 ECTS points, 4.0 Contact hours 120 Stunden gesamt, davon 60 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	Students are introduced to the fundamental concepts of general business administration. They learn about economic processes and interrelationships and become familiar with typical processes and requirements within companies. They are able to identify and outline the various areas of business administration. Using diferent tools and concepts, students can describe and analyze a company's situation. In addition, students are equipped to independently calculate and analyze key performance indicators that provide insights into a company's efficiency and effectiveness. In the Business Administration lecture, topics such as the economic environment (economics), business structures, organization, investment and financing, marketing, and accounting are covered in depth. This enables students to gain a comprehensive understanding of how a company operates and the resulting requirements.
Recommended reading	- Slides - Case studies - Exercises
Exams	Module exam
Comments	
Lecture IT Service Management	
Internal number	MINB352
Lecturer	Prof. Dr. rer. pol. Mathias Philipp

Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	The lecture covers the core processes of IT service management as well as methods for systematic planning, provision and support of IT services. For each process, the objectives, tasks, demarcation, mode of operation and the dependencies on the other processes are worked out. The students thus acquire the competence to know the relevant technical terms and to apply them in practical situations. The necessary roles and responsibilities are learned. The students understand how IT processes are represented in reference models. The lecture is based on the IT Infrastructure Library (ITIL), which is a generally accepted standard for the structure and operation of IT organizations.
Recommended reading	Lecture material as PowerPoint slides Blackboard notes for interactive development of core problems Numerous multiple-choice questions on each process in ILIAS
Exams	Module exam
Comments	

Module Internship Preparation and Roundup	
Internal number	MINB4P0
Coordinator	Prof. Dr. Heiko Körner
Scope	6.0 ECTS points, 4.0 Contact hours
Placement	4th Semester
Pre-requisites with regard to content	Computer Science 1
Pre-requisites according to the examination regulations	Vorstudium
Competences	After completing this module, students will be able to handle important work-related skills that are also relevant for the practical semester. They can use the Scrum process model to manage projects and work in corresponding Scrum teams. They master techniques for the professional creation of scientific documents, can prepare data in a targeted manner and visualise their findings in an appealing way using modern presentation tools.
Exams	Individual exams
Lecture Internship Preparation	
Internal number	MINB4P1
Lecturers	B.Sc. Veit Richter Dr. Martin Holzer
Scope	3.0 ECTS points, 2.0 Contact hours 90 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	This course deals with the general handling of MS Office products and gives specifically an introduction to the main functions of MS-Excel. Topics include input methods, formulas, chart depictions and search functions. Basic knowledge about the programming in VBA are also taught. These methods will also be used for macro skripts in MS-Word. Afterwards, the students have learned how to solve typicals problems efficiently with these today's standard programs.
Recommended reading	- Set of lecture slides - Accompanying script for reference - Exercises
Exams	Exercise 1 Week (not graded)
Comments	Practical assignment in a computer laboratory.
Lecture Internship Roundup	
Internal number	MINB4P2
Lecturers	Dipl. WiInf. Lars Thoralf Thielemann Prof. Dr. Heiko Körner

Scope	3.0 ECTS points, 2.0 Contact hours 90 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Exercise
Language of instruction	German
Content	This lecture deals with the general handling of MS Office products and specifically provides an introduction to the most important functionalities of MS Excel. Students learn, for example, how to use input methods, formulae, diagrams and search functions. Basic knowledge of programming under VBA is also taught. These are then used to create macro scripts in MS Word. The focus is on the efficient use of MS Office products. Participating students are then able to quickly solve typical tasks.
Recommended reading	Lecture notes
Exams	Exercise 1 Week (not graded)
Comments	The course consists of a lecture (50%) and supervised practical exercises (50%).

Module Internship	
Internal number	MINB4PX
Coordinator	Prof. Dr. Patrick Baier
Scope	24.0 ECTS points, 0.0 Contact hours
Placement	4th Semester
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	Vorstudium
Competences	The internship is designed to deepen the previously acquired knowledge and skills by qualified collaboration in a larger project. The focus is on improving the technical competence and the development of social and personal skills. The student needs to assert himself as an independent member of the team. He becomes acquainted with new fields of duty and will become familiar with new tools. He learns to evolve himself and to assess his skills. The internship may be pursued in a company, in a research facility or an authority.
Exams	Individual exams
Lecture Internship	
Internal number	MINB4PX
Lecturer	Prof. Dr. Patrick Baier
Scope	24.0 ECTS points, 0.0 Contact hours 720 Stunden gesamt, davon 0 Stunden Kontaktstudium.
Type/mode	On-the-job Training
Language of instruction	German
Content	The project must include at least 95 days presence and a relevantly application in computer science using modern technologies. There are to create an internship report and an experience report. The supervising company grants a work certificate. By the university of applied sciences each student is assigned a mentor. The task of the mentor is to monitor the quality of training detail.
Recommended reading	The material depends on the task and is made available by the supervising company.
Exams	Hands-on Work 95 Days (not graded)
Comments	Participation in a larger project

Module Software Engineering and Distributed Systems 2	
Internal number	MINB510
Coordinator	Prof. Dr. Thomas Fuchß
Scope	8.0 ECTS points, 7.0 Contact hours
Placement	5th Semester
Pre-requisites with regard to content	Databases and Communication Networks 1, Computer Science 2, Interfacedesign, Internship
Pre-requisites according to the examination regulations	none
Competences	The students learn how to work independently and productively in large software projects. This includes the decomposing of development tasks as well as the determination and assessment of appropriate architectures. They are able to capture the necessary steps in the context of a given task, to structure and clarify their decisions using suitable tools and methodologies, independently. In this context, the students also gain the ability to recognize and classify goals and problems of distributed software systems. They can explain the general concepts of architectures, processes, communication, naming, coordination, replication fault tolerance and security, and apply them to the construction of distributed software services and applications.
Exams	Written Exam 120 Min. (graded)

Lecture Software Engineering	
Internal number	MINB511.a
Lecturer	Prof. Dr. Thomas Fuchß
Scope	2.5 ECTS points, 2.0 Contact hours 75 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German

Content	The course "Software Engineering" builds on the practical experience students have gained during their internships and introduces techniques and methods for structured large-scale software development. The lecture begins with a review and consolidation of fundamental concepts such as objects, classes, associations, methods, inheritance, and polymorphism to ensure a solid understanding of the basics. It then focuses on the challenges of modern software development processes and structured approaches to address them effectively. Students learn how to integrate agile methodologies, such as Scrum, with established process models like the Unified Software Development Process to manage complex software projects. UML is introduced as a core modeling language to document development decisions and facilitate clear communication. Particular emphasis is placed on understanding the complexities of large-scale systems and applying structured methods and processes to address these challenges. Throughout the course, students develop the ability to work independently in agile environments, make informed development decisions, and document these decisions methodically. Theoretical concepts are complemented by practical examples that help bridge the gap between theory and real-world applications. In the associated lab, students apply the knowledge gained in the lecture to various example projects. They conduct the first iteration of a software development process, practicing teamwork, the use of agile methods, and professional documentation with UML.

Recommended reading	Slides, videos, textbooks, and other literature: - Arlow, J.; Neustadt, I.: UML 2 and the Unified Process: Practical Object-Oriented Analysis and Design, 2. ed. - Addison-Wesley Professional, 2005. - Shimp, D. and Rawsthorne, D. Exploring Scrum: The Fundamentals – CreateSpace, 2011. - Jacobson, I.; Booch, G. and Rumbaugh, J.: The unified software development process - Reading, Mass.: Addison-Wesley, 1999. - Kim, G.; Humble, J.; Debois, P. und Willis, J.: Das DevOps-Handbuch: Teams, Tools und Infrastrukturen erfolgreich umgestalten - Heidelberg: O'Reilly; Heidelberg: dpunkt.verlag, 2017. - Larman, C.: Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development, 3. ed. - Upper Saddle River, NJ : Prentice Hall, 2004. - Larman, C. und Vodde, B.: Large-Scale Scrum: Scrum erfolgreich skalieren mit LeSS - Heidelberg: dpunkt.verlag, 2017. - Oestereich, B.: Developing Software with UML: Object-Oriented Analysis and Design in Practice 2. ed. - Addison-Wesley Professional, 2003. - Oestereich, B.: Analyse und Design mit UML 2.1: Objektorientierte Softwareentwicklung, 8. ed. - München; Wien : Oldenbourg, 2006 - OMG Object Management Group. Unified Modeling Language (OMG UML) Version 2.5.1 – OMG, 2017. - Seidl, M.; Scholz, M. and Huemer, C.: UML @ Classroom: An Introduction to Object-Oriented Modeling, Springer, 2015. - Schwaber, K. and Sutherland, J. The Scrum Guide: The Definitive Guide to Scrum – Scrumguides.org, 2020. - Sommerville, I.: Software Engineering, 10. Auflage - Pearson, 2018. - Wintersteiger, A.: Scrum: Schnelleinstieg, 4. Auflage - Frankfurt am Main: entwickler.press, 2018.
Exams	Module exam
Comments	The lecture will take the form of seminars with exercises.
Lecture Distributed Systems 2	
Internal number	MINB511.b
Lecturer	Prof. Dr. Christian Zirpins
Scope	2.5 ECTS points, 2.0 Contact hours 75 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German

Content	The lecture conveys both fundamental and extended principles of distributed systems and illustrates these in practical form on the basis of concrete paradigms and technologies. The spectrum of principles covered includes fundamental aspects of the objectives and classes of distributed systems, as well as their architectures, processes, communications, and naming. Advanced principles include coordination, consistency and replication, fault tolerance and security. The covered principles are exemplified by various paradigms. Here, exemplary implementations of individual principles are presented. In addition, an introduction to the development of corresponding systems based on concrete software technologies is given. Upon completing this lecture class, students will achieve a comprehensive understanding of the principles underlying distributed systems, ranging from their fundamental objectives and architectures to advanced concepts such as coordination, consistency, replication, fault tolerance, and security. They will gain insights into the practical application of these principles through the examination of specific paradigms and technologies, enhancing their ability to analyze and design distributed systems. Moreover, the introduction to developing these systems using concrete software technologies will equip students with the practical skills necessary for implementing robust, efficient, and secure distributed systems in various computing environments.
Recommended reading	- Andrew S. Tannenbaum, Marten van Steen, "Verteilte Systeme, Prinzipien und Paradigmen", 2. aktualisierte Auflage, Pearson Studium, 2008, ISBN 978-3-8273-7293-2 - George Coulouris, Jean Dollimore, Tim Kindberg, Gordon Blair, "Distributed Systems, Concepts and Design", Fifth Edition, Addison-Wesley, 2012, ISBN 978-0-13-214301-1 - Additional literature will be announced during the lecture
Exams	Module exam
Comments	Autonomous work includes pre- and post processing of lectures, exercises and exam preparation.
Lecture Softwareengineering Laboratory	
Internal number	MINB512
Lecturer	Prof. Dr. Thomas Fuchß
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Laboratory Course
Language of instruction	German

Content	In the Software Engineering Lab, students complete a full iterative software development process within a team. Starting with requirements analysis, they develop an analysis and design model and implement it in Java. Along the way, they actively engage with concepts such as use-case-driven development, architecture orientation, iterative and incremental approaches, and component-based software design. Through a concrete example project, students experience the practical application of these methods and learn to make independent design decisions while adhering to given requirements. The lab emphasizes teamwork and independent problem-solving, preparing participants to work effectively in agile development teams and address the challenges of complex software projects.
Recommended reading	Slides, videos, textbooks, and other literature: - Arlow, J.; Neustadt, I.: UML 2 and the Unified Process: Practical Object-Oriented Analysis and Design, 2. ed. - Addison-Wesley Professional, 2005. - Shimp, D. and Rawsthorne, D. Exploring Scrum: The Fundamentals – CreateSpace, 2011. - Jacobson, I.; Booch, G. and Rumbaugh, J.: The unified software development process - Reading, Mass.: Addison-Wesley, 1999. - Kim, G.; Humble, J.; Debois, P. und Willis, J.: Das DevOps-Handbuch: Teams, Tools und Infrastrukturen erfolgreich umgestalten - Heidelberg: O'Reilly; Heidelberg: dpunkt.verlag, 2017. - Larman, C.: Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development, 3. ed. - Upper Saddle River, NJ : Prentice Hall, 2004. - Larman, C. und Vodde, B.: Large-Scale Scrum: Scrum erfolgreich skalieren mit LeSS - Heidelberg: dpunkt.verlag, 2017. - Oestereich, B.: Developing Software with UML: Object-Oriented Analysis and Design in Practice 2. ed. - Addison-Wesley Professional, 2003. - Oestereich, B.: Analyse und Design mit UML 2.1: Objektorientierte Softwareentwicklung, 8. ed. - München; Wien : Oldenbourg, 2006 - OMG Object Management Group. Unified Modeling Language (OMG UML) Version 2.5.1 – OMG, 2017. - Seidl, M.; Scholz, M. and Huemer, C.: UML @ Classroom: An Introduction to Object-Oriented Modeling, Springer, 2015. - Schwaber, K. and Sutherland, J. The Scrum Guide: The Definitive Guide to Scrum – Scrumguides.org, 2020. - Sommerville, I.: Software Engineering, 10. Auflage - Pearson, 2018. - Wintersteiger, A.: Scrum: Schnelleinstieg, 4. Auflage - Frankfurt am Main: entwickler.press, 2018.
Exams	Laboratory Work 1 Semester (not graded)
Comments	Attended teamwork

Lecture Distributed Systems 2 Laboratory

Internal number	MINB513
Lecturer	Prof. Dr. Christian Zirpins
Scope	1.0 ECTS points, 1.0 Contact hours 30 Stunden gesamt, davon 15 Stunden Kontaktstudium.

Type/mode	Laboratory Course
Language of instruction	German
Content	The lab provides practical insights into the functioning and construction of distributed information systems. To this end, current paradigms are taken up and fundamental principles are examined in the context of exemplary realizations. The lab tasks are based on the contents of the lecture, but also address current topics of industrial research and development. The practical implementation is done under utilization of modern industry-relevant platforms and frameworks.
Recommended reading	- Andrew S. Tannenbaum, Marten van Steen, "Verteilte Systeme, Prinzipien und Paradigmen", 2. aktualisierte Auflage, Pearson Studium, 2008, ISBN 978-3-8273-7293-2 - George Coulouris, Jean Dollimore, Tim Kindberg, Gordon Blair, "Distributed Systems, Concepts and Design", Fifth Edition, Addison-Wesley, 2012, ISBN 978-0-13-214301-1 - Additional literature will be announced during the lecture
Exams	Laboratory Work 1 Semester (not graded)
Comments	Basic knowledge of programming, operating systems and databases is required. The course includes 50% supervised presence time (1 SWS) in the LKIT lab and 50% individual work. Proof of achievement is provided by presentation and defense of the solution.

Module Databases and Communication Networks 2	
Internal number	MINB520
Coordinator	Prof. Dr. Zoltán Nochta
Scope	5.0 ECTS points, 4.0 Contact hours
Placement	5th Semester
Pre-requisites with regard to content	Databases and Communication Networks 1
Pre-requisites according to the examination regulations	none
Competences	
Exams	Written Exam 120 Min. (graded)
Lecture Databases 2	
Internal number	MINB521.a
Lecturer	Prof. Dr. Zoltán Nochta
Scope	2.5 ECTS points, 2.0 Contact hours 75 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	
Recommended reading	- "Datenbanksysteme" von Alfons Kemper, Andre Eickler - "Database Solutions" von Thomas Connolly, Carolyn Begg
Exams	Module exam
Comments	
Lecture Communication Networks 2	
Internal number	MINB521.b
Lecturer	Prof. Dr. Oliver Waldhorst
Scope	2.5 ECTS points, 2.0 Contact hours 75 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German

Content	In this course, students expand their knowledge of communication networks, in particular by taking an in-depth look at the functionalities and challenges of the layers of the Internet protocol stack. After completing the course, they will be able to analyze, evaluate and practically apply advanced mechanisms and protocols in the application layer, transport layer, network layer and security layer. They will be able to identify complex network problems, combine specific solution modules and develop innovative solutions. The lecture covers the following topics: - Transmission of multimedia content in the application layer, e.g. Netflix and Skype, as well as the basics of secure communication such as TLS and secure email. - Transport layer mechanisms, including extensions to TCP such as SACK and CUBIC, as well as new protocols such as QUIC. - Network layer with addressing and routing concepts, including IPv6, Software Defined Networking (SDN) and IPsec. - Data link layer with a focus on VLANs, MPLS and data center networks. The lecture is taught in a flipped classroom format. Students prepare for the classroom sessions independently using lecture slides and explanatory videos. In these sessions, the topics are explored in greater depth through case studies and exercises. Online tests offer students the opportunity for self-assessment and to collect bonus points for the exam. The examination consists of a 60-minute written exam, which is part of the module exam "Databases and Communication Networks 2". The total workload is 75 hours, divided into 25 hours of attendance time, 25 hours of asynchronous learning and 25 hours for exam preparation and follow-up.
Recommended reading	- Slide collection and explanatory videos in the ILIAS system - James Kurose, Keith Ross: Computer Networking - A Top-Down Approach, 8th edition, Pearson, 2021 - Various Internet standards, see https://www.rfc-editor.org - Further information in the lecture
Exams	Module exam
Comments	

Module Computer Graphics and Computer Vision	
Internal number	MINB530
Coordinator	Prof. Dr. Christian Pape
Scope	7.0 ECTS points, 6.0 Contact hours
Placement	5th Semester
Pre-requisites with regard to content	Mathematics 1, Mathematics 2, Software Project
Pre-requisites according to the examination regulations	none
Competences	Visual cognition and its creation through modern computer graphics, as well as color models, textures and graphic effects are understood in basic theoretical details as well as in practical application.
Exams	Written Exam 120 Min. (graded)
Lecture Computer Graphics	
Internal number	MINB531.a
Lecturer	Prof. Dr. Christian Pape
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	The students learn to store, code and display two-dimensional graphics in the computer and external storage media. They will be able to apply their mathematical skills to simple areas of computer graphics, such as the use of coordinate systems, modeling three-dimensional objects with polygons, designing algorithms to calculate sections of geometric objects. The students learn about photorealistic image generation using ray tracing techniques. They can describe and implement homogeneous coordinates in object space and model space. OpenGL can be used in principle for practical programming.
Recommended reading	- Lecture notes - Steve Marschner, Peter Shirley. Fundamentals of Computer Graphics. O'Reilly. - John Vince. Mathematics for Computer Graphics. Springer. - Matt Pharr, Wenzel Jakob, Greg Humphreys. Physically based Rendering. https://pbrt.org/
Exams	Module exam

Comments	
Lecture Computer Vision	
Internal number	MINB531.b
Lecturer	Prof. Dr.-Ing. Astrid Laubenheimer
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	
Recommended reading	
Exams	Module exam
Comments	
Lecture Computer Graphics Laboratory	
Internal number	MINB532
Lecturer	Prof. Dr. Christian Pape
Scope	3.0 ECTS points, 2.0 Contact hours 90 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Laboratory Course
Language of instruction	German
Content	In the practical assignment, the knowledge of computer graphics imparted in the lecture will be deepened using the following practical tasks on the computer: 1. An existing arcade game implementation must be supplemented with its own 2D view component. A simple 2D API like SDL is used for this. 2. A rudimentary ray tracer based on given basic libraries is to be created. 3. The arcade game implementation is to be supplemented with a 3D view based on an API such as OpenGL or your own transformations. C++ is used as the implementation language.
Recommended reading	Detailled description of the assigments.
Exams	Exercise 1 Semester (not graded)
Comments	The solutions are presented and discussed with the supervisor in the exercises.

Module IT Security	
Internal number	MINB540
Coordinator	nn1
Scope	5.0 ECTS points, 4.0 Contact hours
Placement	5th Semester
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	Modul Internship
Competences	
Exams	Individual exams
Lecture IT Security	
Internal number	MINB541
Lecturer	nn1
Scope	3.0 ECTS points, 2.0 Contact hours 90 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Seminar
Language of instruction	German
Content	
Recommended reading	
Exams	Written Exam 90 Min. (graded)
Comments	
Lecture IT Security Laboratory	
Internal number	MINB542
Lecturer	Prof. Dr.-Ing. Holger Vogelsang
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Exercise
Language of instruction	German
Content	
Recommended reading	
Exams	Exercise 1 Semester (not graded)
Comments	

Module Elective courses 1	
Internal number	MINB550
Coordinator	Prof. Dr.-Ing. Holger Vogelsang
Scope	4.0 ECTS points, 4.0 Contact hours
Placement	5th Semester
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	none
Competences	The compulsory elective subjects enable students to set specialisations according to their own interests and thus apply further specialist areas of computer science or media informatics. The courses belonging to the module are announced on the intranet at the beginning of each semester.
Exams	Individual exams
Lecture Advanced Topics in Computer Science	
Internal number	I W156
Lecturer	Prof. Dr. Martin Sulzmann
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	English
Content	
Recommended reading	
Exams	Written Exam 90 Min. (graded)
Comments	
Lecture Malware development and malware analysis	
Internal number	I W164
Lecturer	B.Sc. Florian Dalwigk
Scope	4.0 ECTS points, 4.0 Contact hours 120 Stunden gesamt, davon 60 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German

Content	The students - learn about the history of malware. - can identify and categorise malware by the way it works. - understand how malware is recognised under Windows. - learn about the process of malware development. - can develop functional malware such as ransomware and Trojans. - learn which distribution techniques exist for malware. - are able to analyse malware with the help of Ghidra. Contents: - History of malware - Malware taxonomy - Malware architectures - Malware as a Service (MaaS) - Importance of malware in the field of cybercrime - AV detection techniques - WinAPIs, PE format - Payload encryption, payload obfuscation, payload staging - Malware binary signing - Fully Undetectable Malware (FUD) - Project: Ransomware - Project: Trojans - Project: Analysing WannaCry with Ghidra - Malware delivery techniques - Protection against malware Basic knowledge of "ethical hacking" advantageous, initial experience with Assembler and/or Python, access to a Windows system.
Recommended reading	Zhassulan Zhussupov. (2024). Malware Development for Ethical Hackers: Learn how to develop various types of malware to strengthen cybersecurity (English Edition). <packt>
Exams	Written Exam 90 Min. (graded)
Comments	

Lecture Business Intelligence

Internal number	I W179
Lecturer	Prof. Dr. Uwe Haneke
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	- Introduction and business-management background - The concept of data warehousing - Business Analytics and Balanced Scorecard (BSC) - CRM and Data Mining - Trends in Business Intelligence-Case studies
Recommended reading	
Exams	Written Exam 90 Min. (graded)

Comments	
Lecture Parallel Systems	
Internal number	I W391
Lecturer	Prof. Dr. Christian Langen
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	
Recommended reading	
Exams	Verbal Exam 20 Min. (graded)
Comments	
Lecture IT-Security Management	
Internal number	I W394
Lecturer	Prof. Dr. rer. pol. Mathias Philipp
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	
Recommended reading	
Exams	Written Exam 90 Min. (graded)
Comments	
Lecture Projective geometry	
Internal number	I W501
Lecturer	Prof. Dr. Frank Schaefer
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	
Recommended reading	
Exams	Written/verbal Exam 90/20 Min. (graded)
Comments	
Lecture Philosophy and theory of computer science	
Internal number	I W502
Lecturer	Prof. Dr. Thomas Morgenstern

Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	
Recommended reading	
Exams	Presentation 20 Min. (graded)
Comments	
Lecture Methods in User Research „Empathic-pragmatic“	
Internal number	I W503
Lecturer	Dipl.Design. Heike Biscosi
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	User Research - methods all around fictitious and real users, to to establish a "human centered approach" in projects. Teaching contents are methods which contribute to a better understanding of people and their usage contexts, to improve the development, design and evaluation of interactive products and systems. Following topics - in theory and praxis - will be part of the seminar: - Creative and qualitative research methods, such as target group analysis, mental models, persona design, persona-moodboard, job stories, cultural probes, user diaries, focus groups, interviews, scenarios and storyboards, user journeys, acceptance and usability testings. - Basic principles of different quantitative methods: survey and questionnaire design, descriptive statistics, laboratory-based studies, experimental studies. - Evaluation of quantitative methods, as described in research reports.
Recommended reading	- Lecture notes, - Case studies from practice, - further literature references will be given in the lecture.
Exams	Homework 1 Semester (graded)
Comments	Seminaristic lecture with practical exercises.
Lecture Introduction to applied cryptography	
Internal number	I W505
Lecturer	Dr. Carmen Kempka
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	

Recommended reading	
Exams	Written Exam 90 Min. (graded)
Comments	
Lecture ERP Systems with Laboratory	
Internal number	I W551
Lecturer	Prof. Dr. rer. pol. Mathias Philipp
Scope	4.0 ECTS points, 4.0 Contact hours 120 Stunden gesamt, davon 60 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	Contents: ERP basics, system integration, system architectures, and logistics: Distribution (SD), Materials Management (MM), Production Planning and Control (PP) as well as Financial Accounting (FI) and Controlling (CO). In addition, an overview is given to the software selection.
Recommended reading	Recommended reading: Lecture material completely as PowerPoint documents, blackboard notes for interactive development of central problem positions, a main textbook to ERP, a main textbook to SAP ECC 6.0.
Exams	Written Exam 90 Min. (graded)
Comments	Kind of work: Lecture participation
Lecture Mathematics for Machine Learning	
Internal number	I W610
Lecturers	Prof. Dr.-Ing. Astrid Laubenheimer M.Sc. Ahmad Assani
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	
Recommended reading	
Exams	Written/verbal Exam 90/20 Min. (graded)
Comments	
Lecture Embedded Software	
Internal number	I W611
Lecturer	Prof. Dr. Dirk Hoffmann
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German

Content	Students will be able to understand the fundamental concepts of software development for embedded real-time systems. In the context of this lecture, embedded systems are all computers controlled by software that are part of a larger system and whose primary function is not computing. Real-time systems also involve aspects of temporal behavior, i.e., they are systems that not only have to provide a correct answer, but also have to calculate the system answer within a predetermined and guaranteed period of time. In detail, topics from the following areas are covered: design and architecture of automotive control units, fundamentals of real-time programming, coding for data transmission, embedded C. The participants of the lecture apply their knowledge on the basis of exercises.
Recommended reading	Slides, blackboard, exercise sheets
Exams	Written Exam 90 Min. (graded)
Comments	Lecture
Lecture Game Programming	
Internal number	I W620
Lecturer	M.Sc. Raphael Hettich
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	English
Content	
Recommended reading	
Exams	Written Exam 90 Min. (graded)
Comments	
Lecture Computer Vision Laboratory	
Internal number	I W773
Lecturer	Prof. Dr.-Ing. Astrid Laubenheimer
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Laboratory Course
Language of instruction	German
Content	
Recommended reading	
Exams	Laboratory Work 1 Semester (graded)
Comments	
Lecture App Programming	
Internal number	I W912
Lecturer	M.Sc. Adrian Wörle
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.

Type/mode	Lecture
Language of instruction	German
Content	The lecture teaches the construction of mobile media applications. The main concepts are discussed using the Android platform. In a first partt, the basic technologies and limitations of mobile devices are shown. The second part examins different development strategies like native applications, device independend abstractions and web applications. A main part of the lecture is the integration of different media types into mobile applications and the constraints the developer has to keep in mind.
Recommended reading	will be announced
Exams	Written Exam 90 Min. (graded)
Comments	Leacture with exercise
Lecture Cloud Computing	
Internal number	I W913
Lecturers	Dipl. Inform. (FH) Michael Fischer Dipl. Inform. (FH) Georg Magschok
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	The buzzword "Cloud" represents a variety of interesting technologies which gained importance in the life of a computer science professional. Those are being collected, examined, explained and understood during the course. Primary objective is usefulness for the student, regardless of whether he acts as a cloud user, developer, administrator or even entrepreneur. Understand the broad meaning of "Cloud Computing" from a variety of perspectives: Definition, use cases, technology basics, key players, APIs, scaling, redundancy …
Recommended reading	Powerpoint slides
Exams	Written Exam 90 Min. (graded)
Comments	
Lecture Affective Computing	
Internal number	I W924
Lecturer	Prof. Thomas Hinz
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German

Content	Emotional expressions are important signals for people to make sense of situations, actions and relationships in their social interactions with each other. Is the empowerment of technological systrms with the capacity to also sense and express emotions able to improve their users' interactions with them? This question is the driving force behind the field of Affective Computing. The students know different theories of emotions, contrast them with each other and debate them. They apply the acquired knowledge by addressing problems from within the primary areas of application for Affective Computing through the development of prototypical interactive systems that are capable of sensing or expressing emotions.
Recommended reading	Lecture notes, case studies.
Exams	Homework 1 Semester (graded)
Comments	
Lecture Video	
Internal number	I W925
Lecturers	Marc Steinmetz Prof. Thomas Hinz
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	
Recommended reading	
Exams	Homework 1 Semester (graded)
Comments	
Lecture Big Data Engineering	
Internal number	I W926
Lecturer	Prof. Dr. Christian Zirpins
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German

Content	The lecture Big Data Engineering addresses the systematic construction of data-intensive systems. Generic architectural approaches are introduced in order to design robust, performant and scalable data systems for various applications. For different architectural areas various kinds of data storage and processing models are discussed. Topics include, among others, distributed file systems, serialization, batch and stream processing with MapReduce and other programming models, queuing mechanisms and NoSQL databases. These are both conceptually described as well as implemented by means of exemplary tools and techniques. The focus is on established industry standards such as Apache Thrift, Hadoop, Kafka, Cassandra, Storm. These are illustrated by means of an exemplary Web Analytics application. During the course students acquire, among others, the following abilities: - They evaluate different approaches of data systems for given application problems with specific requirements. - They describe structure and function of specific architectural approaches for Big Data systems. - They categorize tools and techniques for Big Data systems and utilize them professionally. - They design architecture and data models as well as processing logic and queries for given Big Data applications and implement these based on specific open source tools and techniques.
Recommended reading	- Nathan Marz, James Warren, "Big Data: Principles and best practices of scalable realtime data systems", Manning, 2015, ISBN: 1-617290-34-3 - Martin Kleppmann, "Designing Data-Intensive Applications", O'Reilly, 2014 (Early Release), ISBN: 978-1-4493-7332-0 - Tom White, "Hadoop: the definitive guide: storage and analysis at internet scale", 4. ed., O'Reilly, 2015, ISBN: 978-1-491-90163-2 - Michael Frampton, "Big Data Made Easy: A Working Guide to the Complete Hadoop Toolset", Apress, 2015, ISBN: 978-148-420-094-0 - Vivek Mishra, "Beginning Apache Cassandra Development", Apress, 2014, ISBN: 978-148-420-142-8 - Additional literature will be announced during the lecture
Exams	Written Exam 90 Min. (graded)
Comments	Independent work relates to the preparation and followup of lectures, laboratory exercises and exam preparation.

Lecture Digital Transformation & digital marketing

Internal number	I W929
Lecturers	Prof. Thomas Hinz Marc Steinmetz
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	

Recommended reading	
Exams	Homework 1 Semester (graded)
Comments	
Lecture Seminar	
Internal number	I Wsem
Lecturer	Alle Dozenten
Scope	4.0 ECTS points, 4.0 Contact hours 120 Stunden gesamt, davon 60 Stunden Kontaktstudium.
Type/mode	Seminar
Language of instruction	German
Content	Each participant of the seminar creates under the guidance of a supervising faculty staff a written report in housework. The contents of the report should be computer science related. Based on the report suitable presentation techniques (slides, video sequences, programmed examples) are selected. Each participant individually presents his report followed by a discussion. The seminar topics are classified into thematic groups. Besides the technical problem the student has to learn how to do 'self-marketing'. The assessment of the student is based on the following criteria: degree of difficulty, quality of written preparation; didactically skillful presentation.
Recommended reading	Depends on the topic
Exams	Presentation 20 Min. (graded)
Comments	Meetings with the faculty supervisor; eventually experimental studies, literature refurbishment; presenting the work-out; defend the own presentation; active participation in discussing the presentations of others.
Lecture Workshop Empirical Software Engineering	
Internal number	I Wxyz
Lecturers	Prof. Dr. Christian Zirpins Prof. Dr. Zoltán Nochta Prof. Dr. Oliver Waldhorst
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Project Lecture
Language of instruction	German

Content	The course teaches practical methods of empirical software engineering and focuses on analysing and evaluating software systems in real-life use. The focus is on field and case studies that deal with the behaviour of users, the interaction with software and its technical and functional properties. By analysing authentic usage contexts, realistic insights are gained that are important for both science and industry. Students actively participate in the planning, implementation and evaluation of a real field study, which is carried out in cooperation with the university's IDSS research institute and partners from industry. They work as part of an ongoing research project and test scientific methods in an application-oriented environment. The tasks include the systematic collection and evaluation of usage data as well as the organisational support of the study and the technical validation of the software under investigation. Through practical experience, participants develop an in-depth understanding of the empirical investigation of software systems and their utilisation. They acquire skills in project management, in the application of empirical research methods and in software-supported data analysis. They also learn how to systematically gain scientific knowledge and critically assess its relevance for the further development and optimisation of software systems.
Recommended reading	1. Vorlesungsfolien und Dokumentation in ILIAS 2. Wohlin, Claes, et al. Experimentation in Software Engineering. Springer Nature, 2024. 3. Further literature will be announced during the course
Exams	Hands-on Work 1 Semester (graded)
Comments	Seminar work with practical components, practical group work + final presentation

Module Embedded Software	
Internal number	MINB610
Coordinator	Prof. Daniel Schwarz
Scope	5.0 ECTS points, 4.0 Contact hours
Placement	6th Semester
Pre-requisites with regard to content	Computer Science 1
Pre-requisites according to the examination regulations	Modul Internship
Competences	The courses of this module teach the students the fundamental concepts about embedded systems. Students know the basic terminology about embedded systems and they are able to distinguish different types of real-time systems from each other. By studying the CAN bus technology, students get to know a typical communication medium and acquain with the CDMA technology an important coding scheme for data transmission. Students are able to implement typical programming tasks in the field of embedded systems in C. Furthermore, students learn how to deal with software tools that are suited for analyzing and developing embedded systems.
Exams	Individual exams
Lecture Embedded Software	
Internal number	MINB611
Lecturer	Prof. Daniel Schwarz
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	The lecture introduces software development methods for embedded real time systems. Embedded systems within the meaning of this lecture are systems that are controlled by computer software and are part of a larger system whose primary function is not compute-oriented. For real-time systems, the result has to be computed within a specified time frame. In particular, topics from the following areas are covered: Design and architecture of automotive ECUs, bus architectures, data transmission encodings, Embedded C.
Recommended reading	Slides, blackboard, exercise sheets
Exams	Concept 1 Semester (graded)
Comments	Lecture
Lecture Embedded Software Laboratory	
Internal number	MINB612
Lecturer	Prof. Daniel Schwarz
Scope	3.0 ECTS points, 2.0 Contact hours 90 Stunden gesamt, davon 30 Stunden Kontaktstudium.

Type/mode	Exercise
Language of instruction	German
Content	With the help of the modeling tool CANoe the participants design a control unit in the field of automotive electronics. The project also includes tasks from the field of signal decoding.
Recommended reading	Software and hardware tools für designing automative ECUs
Exams	Exercise 1 Semester (not graded)
Comments	Practical work

Module Cognitive human-machine interaction	
Internal number	MINB620
Coordinator	Prof. Dr. Matthias Wölfel
Scope	5.0 ECTS points, 4.0 Contact hours
Placement	6th Semester
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	Modul Internship
Competences	This module integrates different media technologies. The students will be able to write user interfaces for rich fat clients and mobile media applications. They learn how computer vision works and how computer vision ist used in media applications.
Exams	Individual exams
Lecture Intuitive and Perceptive User Interfaces	
Internal number	MINB621
Lecturer	Prof. Dr. Matthias Wölfel
Scope	3.0 ECTS points, 2.0 Contact hours 90 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	The lecture first deals with SWT/JFace and the Eclipse Rich Client Platform 4 (RCP), which uses SWT and JFace as its basis. The most important topics are the model-view-controller pattern, layout management and event handling using the observer pattern. Based upon this techniques advanced technologies like the separation of business logic and user interface code using data binding and dialog control are presented. Other topics are internationalization and multithreading in the context of user interfaces. The last part of the lecture shows the declarative construction of user interfaces and the application of the RCP framework.

Recommended reading	Books and Web sites: - Marc Teufel, "Eclipse 4", entwickler.press, Oktober 2012 - Lars Vogel, "Eclipse 4 Application Development", Mai 2012 - M. Marinilli, "Professional Java User Interfaces", Wiley & Sons, 2006 - R. Warner, R. Harris, "The Definite Guide to SWT and JFace", Apress, 2007 - M. Scarpino et.al., "SWT/JFace in Action", Manning Publications Co., 2005 - J. McAffer, J. M. Lemieux, "Eclipse Rich Client Platform", Addison-Wesley Longman (Pearson Education), 2010 - G. Wütherich, N. Hartmann, B. Kolb, M. Lübken, "Die OSGi Service Platform", dpunkt-Verlag, 2008 - http://www.ralfebert.de/rcpbuch/ - http://www.eclipse.org/swt/ - http://www.eclipse.org/articles/Article-UI-Guidelines/Index.html - http://www.eclipse.org/swt/snippets/ - http://wiki.eclipse.org/index.php/JFaceSnippets - http://www.java2s.com/
Exams	Written Exam 90 Min. (graded)
Comments	Lecture preparation, exam preparation, implementing the bonus exercise, 30% of the lecture is held as a computer exercise
Lecture Intuitive and Perceptive User Interfaces Laboratory	
Internal number	MINB622
Lecturer	Prof. Dr. Matthias Wölfel
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Exercise
Language of instruction	German
Content	The lecture teaches the construction of mobile media applications. The main concepts are discussed using the Android platform. In a first partt, the basic technologies and limitations of mobile devices are shown. The second part examins different development strategies like native applications, device independend abstractions and web applications. A main part of the lecture is the integration of different media types into mobile applications and the constraints the developer has to keep in mind.
Recommended reading	will be announced
Exams	Exercise 1 Semester (not graded)
Comments	Leacture with exercise

Module Student Research Project	
Internal number	MINB630
Coordinator	Prof. Dr. Heiko Körner
Scope	4.0 ECTS points, 4.0 Contact hours
Placement	6th Semester
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	none
Competences	Students will be able to independently apply the knowledge they have acquired in their previous studies to a complete task. They can analyse the problem, create a solution concept, find an implementation and implement it on their own. They can also write down their results observing scientific standards. They can also present their work in a short presentation and defend it in a subsequent discussion.
Exams	Verbal Exam 20 Min. (graded)
Lecture Student Research Projekt	
Internal number	MINB631
Lecturer	Alle Dozenten
Scope	4.0 ECTS points, 4.0 Contact hours 120 Stunden gesamt, davon 60 Stunden Kontaktstudium.
Type/mode	Hands-on Experience
Language of instruction	German
Content	A student research project deals with a topic in the field of software or hardware. The aim is to carry out a practical task, but work in the areas of evaluation or literature research is also possible. Students analyse the task and research which tools are best suited to solve it. They then use these accordingly. Comprehensive documentation must be prepared for the project work, covering all steps of the task and its completion (e.g. the exact problem definition, the concept, the implementation, operating instructions and more). A joint colloquium concludes the project work. The students show their results in a short presentation and then take part in a discussion. The project work is thus a preparation for the later final thesis, which the students will write according to very similar guidelines.
Recommended reading	Depending on the task
Exams	Student Research Project 1 Semester (graded)
Comments	

Module Key Qualification	
Internal number	MINB640
Coordinator	Prof. Dr.-Ing. Holger Vogelsang
Scope	6.0 ECTS points, 6.0 Contact hours
Placement	6th Semester
Pre-requisites with regard to content	Language Competence
Pre-requisites according to the examination regulations	Modul Internship
Competences	On successful completion of the module, students will be able to - behave appropriately towards people from other cultures in relation to the increasing globalisation of their work, - understand statements made by these people, - understand simple legal issues and contracts, - present the results of their own work in the form of a specialised presentation.
Exams	Written Exam 120 Min. (graded)
Lecture Intercultural Communication	
Internal number	MINB641
Lecturer	Prof. Dr. Andrea Cnyrim
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	English
Content	Participants learn to understand intercultural competence as a strategic competitive factor and to organise their own actions in a culturally appropriate way: - Key aspects of intercultural communication (e.g. culturally determined norms, behaviours, values, verbal and non-verbal communication) with particular emphasis on differences between fact-oriented cultures such as Germany and relationship-oriented cultures such as China and India - Influence of different cultural standards on international business relationships (e.g. business initiation, negotiations, employee management, decision-making, conflict resolution, etc.) - Empirical studies (e.g. Geert Hofstede, Fons, Trompenaars etc.) - Case studies from different cultural areas (e.g. Germany, France, USA, Japan, China, India, etc.).
Recommended reading	
Exams	Verbal Exam 20 Min. (not graded)
Comments	
Lecture Law	
Internal number	MINB642.a

Lecturer	RA Karin Raab
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	- Introduction to the right - That "Bürgerliches Gesetzbuch” (BGB) - The "Handelsgesetzbuch” (HGB) - The judicial procedure
Recommended reading	
Exams	Module exam
Comments	

Lecture IT and media law

Internal number	MINB642.b
Lecturers	RA Jeremias Held RA Josua Neudeck
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	The lecture deals with legal issues in information technology and media law that students encounter in their everyday work. For example, students learn the basics of dealing with copyright-protected works, data, trademarks, designs or personal rights as well as the legally compliant design of websites, web shops and apps. - Basics of copyright law and the relevant industrial property rights - (IT) contract law - AI and data protection - Conclusion of contracts on the internet - General legal requirements for websites - Internet and email marketing - Legal relationships with apps - Special legal features of social media
Recommended reading	- PowerPoint-Folien zum Referat - Herzog, Recht für Designer, 2. Auflage 2022
Exams	Module exam
Comments	RA Josua Neudeck (https://www.vogel-partner.eu/team/josua-neudeck/) RA Jeremias Held (https://www.vogel-partner.eu/team/jeremias-held/)

Module Elective courses 2	
Internal number	MINB650
Coordinator	Prof. Dr.-Ing. Holger Vogelsang
Scope	6.0 ECTS points, 6.0 Contact hours
Placement	6th Semester
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	Modul Internship
Competences	The student should be able to lay his emphasis on individual interests.
Exams	Individual exams
Lecture Digital audio signal processing	
Internal number	EITB622A
Lecturer	Prof. Dr. Christian Langen
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	The course teaches the basics of digital signal processing in audio systems that are used in artistic and commercial applications. The first part of the course provides knowledge and skills for understanding basic concepts such as - periodic sampling of signals - reconstruction of sampled signals and aliasing - non-recursive and recursive systems - basic non-recursive filter algorithms are taught. In the second part, the basics of - recursive filters - Spectral analysis using discrete and fast Fourier transforms (DFT, FFT) - Adaptive filters for the suppression of noise and digital audio effects such as Compressor/limiter - ring and phase modulation (chorus, flanger) are discussed and implemented in real time using a consistent methodology for development and implementation using the C/C++ programming language. This serves to provide knowledge of classic digital signal processing algorithms and to deepen this knowledge through technical programming implementation. In addition to classic signal processing, these algorithms are used in the pre-processing of training and inference patterns for artificial intelligence, machine learning and neural networks. Other proposed topics such as and aspects of neural networks and artificial intelligence for noise cancellation using CUDA C/C++ in offline operation on a GPU server will be presented in the seminar.

Recommended reading	- Reay, Donald: Digital Signal Processing and Applications with the OMAP - L138 eXperimenter, Wiley, 2012 - J Welch, Thad: Real-Time Digital Signal Processing from MATLAB® to C with the TMS320C6x DSPs Second Generation, CRC Press, 2012 - Chassaing, Rulph: Digital Signal Processing and Applications with the C6713 and C6416 DSK, Wiley, 2005. Schuler, H.: Prozessführung, Oldenbourg, 1999 - Doblinger, Gerhard: Signalprozessoren: Architekturen, Algorithmen, Anwendungen, Schlembach, Weil der Stadt, 2004 - Dahnoun, Naim: DSP implementation using the TMS320C6000 DSP platform, Prentice Hall, Harlow, 2000 - Bateman, Andrew: The DSP handbook: algorithms, applications and design techniques, Prentice Hall, Harlow, 2002 - Kehtarnavaz, Nasser; Simsek, Burc: C6x-Based Digital Signal Processing, Prentice Hall, Upper Saddle River, NJ, 2000
Exams	Written Exam 90 Min. (graded)
Comments	

Lecture IoT Internet of Things - Use cases and algorithms	
Internal number	I W000x
Lecturer	Prof. Dr. Christine Preisach
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	
Recommended reading	
Exams	Verbal Exam 20 Min. (graded)
Comments	

Lecture HKA-APP	
Internal number	I W155
Lecturers	Prof. Dr. Manfred Seifert M.Sc. Daniel Weisser
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Hands-on Experience
Language of instruction	German

Content	HsKAmpus is intended to provide comprehensive functions for students of all faculties of the HsKA: - https://www.h-ka.de/hskampus/ - https://www.youtube.com/watch?v=OcyRZrwXzVM This primarily includes functions from the so-called. Online services based on the LSF server (events/schedule, facilities, people, student life), the QIS server (grade view) and other servers (canteen, KIT, KVV, ...). Other formats and functions are possible: - Creation or further development for Android, iOS, Windows, Web and our Broker/Server as well as the new Ersti-Hilfe - Provision in Google Play, Apple App Store, Microsoft Windows Store and as a web app - Marketing on various channels (website, FaceBook, Instagram, HsKA site, advertising material, ...) - User support - Communication at the university (campus day).
Recommended reading	http://www.hskampus.de https://www.facebook.com/hskampus https://www.instagram.com/hskampus/
Exams	Hands-on Work 1 Semester (graded)
Comments	

Lecture Graphical-geometric algorithms

Internal number	I W158
Lecturer	Prof. Dr. Christian Pape
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	
Recommended reading	
Exams	Written/verbal Exam 90/20 Min. (graded)
Comments	

Lecture Cyber espionage

Internal number	I W165
Lecturer	B.Sc. Florian Dalwigk
Scope	4.0 ECTS points, 4.0 Contact hours 120 Stunden gesamt, davon 60 Stunden Kontaktstudium.
Type/mode	Thesis
Language of instruction	German

Content	The students learn - the history of espionage and cyber espionage. - what is meant by hybrid warfare and which techniques are techniques used by intelligence services, among others. - how Germany's security architecture is organised. - know the legal aspects of cyber espionage. - know the espionage techniques used by intelligence and secret services. - how cyber attacks are attributed to specific actors and espionage groups (APTs). - what types of malware are used in the field of cyber espionage. - how threats in the context of cyber espionage can be technically detected and categorised/analysed using various frameworks. - know known cyber espionage cases from the past. - know technical possibilities for covert communication. Contents: - History of espionage and secret services - Security architecture in Germany (BND, MAD, BfV, LfV, ...) - Legal aspects of cyber espionage (Article 10 law, BNDG, BVerfSchG, § 99 StGB, ...) - Intelligence service espionage techniques - Operational security - Attribution procedures - Critical infrastructures - Advanced persistent threats - Hybrid warfare - Malware taxonomy - Social engineering - Stuxnet, SolarWinds, Pegasus, WannaCry, Krypto AG etc. - Threat intelligence - Covert communication - Threats from artificial intelligence Basic knowledge of ethical hacking is advantageous.
Recommended reading	- Huber, E. (2019). Cybercrime: Eine Einführung. Springer VS. - Oelmaier, F., Knebelsberger, U., & Naefe, A. (2023). Krisenfall Ransomware: Strategien für Wiederaufbau, Forensik und Kommunikation. Springer Fachmedien Wiesbaden.
Exams	Written Exam 90 Min. (graded)
Comments	

Lecture Augmented and virtual reality

Internal number	I W171
Lecturer	Prof. Dr. Matthias Wölfel
Scope	4.0 ECTS points, 4.0 Contact hours 120 Stunden gesamt, davon 60 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German

Content	
Recommended reading	
Exams	Written Exam 90 Min. (graded)
Comments	
Lecture ERP Special Chapters	
Internal number	I W182
Lecturer	Prof. Dr. rer. pol. Mathias Philipp
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	Enterprise analysis, software choice, system integration, basics of customizing, small development task in ABAP in addition to an ABAP introduction, optional: project office: integrated project and service processing with SAP ECC 6.0
Recommended reading	Lecture material completely as pdf documents, blackboard notes for interactive development of central problem positions, extensive material for every case study.
Exams	Written Exam 90 Min. (graded)
Comments	Lecture, workshops, lab: Case study based participation in group oriented workshops about enterprise analysis, presentation of group results, independent implementation of the analysis results of into SAP by appropriate system customizing in the lab. Independent treatment of another lab task (e.g., ABAP course, case study project office)
Lecture IT Security	
Internal number	I W210
Lecturers	Dipl. Inform. (FH) Georg Magschok Dipl. Inform. (FH) Michael Fischer
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	Technological and topological mechanisms for securingnetworks, attack patterns and defense mechanisms againstthem. Basics of, variants of and defense against maliciousssoftware. Analysis and judgement of security mechanismsand related activities. Excercies at the end of each semester provide practicalexperience in dealing with security topics.
Recommended reading	
Exams	Written Exam 90 Min. (graded)
Comments	Presentation with a lot of room for discussions andinteraction. Finalized by a hands-on session.
Lecture Robotics	

Internal number	I W233
Lecturer	Prof. Dr. Björn Hein
Scope	4.0 ECTS points, 4.0 Contact hours 120 Stunden gesamt, davon 60 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	
Recommended reading	
Exams	Written/verbal Exam 90/20 Min. (graded)
Comments	

Lecture Graphical User Interfaces

Internal number	I W332
Lecturer	Dipl.-Inf. Per Sterner
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	The lecture first deals with SWT/JFace and the Eclipse Rich Client Platform 4 (RCP), which uses SWT and JFace as its basis. The most important topics are the model-view-controller pattern, layout management and event handling using the observer pattern. Based upon this techniques advanced technologies like the separation of business logic and user interface code using data binding and dialog control are presented. Other topics are internationalization and multithreading in the context of user interfaces. The last part of the lecture shows the declarative construction of user interfaces and the application of the RCP framework.
Recommended reading	Books and Web sites: - Marc Teufel, "Eclipse 4", entwickler.press, Oktober 2012 - Lars Vogel, "Eclipse 4 Application Development", Mai 2012 - M. Marinilli, "Professional Java User Interfaces", Wiley & Sons, 2006 - R. Warner, R. Harris, "The Definite Guide to SWT and JFace", Apress, 2007 - M. Scarpino et.al., "SWT/JFace in Action", Manning Publications Co., 2005 - J. McAffer, J. M. Lemieux, "Eclipse Rich Client Platform", Addison-Wesley Longman (Pearson Education), 2010 - G. Wütherich, N. Hartmann, B. Kolb, M. Lübken, "Die OSGi Service Platform", dpunkt-Verlag, 2008 - http://www.ralfebert.de/rcpbuch/ - http://www.eclipse.org/swt/ - http://www.eclipse.org/articles/Article-UI-Guidelines/Index.html - http://www.eclipse.org/swt/snippets/ - http://wiki.eclipse.org/index.php/JFaceSnippets - http://www.java2s.com/
Exams	Written Exam 90 Min. (graded)

Comments	Lecture preparation, exam preparation, implementing the bonus exercise, 30% of the lecture is held as a computer exercise
Lecture IT Consulting	
Internal number	I W433
Lecturer	Prof. Dr. rer. pol. Mathias Philipp
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	First, students are given an overview of the international consulting market and learn the methodological principles of this industry as well as the main areas of work of IT consulting. Various approaches to strategy consulting, process consulting and IT system consulting are discussed, along with the respective consulting tools and methods.
Recommended reading	Lecture material completely as pdf documents, blackboard notes for interactive development of central problem positions, instructions for interactive role play and case study material
Exams	Written Exam 90 Min. (graded)
Comments	Participation lecture, development of an interactive role play in the group, individual execution of a short case study.
Lecture Embedded Software Laboratory	
Internal number	I W612
Lecturer	Prof. Dr. Dirk Hoffmann
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Laboratory Course
Language of instruction	German
Content	Students will be able to develop typical algorithms used in embedded systems in the C++ programming language. Students will develop a prototypical CDMA decoder that is able to extract the bits sent by GPS satellites from a composite signal.
Recommended reading	Software and hardware tools für designing automative ECUs
Exams	Laboratory Work 1 Semester (graded)
Comments	Practical work
Lecture Enterprise software from the cloud	
Internal number	I W779
Lecturer	Prof. Dr. Zoltán Nochta
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German

Content	
Recommended reading	
Exams	Written Exam 90 Min. (graded)
Comments	

Lecture Python frameworks

Internal number	I W800
Lecturer	Prof. Dr. Jürgen Zimmermann
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	Important frameworks for "classic" application development with Python are presented (WAS): - FastAPI: A modern micro-framework with 72,800 stars on GitHub to develop REST and GraphQL interfaces. - Flask: A popular micro-framework with 66,900 stars on GitHub for developing REST and GraphQL interfaces. - Django: A popular web framework with 75,000 stars on GitHub. In a smooth transition between lectures and exercises, an end-to-end example is provided for each framework (WOMIT), from the interface (REST, GraphQL) to the database (PostgreSQL, MySQL, SQLite). The object-relational mapping is implemented using SQLAlchemy. Furthermore, each example project is built as a Docker image and run as a container with Docker Compose. The examples are installed and explained together on the student notebooks with VS Code. During these guided exercises with finished and executable applications, the students are also familiarised with the necessary infrastructure for Python. This includes e.g: - a virtual environment with venv - a package manager with pip plus pyproject.toml - ASGI (Asynchronous Server Gateway Interface) with either uvicorn, hypercorn and daphne - Asynchronous integration tests with pytest and requests - Code analysis with mypy, pyright, pylint, flake8 and SonarQube as well as refurb - Security analysis with bandit and safety - Code formatting with black - Generation of API documentation with mkdocs with Material Design plus PlantUML for UML and ER diagrams - Load tests with locust As a result, students acquire the skills to weigh up the advantages and disadvantages of established Python frameworks against frameworks with Java or JavaScript, for example (WOZU).

Recommended reading	- FastAPI https://fastapi.tiangolo.com - Flask https://flask.palletsprojects.com - SQLAlchemy https://www.sqlalchemy.org - Strawberry https://strawberry.rocks - Pydantic https://github.com/pydantic/pydantic - Marshmallow https://marshmallow.readthedocs.io
Exams	Written Exam 90 Min. (graded)
Comments	

Lecture Sound design	
Internal number	I W801
Lecturer	B.Sc. Noah Ibers
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	This lecture introduces various concepts and areas of sound design. Besides technical basics to: - Sound theory and waves - Recording technology, storage and processing - sound synthesis creative applications of sound design like: - Audio processing - music and audio production - music theory - use and effect of sound in applications or films will also be thematized. The lecture teaches how professional soundscapes and moods can be created to achieve desired effects. The lecture is accompanied by exercises in which the knowledge is practically applied. The content of the assignments ranges from editing audio tracks, sound synthesis and scoring of film scenes to the development of sound brands.
Recommended reading	
Exams	Written Exam 60 Min. (graded)
Comments	

Lecture Business Process Management	
Internal number	I W854
Lecturer	Prof. Dr. Uwe Haneke

Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	Starting with clarifying the terminology of business process management, the lecture gives an introduction and analysis of various concepts for business process documentation and modeling. This includes a discussion of support through appropriate methodologies and software tools. Modern concepts such as process mining are also covered. Using different tools, business processes are documented and subsequently simulated as part of a case study. Finally, aspects of process quality assurance, performance evaluation, and process cost accounting are addressed. Students are enabled to independently handle processes in a business environment, including documentation, modeling, and analysis. Overview: - The concept of processes and types of processes - Methodologies in process management - Process analysis (documenting processes) - Process modeling (modifying processes) - Tools for process modeling - Process simulation - Process mining - Key performance indicators for evaluating business processes
Recommended reading	
Exams	Written Exam 90 Min. (graded)
Comments	

Lecture Databases Special Chapters

Internal number	I W907
Lecturer	M.Sc. Tobias Wink
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	
Recommended reading	
Exams	Written/verbal Exam 90/20 Min. (graded)
Comments	

Lecture SAP Certification

Internal number	I W908
Lecturers	Prof. Dr. rer. pol. Mathias Philipp M.Sc. Matthias Mruzek-Vering

Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	TERP10: SAP ERP - Integration of Business Processes is a 10-day training course held at the universities participating in the pilot project. The students learn how the fundamental integrative business processes in procurement, production, planning, project management, sales, customer service, asset management, financial accounting, human resources, and analytics interact within the SAP ERP application. The course provides students with a broad basic knowledge of the core business processes, business interrelations, and integration of business processes in SAP ERP. At the end of the course, students take a certification examination. If they pass the examination, they receive an SAP certificate, which is a fully recognized qualification in the industry.
Recommended reading	cource book
Exams	Written Exam 90 Min. (graded)
Comments	10-day training: in the moring: theory in the evening: laboratory last day: SAP certification 3 hours multiple chioce and multiple responce questions
Lecture Serious Games	
Internal number	I W910
Lecturer	Prof. Daniel Schwarz
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	
Recommended reading	
Exams	Written Exam 90 Min. (graded)
Comments	
Lecture Model-based Software Development	
Internal number	I W911
Lecturer	Prof. Dr. Martin Sulzmann
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German

Content	Formal Modelling Languages Synchronous languages (Lustre/SCADE) Temporal Specifications (LTL) Domain-specific Extensions Textual versus visual modelling Modeltransformation via internal DSLs Modelling guide lines Formal testing and verification Coverage criteria Testcasegeneration Static analysis and model-checking
Recommended reading	- lectures notes and slides - exercies - online references
Exams	Written Exam 90 Min. (graded)
Comments	Prerequisistes: - UML Basics - C++, - Logic (propsitional), - Lexer, Parser, EBNF (Compiler basics) Mix of lecture (2/3) and practical exercies/project work (1/3)

Lecture Mobile communication	
Internal number	I W914
Lecturer	Prof. Dr. Oliver Waldhorst
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German

Content	In this course, students learn about the basic principles and technologies of mobile communication systems. After completing the course, they will be able to describe problems of mobile networks such as wireless signal transmission, media access and mobility management, identify and apply solution modules to solve these problems and evaluate existing solutions. They will also be able to analyze the characteristics and applications of various wireless systems such as WLAN, Bluetooth, mobile radio technologies (e.g. GSM, UMTS, LTE, 5G) and their underlying protocols and architectures. The lecture covers the following topics: - Basics of mobile communication: wireless signal transmission, multiplexing techniques, band spreading, OFDM, MIMO and multipath propagation. - Media access: methods such as Aloha, Carrier Sense Multiple Access (CSMA) and time-slot-based protocols. - Mobility management: position management, handover and routing in mobile networks. - Technologies and standards: WLAN (IEEE 802.11), Bluetooth, mobile networks (GSM, UMTS, LTE, 5G). The course is held in a flipped classroom format. Students prepare for the live sessions independently using lecture slides and explanatory videos. In the classroom sessions, the content is deepened through case studies and practical exercises. The examination consists of an oral examination or a written exam, depending on the agreement. The total workload is 60 hours, of which 20 hours are spent on asynchronous learning, 20 hours on face-to-face events and 20 hours on exam preparation.
Recommended reading	- Slide collection and explanatory videos in the ILIAS system - Jochen Schiller, Mobile Communication. Pearson Studium, 2003. - Martin Sauter, Grundkurs Mobile Kommunikationssysteme, 8th edition, 2022 (available as an e-book via the KIT library) - Further information in ILIAS and in the lecture
Exams	Verbal Exam 20 Min. (graded)
Comments	
Lecture Concept, Design und Presentation of interactive Projects	
Internal number	I W915
Lecturer	Prof. Thomas Hinz
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	
Recommended reading	
Exams	Homework 1 Semester (graded)
Comments	
Lecture CC Operation	
Internal number	I W917

Lecturer	Dr. Günther Schreiner
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	
Recommended reading	
Exams	Written Exam 90 Min. (graded)
Comments	
Lecture In-memory Databases	
Internal number	I W920
Lecturer	Prof. Dr. Zoltán Nochta
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	
Recommended reading	
Exams	Written Exam 90 Min. (graded)
Comments	
Lecture Planning and optimisation with evolutionary methods	
Internal number	I W927
Lecturer	Dr.-Ing. Wilfried Jakob
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	
Recommended reading	
Exams	Written Exam 90 Min. (graded)
Comments	
Lecture Predictive Modelling and Machine Learning	
Internal number	I W928
Lecturer	Prof. Dr. Martin Sulzmann
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	English
Content	

Recommended reading	
Exams	Written Exam 90 Min. (graded)
Comments	

Lecture Microservices

Internal number	I W930
Lecturer	Prof. Dr. Jürgen Zimmermann
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	Students learn in a practical way about the architectural principle of microservices, which have established themselves alongside conventional, cumbersome application servers. Using a consistent example, microservices are developed with the following platform: - Kubernetes (incl. Helm) and Docker images for virtualisation, orchestration, service registry, etc. The products Docker Desktop Community and Lens are used as administration tools. - Spring Boot as a framework to implement microservices with REST and also GraphQL as an interface. - Spring Data JPA to access relational database systems with Hibernate and the Jakarta Persistence standard. - PostgreSQL, MySQL and Oracle XE are used as relational database systems with the administration tools pgadmin, phpMyAdmin and SQL Developer and are all installed and operated in Kubernetes. - IntelliJ IDEA Ultimate is used as the IDE. For IntelliJ IDEA Ultimate - and other JetBrains products - HKA students have been able to obtain a free licence, valid for 1 year, on the initiative of the lecturer since 2014. - Gradle with Cloud Native Buildpacks is used as a build system. As a result, students acquire the skills to weigh up the advantages and disadvantages of microservices against monolithic architectures (WOZU).
Recommended reading	"Spring Framework Documentation", https://docs.spring.io/spring/docs/current/spring-framework-reference "Spring Boot Reference Guide", https://docs.spring.io/spring-boot/docs/current/reference/htmlsingle "Spring GraphQL Reference", https://docs.spring.io/spring-graphql/docs/1.0.0-M2/reference/html "Spring Data JPA", https://docs.spring.io/spring-data/jpa/docs/current/reference Docker, https://www.docker.com/why-docker Kubernetes, https://kubernetes.io/docs
Exams	Written Exam 90 Min. (graded)
Comments	

Lecture App Programming for iOS

Internal number	I W931
Lecturer	B.Sc. David von Knobelsdorff

Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Thesis
Language of instruction	German
Content	
Recommended reading	
Exams	Written Exam 90 Min. (graded)
Comments	
Lecture Modern server applications and web apps with TypeScript	
Internal number	I W934
Lecturer	Prof. Dr. Jürgen Zimmermann
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	
Recommended reading	
Exams	Written Exam 90 Min. (graded)
Comments	
Lecture Microtechnology Laboratory	
Internal number	I W935
Lecturer	Prof. Dr. rer. nat. Oliver Schecker
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Laboratory Course
Language of instruction	German
Content	Development of applications with a microtechnology focus. Examples include autonomous micro airships, self-monitored first aid kits, energy self-sufficient door signs, components of the "High Speed Karlsruhe" racing car if the student is involved in this project (https://www.highspeed-karlsruhe.de/).
Recommended reading	
Exams	Hands-on Work 1 Semester (not graded)
Comments	
Lecture Data protection according to GDPR	
Internal number	WIB179
Lecturer	Prof. Dr. Ingo Stengel
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture

Language of instruction	German
Content	
Recommended reading	
Exams	Written Exam 90 Min. (graded)
Comments	

Module Elective courses 3	
Internal number	MINB710
Coordinator	Prof. Dr.-Ing. Holger Vogelsang
Scope	8.0 ECTS points, 8.0 Contact hours
Placement	7th Semester
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	Modul Internship
Competences	The student should be able to lay his emphasis on individual interests.
Exams	Individual exams
Lecture Embedded Firmware for the Internet of Things	
Internal number	I W161
Lecturer	M.Sc. Nils Ruf
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	The Internet of Things (IoT) networks a large number of sensors and actuators in the private smart home sector as well as in the industrial environment. The end devices only have very limited resources in terms of computing power, memory size and energy budget. Nevertheless, the end devices must be able to fulfil their task in a timely and reliable manner without becoming a target for cyber attacks. This course provides an overview of the special requirements for software development for embedded, networked systems in order to be able to operate them in an energy-efficient manner and with limited resources. Topics covered include memory management, multitasking and scheduling, access to hardware and peripherals, various bus protocols, connectivity and security aspects. These topics are deepened practically in a laboratory and the students will implement the knowledge they have learnt in an example project.
Recommended reading	
Exams	Written Exam 90 Min. (graded)
Comments	
Lecture Practical application of network engineering and system operations	
Internal number	I W162
Lecturer	B.Sc Erik Dyka
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture

Language of instruction	German
Content	In the course "Practical Application of Network Engineering and System Operations", students acquire practical skills in the planning, configuration and implementation of company networks. They learn to create network concepts, apply subnetting and configure switches with VLANs and redundant connections. In addition, basic firewall settings are made with PfSense, including security policies such as DMZ, NAT and zero trust principles. Another focus is on setting up NAS systems with suitable RAID levels and creating highly available storage and Proxmox clusters. The students deploy virtual machines and simulate system failures. In the final project, they develop a complete network and hosting concept for a practical scenario, implementing redundancy, VPN access and encrypted communication. At the end of the course, students will be able to plan, set up and operate company networks securely. After successfully completing this module, students will be able to - Set up and configure a network: Design, plan and set up a small business network. Identify network components such as switches, firewalls and routers and explain their tasks in the OSI model. Create a network concept and carry out correct subnetting. Configure VLANs (access, tagged and trunk ports) and set up redundant connections between switches. - System configuration: Configure a switch via console cable or SSH and make basic VLAN settings. Install and configure a PfSense firewall (WAN/LAN ports, DNS, DHCP). Set up firewall rules for network security (DMZ, default no-access, zero trust, microsegmentation, NAT, port forwarding). Implement the combination of switches and firewalls to realise a secure network. - Server and storage clusters: Configure NAS systems with appropriate RAID levels and set up file shares. Set up and administer high-availability storage clusters. Install and configure Proxmox clusters and deploy virtual machines (VMs). Perform live migrations between cluster nodes and simulate system failures. - Practical network planning and operation: Design an enterprise network for 24/7 operation and overcome the challenges of continuous operation. Identify and eliminate sources of error such as single points of failure. Plan and implement network segmentation and cabling strategies for different use cases. - Final project - realisation of a scenario: Develop a network and hosting concept for a specific scenario (e.g. corporate network). Implement VPN solutions for different user groups. Consistently implement security guidelines such as "default no access" and encrypted communication. Create and partially implement a concept for fail-safe and redundant networks.

Recommended reading	Lecture notes KN1+2
Exams	Laboratory Work 1 Semester (graded)
Comments	Prerequisites: - Successful completion of KN1 - KN2 content is a prerequisite - Creation of a boot stick and independent installation of a computer with a Linux distribution
Lecture Game Design	
Internal number	I W163
Lecturer	M.Sc. Kevin Torner
Scope	4.0 ECTS points, 4.0 Contact hours 120 Stunden gesamt, davon 60 Stunden Kontaktstudium.
Type/mode	Hands-on Experience
Language of instruction	German
Content	This course will give you an insight into the multifaceted world of game design. You will deal with fundamental questions such as the definition of a game, the constituent elements of a game and what actually constitutes fun. The aim of the course is to provide you with basic tools to help you analyze and design games.
Recommended reading	- Jesse Schell, "The Art of Game Design: A book of lenses", CRC Press. 1st edition, 2008. - Ernest Adams, Joris Dormans, "Game Mechanics: Advanced Game Design", New Riders Publishing, 1st edition, 2012. - Raph Koster, "Theory of Fun for Game Design", O'Reilly Media, 2nd edition, 2013.
Exams	Homework 1 Semester (graded)
Comments	
Lecture Leadership Training	
Internal number	I W170
Lecturers	Dipl. Inform. Klaus-Dieter Hüttel Prof. Dr. rer. pol. Mathias Philipp
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Project Lecture
Language of instruction	German
Content	Boundary conditions and expectations of communication are developed in intense discussion. Strategies and tactics for discussions and the management of critical situations are trained.
Recommended reading	Blackboard and whiteboard-poster
Exams	Module exam
Comments	Seminary lecture, block course after the end of the term
Lecture Search Engines	

Internal number	I W393
Lecturer	B.Sc. Michael Siebers
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	
Recommended reading	
Exams	Concept 1 Semester (graded)
Comments	

Lecture Artificial intelligence in cyber security

Internal number	I W506
Lecturer	B.Sc. Florian Dalwigk
Scope	4.0 ECTS points, 4.0 Contact hours 120 Stunden gesamt, davon 60 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	The students - can categorise terms such as LLMs, ML, DL, NN etc. in an overall context. - understand how LLMs work and where they can (not) be used. - learn how to generate and detect deep fakes. - can develop small scripts to address LLM APIs (online and local) and model attacks and defence strategies based on them. - are familiar with various attacks on LLMs/LLM applications and can carry them out independently. - can confidently apply various prompt engineering techniques to practical problems. Contents: - Basics of cyber security - Basics of generative AI - Generating and detecting deep fakes - Local language models, ChatGPT - ShellGPT - OWASP Top 10 for LLM Applications - LLM exploits (Art-Prompt, Grandma-Exploit, ...) - Social engineering with AI - Cyber defence with AI - Prompt engineering
Recommended reading	Florian Dalwigk, "Hacking and cybersecurity with AI" (will be provided as script)
Exams	Written/verbal Exam/Hands-on Work 90/20/1 Min./Min./Semester (graded)
Comments	Prerequisites: Basic knowledge of programming (preferably Python), basic knowledge of network technology

Lecture Ethical hacking

Internal number	I W507
Lecturer	B.Sc. Florian Dalwigk
Scope	4.0 ECTS points, 4.0 Contact hours 120 Stunden gesamt, davon 60 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	The students - understand the legal and ethical problems associated with ethical hacking, - learn how to set up their own pentest lab with Kali Linux and VirtualBox, - can identify and exploit security vulnerabilities in web applications and servers, - are able to develop simple scripts to identify and exploit vulnerabilities, - learn how to carry out cyber attacks with AI, - learn how to summarise the vulnerabilities found in a pentest report. Content: - Legal and ethical basics of ethical hacking - Cyber kill chain - Pentesting tools, including Hashcat, Hydra, Gobuster and Nmap - Reverse shells - Secure saving and cracking of passwords - XSS, SQL injections, buffer overflows - OWASP Top 10 - Social engineering - Metasploit - The role of AI in cyber security - Pentest reports
Recommended reading	Florian Dalwigk, "Ethical Hacking - The big book on hacking with Python" (provided as script)
Exams	Written/verbal Exam/Hands-on Work 90/20/1 Min./Min./Semester (graded)
Comments	
Lecture Post-quantum cryptography	
Internal number	I W508
Lecturer	B.Sc. Florian Dalwigk
Scope	4.0 ECTS points, 4.0 Contact hours 120 Stunden gesamt, davon 60 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	
Recommended reading	
Exams	Written Exam 90 Min. (graded)
Comments	
Lecture External selected chapter 1	
Internal number	I W600

Lecturer	Prof. Dr.-Ing. Holger Vogelsang
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	This course is a placeholder for an external, graded course from another faculty or university. You must have the external subject approved before attending it.
Recommended reading	
Exams	Written Exam 90 Min. (graded)
Comments	
Lecture InspirING	
Internal number	I W600.a
Lecturer	Prof. Dr.-Ing. Holger Vogelsang
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Hands-on Experience
Language of instruction	German
Content	
Recommended reading	
Exams	Verbal Exam 20 Min. (graded)
Comments	
Lecture External selected chapter 2	
Internal number	I W700
Lecturer	Prof. Dr.-Ing. Holger Vogelsang
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	This course is a placeholder for an external, graded course from another faculty or university. You must have the external subject approved before attending it.
Recommended reading	
Exams	Written Exam 90 Min. (not graded)
Comments	
Lecture Reinforcement Learning	
Internal number	I W775
Lecturer	Prof. Dr. Patrick Baier
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture

Language of instruction	German
Content	
Recommended reading	
Exams	Written/verbal Exam 90/20 Min. (graded)
Comments	
Lecture Social commitment	
Internal number	I W776
Lecturer	Prof. Dr.-Ing. Holger Vogelsang
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Hands-on Experience
Language of instruction	German

Content	This course enables students to obtain ECTS credits for social work done at Karlsruhe University of Applied Sciences. The activity must be closely coordinated with a professor of the faculty. This can be, for example, support for the O-Phase or support for visually impaired students. In the case of the O-Phase, you will usually have to work on two semesters in order to achieve the required minimum number of hours. If you are interested, you can also obtain the "Certificate of International and Intercultural Competence (CIIC)". It certifies the intercultural competences and foreign language skills acquired during the degree programme, provides evidence of study-related experiences abroad and lists the framework in which the participants have been involved in intercultural activities. To earn the CIIC, you must cover three of four subject areas. The main component in subject area 1 is the voluntary commitment of at least 50 hours (about 2 hours per week in one semester), which can be completed in institutions or projects with an international and/or intercultural connection. In addition to the commitment, you will attend an introductory event as well as a reflection workshop and prepare an experience report, which is necessary to pass the subject area. If you have any questions about the certificate, please contact the Center of Competence: https://www.h-ka.de/ciic Through the Center of Competence, it is also possible to obtain the "Certificate for Social Engagement (ZGE)". It takes into account an even wider range of opportunities to get involved. Find your suitable area, whether it is community, social, cultural or ecological engagement. Your social engagement should comprise at least 100 time hours and last for at least one year. In addition to your commitment, you will attend various seminars from the Studium Generale (a total of 8 ECTS) to link your practical experience with theoretical knowledge. This certificate cannot be recognised as an elective subject. You can find more information here: https://www.h-ka.de/zge At regular intervals, the Center of Competence offers introductory events and reflection workshops for HKA students who are involved in voluntary work outside of their studies. This gives them the opportunity to exchange their experiences as volunteers with other participants and learn to reflect on and classify the insights they have gained. The next dates can be found on the CIIC website.
Recommended reading	
Exams	Verbal Exam 20 Min. (not graded)
Comments	

Lecture Real-time graphics

Internal number	I W777
Lecturer	B.Sc. Tim Hänlein
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture

Language of instruction	German
Content	
Recommended reading	
Exams	Hands-on Work 1 Semester (graded)
Comments	
Lecture Seminar Digital Twin	
Internal number	I W778
Lecturer	Prof. Dr.-Ing. Holger Vogelsang
Scope	4.0 ECTS points, 4.0 Contact hours 120 Stunden gesamt, davon 60 Stunden Kontaktstudium.
Type/mode	Seminar
Language of instruction	German
Content	
Recommended reading	
Exams	Written Exam 60 Min. (graded)
Comments	
Lecture High Speed Karlsruhe	
Internal number	I W936
Lecturer	Prof. Dr.-Ing. Holger Vogelsang
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Hands-on Experience
Language of instruction	German
Content	Collaboration on the "High Speed Karlsruhe" project in the MMT faculty. If you are interested, please contact Mr Stumpf: oliver.stumpf@h-ka.de
Recommended reading	http://www.hskampus.de https://www.facebook.com/hskampus https://www.instagram.com/hskampus/
Exams	Hands-on Work 1 Semester (graded)
Comments	
Lecture Softwareengineering Special Chapters	
Internal number	MINB01
Lecturer	Prof. Dr. Peter Henning
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Seminar
Language of instruction	German

Content	The course focuses on fundamental object-oriented design methods with an emphasis on design patterns and model driven concepts. The students learn to recognize, to know when to use, and to apply design patterns in varying situations in the context of an evolutionary development process. Furthermore the ability of an axiomatic rule base application of patterns, within a model driven approach, are discussed.
Recommended reading	Slides, textbooks, and other literature: Folien-Skript, Lehrbücher: - Gamma, Erich et. al. Entwurfsmuster: Elemente wiederverwendbarer objektorientierter Software - München : Addison-Wesley, 2001. - Buschmann, Frank. A system of patterns (Pattern-Oriented Software Architecture Volume 1) - John Wiley & Sons. 1996. - Schmidt, Douglas C. Patterns for concurrent and networked objects (Pattern-Oriented Software Architecture Volume 2) - John Wiley & Sons. 2000. - Michael Kircher, Prashant Jain. Patterns for Resource Management (Pattern-Oriented Software Architecture Volume 3) - John Wiley & Sons. 2004. - Frank Buschmann, Kevlin Henney, Douglas C. Schmidt. A Pattern Language for Distributed Computing (Pattern-Oriented Software Architecture Volume 4) - John Wiley & Sons. 2007. - Frank Buschmann, Kevlin Henney, Douglas C. Schmidt. On Patterns and Pattern Languages (Pattern-Oriented Software Architecture Volume 5) - John Wiley & Sons. 2007. - Fowler, Martin. Analysemuster: wiederverwendbare Objektmodelle: Ein Pattern-Katalog für Business-Anwendungen - Addison-Wesley-Longman. 1999. - OMG Object Management Group. Meta Object Facility (MOF) Specification - Version 2.4.1: OMG, 2011.
Exams	Presentation 20 Min. (graded)
Comments	The lecture will take the form of seminars with exercises.

Lecture High Performance Computing

Internal number	MINB09
Lecturer	Prof. Dr. Britta Nestler
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	
Recommended reading	
Exams	Written/verbal Exam 90/20 Min. (graded)
Comments	

Lecture ABAP Programming

Internal number	MINB18
Lecturers	B.Sc. Stefan Schorn Prof. Dr. rer. pol. Mathias Philipp

Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	Introduction to the ABAP programming language with practical exercises in SAP NetWeaver Application Server ABAP. Students should familiarise themselves with language elements, workbench, database, selection screens, function modules and ABAP OO and be able to apply them independently to new problems.
Recommended reading	- Lecture material completely in PowerPoint slides - Blackboard notes for interactive development of core problems - Exercise sheets and independent practical exercises on the SAP system
Exams	Written Exam 90 Min. (graded)
Comments	

Lecture Project Management

Internal number	MINB22
Lecturer	Prof. Dr. Uwe Haneke
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Project Lecture
Language of instruction	German
Content	The lecture focuses mainly on practice oriented project management and new procedure models like Scrum. - Introduction to IT project management - Procedure models in IT project management - Defining a project - The project plan: the heart of the project - Getting started: Initialisation of the project - Project controlling - The final words: how to complete a project
Recommended reading	
Exams	Verbal Exam 20 Min. (graded)
Comments	

Lecture Game AI

Internal number	MINB23
Lecturers	Dr. Patrick Glauner Prof. Dr.-Ing. Astrid Laubenheimer
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	English
Content	

Recommended reading	
Exams	Written Exam 90 Min. (graded)
Comments	

Lecture Teamteaching

Internal number	MINB30
Lecturers	Alle Dozenten Prof. Dr.-Ing. Holger Vogelsang
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Project Lecture
Language of instruction	German
Content	
Recommended reading	
Exams	Verbal Exam 20 Min. (graded)
Comments	- Preparation of a tutorial, support of student groups - Organisation of events

Lecture Multimedia (Blended Learning)

Internal number	MINB75
Lecturer	Prof. Dr. Peter Henning
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Project Lecture
Language of instruction	German
Content	
Recommended reading	Book: Henning, Taschenbuch Multimedia.
Exams	Online Test 4 Parts (graded)
Comments	

Lecture Autonomous Systems Labor

Internal number	MINB76
Lecturers	M.Sc. Mickael Cormier Prof. Dr. Norbert Link
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Project Lecture
Language of instruction	German

Content	Project 1: Implementation of an image-processing-based handling system, which performs transport activities on the basis of information extracted from a digital video camera Project 2: Implementation of the core functionality of an aircraft docking guidance system, which directs aircraft to their respective stopping position at the airport gate Project 3: Autonomous navigation, obstacle avoidance and object following with robots
Recommended reading	Lecture notes, task descriptions, project guidelines and FAQs, all accessible via the internet. Handbooks and relevant literature is available on site and for homework in the library.
Exams	Laboratory Work 1 Week (graded)
Comments	Theoretical familiarisation, practical work, reporting, partly as self-responsible work
Lecture Software Quality	
Internal number	MINB92
Lecturer	Prof. Dr. Dirk Hoffmann
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	Students gain practical access to the field of software quality assurance. They work on a specific chapter from the field of software quality assurance and present their results to the other students in a series of short presentations. The participants then discuss the results.
Recommended reading	Hoffmann: "Software-Qualität", Springer-Verlag, 2013
Exams	Presentation 20 Min. (graded)
Comments	Lecture, student presentations
Lecture Smart Technologies	
Internal number	SHELLSST
Lecturer	Prof. Dr.-Ing. Holger Vogelsang
Scope	5.0 ECTS points, 4.0 Contact hours 150 Stunden gesamt, davon 60 Stunden Kontaktstudium.
Type/mode	Project Lecture
Language of instruction	German
Content	
Recommended reading	
Exams	Student Research Project 1 Semester (graded)
Comments	

Module Scientific Working	
Internal number	MINB720
Coordinator	Prof. Dr. Heiko Körner
Scope	5.0 ECTS points, 2.0 Contact hours
Placement	7th Semester
Pre-requisites with regard to content	Student Research Project, Key Qualification
Pre-requisites according to the examination regulations	Modul Internship
Competences	This module enables students to apply the basic principles of research in computer science in a method-based manner. They can evaluate scientific literature to use it in their own work. They are then able to write their own scientific papers.
Exams	Individual exams

Lecture Scientific Working	
Internal number	MINB721
Lecturer	Alle Dozenten
Scope	5.0 ECTS points, 2.0 Contact hours 150 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Hands-on Experience
Language of instruction	German
Content	Students work independently on a practical problem using scientific and practical methods. Topics include the independent development of the methodology, the topic and the exact problem as well as the structure of the paper and the creation of a bibliography. The results are discussed and presented with the lecturers. The students thus learn the procedure for writing the final Bachelor's thesis.
Recommended reading	- Documents on the process, the structure of a paper and citation - Peter Rechenberg, Gustav Pomberger: Informatik-Handbuch. Hanser Fachbuch, 2006, ISBN 3446218424 - Jürg Niederhauser: Die schriftliche Arbeit - kurz gefasst. Bibliographisches Institut, Mannheim, 2006, ISBN 3411042346
Exams	Exercise 1 Month (not graded)
Comments	

Module Thesis	
Internal number	MINB730
Coordinator	Prof. Dr. Heiko Körner
Scope	12.0 ECTS points, 0.0 Contact hours
Placement	7th Semester
Pre-requisites with regard to content	Final Examination, System Software, Business Administration and IT Service Management, Computer Graphics and Computer Vision, Databases and Communication Networks 1, Databases and Communication Networks 2, Computer Science 1, Computer Science 2, Interfacedesign, Cognitive human-machine interaction, Mathematics 1, Mathematics 2, Media Design, Media Project, Embedded Software, Computer Engineering, Internship, Internship Preparation and Roundup, Student Research Project, Key Qualification, IT Security, Software Engineering and Distributed Systems 2, Software Project, Language Competence, Scientific Working
Pre-requisites according to the examination regulations	Modul Internship
Competences	After successfully completing this module, students are able to independently solve a practical problem or research task using scientific methods within a specified period of time. They can structure the task, check dependencies, collect the necessary resources and then work on the task using a specially derived schedule. They can present the written results in an appealing form.
Exams	Individual exams

Lecture Thesis	
Internal number	MINB731
Lecturer	Alle Professoren
Scope	12.0 ECTS points, 0.0 Contact hours 360 Stunden gesamt, davon 0 Stunden Kontaktstudium.
Type/mode	Thesis
Language of instruction	German
Content	In the final thesis, students work independently on a practical problem or research task within a specified period of time using scientific methods. They structure the task, check dependencies, collect the necessary resources and work on the problem according to a timetable. The written thesis summarises the results in a didactically meaningful way and meets academic standards.
Recommended reading	Suitable for the task as agreed
Exams	Bachelor Thesis 4 Months (graded)
Comments	

Module Final Examination	
Internal number	MINB740
Coordinator	Prof. Dr. Heiko Körner
Scope	3.0 ECTS points, 0.0 Contact hours
Placement	7th Semester
Pre-requisites with regard to content	Thesis, System Software, Business Administration and IT Service Management, Computer Graphics and Computer Vision, Databases and Communication Networks 1, Databases and Communication Networks 2, IT Security, Computer Science 1, Computer Science 2, Interfacedesign, Cognitive human-machine interaction, Mathematics 1, Mathematics 2, Media Design, Media Project, Embedded Software, Computer Engineering, Internship, Internship Preparation and Roundup, Student Research Project, Key Qualification, Software Engineering and Distributed Systems 2, Software Project, Language Competence, Scientific Working
Pre-requisites according to the examination regulations	Modul Internship
Competences	Participation in this module enables students to convincingly present the results achieved within a specialised, application-related thesis to an expert audience. They can analyse the content of such work, select the key aspects and present these in a didactically appropriate short presentation. In a subsequent discussion, they are also able to defend their results.
Exams	Individual exams
Lecture Final examination	
Internal number	MINB741
Lecturer	Alle Professoren
Scope	3.0 ECTS points, 0.0 Contact hours 90 Stunden gesamt, davon 0 Stunden Kontaktstudium.
Type/mode	Colloquium
Language of instruction	German
Content	The final examination covers all topics relevant to computer science in the main study programme. Students demonstrate that they have understood and can apply interdisciplinary contexts. They answer questions from various areas of computer science and media that are related to their final thesis. With the final examination, they demonstrate that they have the competence to work independently on novel problems in computer science and media, defend them in a technically sound manner in front of an appropriate audience and can also provide them for further work.
Recommended reading	
Exams	Verbal Exam 20 Min. (not graded)
Comments	