Hochschule Karlsruhe

Faculty for Computer Science and Business Information Systems

Module manual

Course of studies Computer Science (Bachelor), ER 7

Summer semester 2025

Module Computer Science (Bachelor), ER 7

Module Computer Science 1

Internal number	INFB1107
Coordinator	Prof. Dr. Carsten Sinz
Scope	12.0 ECTS points, 10.0 Contact hours
Placement	1st Semester
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	none
Competences	The courses of this module teach the students fundamental programming and algorithmic skills. The students should be enabled to analyze small problems, find solutions to these problems, and develop them in the Java programming language.
Exams	Written Exam 120 Min. (graded)

Lecture Computer Science 1

Internal number	INFB1117.a
Lecturer	Prof. Dr. Carsten Sinz
Scope	5.0 ECTS points, 4.0 Contact hours 150 Stunden gesamt, davon 60 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	With weekly exercises the students deepen the practical contents of the lecture on the computer. They use an integrated Java development environment to create, test and modify programs. In the following exercises the students program simple calculations with Java using variables, expressions and control structures. This also includes graphical data processing tasks. Later, the students develop object-oriented programs on the computer. In the end, they solve recursive problems and implement solution strategies with the help of backtracking.
Recommended reading	Selected exercises with solutions, slides in PDF format, Java programs and their documentation as Javadoc. Supplementary Java exercises with solutions to deepen the programming skills.
Exams	Module exam
Comments	Lecture participation. Solving simple exercises in the lecture with teacher support.

Lecture Theoretical Computer Science 1

Internal number	INFB1117.b
Lecturer	Prof. Dr. Heiko Körner

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 course introduces the theory of formal languages and focusses on regular and context-free languages. The course first consolidates the basics of propositional logic, set theory, the O-calculus and elementary proof techniques. Then the classical areas of theoretical computer science such as finite automata and their minimisation, regular expressions, the Chomsky hierarchy, the pumping lemma for regular and context-free languages as well as associated decision algorithms are covered. Push down automata, normal forms and closure properties are also discussed. The aim is to develop an understanding of the basic computational power of classical computer models with limited memory capacity.
Recommended reading	The substance of the lecture will be discussed at the blackboard. Lecture notes containing the complete material are also available. Furthermore, there are sample solutions to all exercises. Literature: D. W. Hoffmann: Theoretische Informatik, 3. Auflage. Hanser, 2015. 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 Laboratory

Internal number	INFB1127
Lecturer	Prof. Dr. Carsten Sinz
Scope	3.0 ECTS points, 2.0 Contact hours 90 Stunden gesamt, davon 30 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 Computer Engineering 1

Internal number	INFB1207
Coordinator	Prof. Dr. Dirk Hoffmann
Scope	5.0 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	Students learn the basic concepts of computer engineering. They acquire the mathematical concepts of number representation and Boolean algebra, which are necessary for the analysis and design of hardware circuits. They learn how the common basic elements of digital technology are constructed and how these can be combined into complex combinational and sequential circuits. Furthermore, students will be able to explain the structure and functioning of common standard circuits, such as adders or shift registers. They will understand the basic concepts of the instruction set architecture of a processor and will be able to create simple assembly programs for a rudimentary model processor.
Exams	Individual exams

Lecture Computer Engineering 1

Internal number	INFB1217
Lecturer	Prof. Dr. Dirk Hoffmann
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 basic knowledge in the field of logic and circuit design. They learn how the functionality of a computer can be broken down into elementary operations, which are then physically realized in the form of logic gates. Students recognize how the desired functional components are designed from these, which require a minimum number of gates. This lays the foundation for corresponding CAE systems. The following topics are covered in detail: basic functioning of a computer; knowledge of the basic logical circuit blocks; technologies for realizing the basic components; knowledge of the most important electrical parameters; number and character representation in different codes; basics of Boolean algebra; methods of simplifying Boolean expressions; use of CAE software; designing combinational circuits; designing sequential circuits; designing synchronous circuits; flip-flops; counters and registers.
Recommended reading	Slides, blackboard, exercise sheets
Exams	Written Exam 120 Min. (graded)

Comments	Lecture

Lecture Computer Engineering 1 Laboratory

Internal number	INFB1227
Lecturer	Prof. Dr. Dirk Hoffmann
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Exercise
Language of instruction	German
Content	Alongside the lecture, students work through several exercises. The tasks come from the areas of number representation, Boolean algebra, circuit design and minimization, standard circuits and microcomputer architecture.
Recommended reading	Exercise sheets, blackbord
Exams	Exercise 1 Semester (not graded)
Comments	In-class exercises

Lecture Computer Engineering 1 Laboratory

Module Mathematics 1	
Internal number	INFB1307
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	INFB1317
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	he 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, Tutorials given by students, 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	INFB1327
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. Additionally we will look at functions, which can be represented by matrices.
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	INFB1407
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 Foreign Languages

Internal number	INFB1417
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 120 Min. (graded)
Comments	Lecture participation, short talks, discussions

Module Computer Science 2

Internal number	INFB2107
Coordinator	Prof. Dr. Christian Pape
Scope	9.0 ECTS points, 8.0 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	INFB2117
Lecturer	Prof. Dr. Christian Pape
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 lecture is divided into several parts building on one another: - 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. - 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. - 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. - 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. - 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 120 Min. (graded)
Comments	Weekly exercises for reviewing lecture content and for exam preparation. Simple tasks in the lecture.

Lecture Theoretical Computer Science 2

Internal number	INFB2127
Lecturer	Prof. Dr. Heiko Körner
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 conveys the limits of the computational power of today's computers, which occur even with a potentially infinite amount of available memory. The main topics are the computability and undecidability of various problems. An introduction to the theory of intractable problems is also given.
	Students are taught the following areas of theoretical computer science: elementary computational models such as Turing machines and WHILE programmes, the Church-Turing thesis, undecidability and an introduction to complexity theory. The P=NP question and the utilisation of intractable problems for so-called zero-knowledge proofs are also discussed.
	This course gives students an idea of problems that are difficult or even completely unsolvable in principle. They understand that compromises must be made in terms of the quality of the desired results or the runtime.
Recommended reading	The substance of the lecture will be discussed at the blackboard. Lecture notes containing the complete material are also available. Furthermore, there are sample solutions to all exercises.
	Literature: D. W. Hoffmann: Theoretische Informatik, 3. Auflage. Hanser, 2015. M. Sipser: Introduction to the Theory of Computation, 3rd edition. Cengage Learning, Inc., 2012.
Exams	Written Exam 60 Min. (graded)
Comments	This course will take place as a pure lecture. Numerous exercises deepen selected areas and will be discussed in tutorials.

Lecture Computer Science 2 Laboratory

Internal number	INFB2137
Lecturers	Dr. Martin Holzer
	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 Laboratory

Internal number	INFB2207
Coordinator	Prof. Dr. Martin Sulzmann
Scope	5.0 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	INFB2217
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	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 in small groups

Lecture Software Project Laboratory

Internal number	INFB2227
Lecturers	Prof. Dr. Martin Sulzmann Dipl. Inf. (FH) Oktavian Gniot
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 Distributed Systems 1 and Theoretical Computer Science 2

Internal number	INFB2307
Coordinator	Prof. Dr. Christian Zirpins
Scope	4.0 ECTS points, 3.0 Contact hours
Placement	2nd Semester
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	none
Competences	The students acquire knowledge about techniques and concepts of distributed systems using the example of web applications. In particular, they acquire skills to explain the general architecture of the Internet and the Web, to analyze requirements of a Web application, to create an interactive Web application with HTML, CSS and client-side JavaScript, to identify security issues in a Web application and to develop server-side code for application services with authentication, cookies and sessions.
Exams	Individual exams

Lecture Distributed Systems 1

Internal number	INFB2317
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 90 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.

Lecture Distributed Systems 1 Laboratory

Internal number	INFB2327

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	
Recommended reading	
Exams	Laboratory Work 1 Semester (not graded)
Comments	

Module Computer Engineering 2	
Internal number	INFB2407
Coordinator	Prof. Dr. Christian Langen
Scope	6.0 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	The students are familiar with the foundations required for design of embedded systems. This includes computer aided hardware design techniques and an introduction into the hardware design lanquage VHDL. Additionally, students are familiarized with internal functions of various processors and peripherals. All knowledge gained will be reinforced by practical work in the laboratory.
Exams	Individual exams

Lecture Computer Engineering 2	
Internal number	INFB2417
Lecturer	Prof. Dr. Christian Langen
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 will provide an overview of programmable logic. This will be followed by a description of the basic modular devices that comprise programmable logic. The students will particapate in an exercise which exposes them to the CAD for programmable logic. An introduction to the design language VHDL will be given. This will be expanded to provide background in parallel and sequential description modes used in VHDL. The remaining description modes (processes and structures) will also be discussed. On the processor side, the lecture will cover the following, basic processor hardware, processor architecture, addressing modes, instructions, memory mapping, peripherals and bit processing.
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	INFB2427

Lecturer	Prof. Dr. Christian Langen
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	INFB2507
Coordinator	Prof. Dr.-Ing. Astrid Laubenheimer
Scope	7.0 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	INFB2517.a
Lecturer	Prof. Dr.-Ing. Astrid Laubenheimer
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	Module exam
Comments	

Lecture Statistics	
Internal number	INFB2517.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	INFB3107
Coordinator	Prof. Dr. Thomas Fuchß
Scope	7.0 ECTS points, 6.0 Contact hours
Placement	3rd Semester
Pre-requisites with regard to content	Software Laboratory, Computer Science 2
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	INFB3117
Lecturer	Prof. Dr. Thomas Fuchß
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 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	INFB3127
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	The course is organized in three exercises, covering compiler construction and interprocess communication. Starting with a scanner, the students consolidate their skills in handling large dynamic data structures, pointers, and doing low level IO. The second exercise focuses on the development of a recursive descendent parser and a short introduction to semantic analysis and code generation. The third exercise is an introduction to the field of interprocess communication. Within the exercise, elementary techniques and concepts are trained: - generating processes / threads - terminating processes / threads - synchronizing processes / threads
Recommended reading	Slides and textbooks: - Eduard Glatz. Betriebssysteme: Grundlagen, Konzepte, Systemprogrammierung - dpunkt.verlag, 2010 - A.V. Aho, M.S. Lam, R. Sethi und J.D. Ullman. Compiler - Prinzipien, Techniken und Werkzeuge - 2nd Edition - München: Pearson Studium, 2008. - D. Grune et. al. Modern compiler design - Wiley, 2000. - Andrew S. Tanenbaum. Betriebssysteme, Entwurf und Realisierung Teil 1 - Hanser, 1990.
Exams	Laboratory Work 1 Semester (not graded)
Comments	Attended teamwork and three lectures.

Module Databases and Communication Networks 1

Internal number	INFB3207
Coordinator	Prof. Dr. Oliver Waldhorst
Scope	7.0 ECTS points, 7.0 Contact hours
Placement	3rd Semester
Pre-requisites with regard to content	Antomation and Declarative Programming, 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	INFB3217.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	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	INFB3217.b
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 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._x000D_
The lecture covers the following topics:_x000D_
- 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._x000D_
- Transport layer mechanisms, including extensions to TCP such as SACK and CUBIC, as well as new protocols such as QUIC._x000D_
- Network layer with addressing and routing concepts, including IPv6, Software Defined Networking (SDN) and IPsec._x000D_
- Data link layer with a focus on VLANs, MPLS and data center networks._x000D_
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"._x000D_
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_x000D_
- James Kurose, Keith Ross: Computer Networking - A Top-Down Approach, 8th edition, Pearson, 2021_x000D_
- Various Internet standards, see https://www.rfc-editor.org_x000D_
- Further information in the lecture
Exams	Module exam
Comments	

Lecture Databases 1 Laboratory

Internal number	INFB3227
Lecturers	Prof. Dr.-Ing. Holger Vogelsang_x000D_
M.Sc. Amir Bukhari
Scope	2.0 ECTS points, 2.0 Contact hours_x000D_
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. Translated with www.DeepL.com/Translator
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 and follow-up

Lecture Communication Networks 1 Laboratory

Internal number	INFB3237
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 Antomation and Declarative Programming

Internal number	INFB3307
Coordinator	Prof. Dr. Patrick Baier
Scope	5.0 ECTS points, 4.0 Contact hours
Placement	3rd Semester
Pre-requisites with regard to content	Computer Science 1
Pre-requisites according to the examination regulations	none
Competences	
Exams	Individual exams

Lecture Automation

Internal number	INFB3317
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	
Recommended reading	- Rembold, U., Levi, P. : Realzeitsysteme zur Prozeßautomatisierung, Carl Hanser Verlag, München Wien, 1994 - MANN, H., SCHIFFELGEN, H., FRORIEP, R. : Einführung in die Regelungstechnik, Carl- Hanser Verlag, München, Wien, 2000 - Etschberger, K. (Hrsg) : CAN, Controller Area Network, Hanser-Verlag, München, 2001 - Tietze, U. , Schenk, Ch. : Halbleiter-Schaltungstechnik, Springer-Verlag, Berlin, 2005 - DATA LOGIC : Der Strichcode-Fibel, Firmenprospekt, 2008 - FINKENZELLER,K.: RFID-Handbuch, Hanser Verlag, München, Wien, 2006
Exams	Written Exam 90 Min. (graded)
Comments	

Lecture Automation Laboratory

Internal number	INFB3327
Lecturer	Prof. Dr. Patrick Baier
Scope	2.0 ECTS points, 2.0 Contact hours 60 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Exercise
Language of instruction	German

Content	Practice of development processes for industrial, reactive systems with co-operating handling systems: modelling of system dynamics by means of state charts or Petri networks, implementation of the formal software models in PLC software (via AWL/FUP/KOP and STEP7-Graph), process visualisation on an control center PC (via WinCC), system communication via TCP/IP and real time channels, system co-operation.
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	Exercise 1 Semester (not graded)
Comments	Seminar-style teaching, practice, reporting

Module Man-Machine-Communication

Internal number	INFB3407
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	The main objective of the module is the ability of students to create effective, efficient and satisfactory end user interfaces.
Exams	Individual exams

Lecture Man-Machine-Communication Design

Internal number	INFB3417
Lecturer	M.A. Daniel Hepperle
Scope	3.0 ECTS points, 2.0 Contact hours 90 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	
Recommended reading	- "GUI Design Essentials " von Susan Weinschenk, Pamela Jamar, Sarah C. Yeo, Verlag John Wiley & Sons, 1997, ISBN: 0471175498
Exams	Written/verbal Exam 90/20 Min. (graded)
Comments	

Lecture Man-Machine-Communication Design

Internal number	INFB3427
Lecturer	B.Sc. Valeria Zitz
Scope	2.0 ECTS points, 1.0 Contact hours 60 Stunden gesamt, davon 15 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German
Content	An MMC-task which is standard practice is designed starting from task analysis up to the paper prototype. This prototype is subject - possibly over several iterations - of a usability test until the specified quality targets are reached.
Recommended reading	Script, eye-tracker and user monitoring space in the Usability Lab Textbooks: - "GUI Design Essentials " von Susan Weinschenk, Pamela Jamar, Sarah C. Yeo, Verlag John Wiley & Sons, 1997, ISBN: 0471175498
Exams	Homework 1 Semester (not graded)
Comments	Supervised group work with presentation and discussion; test the usability of the prototype, prepare a test report with proposals for improvements.

Lecture Declarative Programming Laboratory

Internal number	INFB3437
Lecturer	Prof. Dr. Christian Pape
Scope	1.0 ECTS points, 2.0 Contact hours 30 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Exercise
Language of instruction	German
Content	Nach einem Einstufungstest können Studierende ihre Englischkenntnisse auf drei Niveaustufen vertiefen. Das Eingangsniveau setzt die Kompetenzstufe A2 (Basic User) im sechsstufigen Gemeinsamen Europäischen Referenzrahmen voraus. Die ersten zwei Niveaustufen (Englisch für Fortgeschrittene 1 und 2) beschäftigen sich neben einer Wiederholung der Grammatik vorwiegend mit Themen aus der berufsorientierten Allgemeinsprache und der Landeskunde, z. B. Bewerbungsschreiben, Beschreibung von Produkten und Dienstleistungen, Geschäftstelefonate, Ablauf von formellen und informellen Besprechungen, Präsentationen usw. Das damit erreichte Niveau entspricht einer Punktzahl im TOEFL von 173 (computer-based) bzw. der Kompetenzstufe B2 (Independent User) des Europäischen Referenzrahmens. Auf der anschließenden Niveaustufe werden fachsprachliche Kenntnisse (Englisch für Wirtschaft und Technik) erworben: In Business English liegt das Hauptgewicht auf gesprochener Sprache und Arbeit in kleinen Gruppen. Am Anfang des Semesters gründet jede Gruppe ein eigenes Unternehmen, das sich dann im Laufe des Semesters dynamisch weiterentwickelt. Parallel dazu werden systematisch Wortschatz und sprachliche Formulierungen zu solchen Themen wie Firmenstrukturen, Meetings, Verhandlungen, Marketing, Produktion und Verkauf, Finanzen, Erfassen von Berichten sowie Präsentationen kennengelernt, damit die Teilnehmer die sprachlichen Mittel beherrschen, jeden Schritt der Simulation auf Englisch zu bewältigen. Zu den Höhepunkten des Kurses gehören eine simulierte Messe, ein Einstellungsverfahren und die Gruppenpräsentation. In Technical English werden ein technischer Grundwortschatz und typische Ausdrucksformen technischer Kommunikation erworben und praktisch angewandt.
Recommended reading	Lehrbuch (je nach Kursstufe), PowerPoint-Folien, Tafelmitschrift, Übungsblätter, Video/DVD, Internetrecherchen
Exams	Exercise 1 Semester (not graded)
Comments	Vorlesungsteilnahme, Kurzvorträge fachlichen Inhalts sowie die Moderation der anschließenden Diskussion, Erstellung von Zusammenfassungen gehörter Fachvorträge und Gruppenarbeiten .

Module Business Administration and Service Management

Internal number	INFB3507
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	Individual exams

Lecture Business Administration

Internal number	INFB3517
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	Written Exam 90 Min. (graded)
Comments	

Lecture IT Service Management

Internal number	INFB3527
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	Written Exam 60 Min. (graded)
Comments	

Module Internship Preparation and Roundup	
Internal number	INFB4P07
Coordinator	Prof. Dr. Heiko Körner
Scope	6.0 ECTS points, 4.0 Contact hours
Placement	4th Semester
Pre-requisites with regard to content	none
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	INFB4P17
Lecturers	Dr. Martin Holzer B.Sc. Veit Richter
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	Exercises, programs with solutions and online documentation.
Exams	Exercise 1 Week (not graded)
Comments	Practical assignment in a computer laboratory.

Lecture Internship Roundup

Internal number	INFB4P27
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	INFB4PX7
Coordinator	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	INFB4PX17
Lecturer	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	
Recommended reading	
Exams	Hands-on Work 95 Days (not graded)
Comments	

Module Software Engineering and Distributed Systems 2

Internal number	INFB5107
Coordinator	Prof. Dr. Thomas Fuchß
Scope	7.0 ECTS points, 7.0 Contact hours
Placement	5th Semester
Pre-requisites with regard to content	System Software, Databases and Communication Networks 1, Computer Science 2, Man-Machine-Communication, Distributed Systems 1 and Theoretical Computer Science 2
Pre-requisites according to the examination regulations	none
Competences	Having successfully completed the module, students are able to work productively and independently on software projects of various sizes. They will be able to analyze and structure tasks as well as develop solutions independently, justify their decisions and document them in a comprehensible manner. They also explain general concepts of architectures, especially for distributed software systems, and apply them constructively. Students recognize the central requirements and challenges of such systems and develop suitable solutions. They will be able to explain concepts such as modularity, communication, fault tolerance and security and incorporate them constructively into the development of comprehensive software systems. They have further developed their technical, social and personal skills as well as their communication skills and self-management. They have learned to apply these new skills in the context of software projects.
Exams	Written Exam 120 Min. (graded)

Lecture Software Engineering

Internal number	INFB5117.a
Lecturer	Prof. Dr. Thomas Fuchß
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 "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	INFB5117.b
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 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	INFB5127
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	INFB5137
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	
Recommended reading	
Exams	Laboratory Work 1 Semester (not graded)
Comments	

Module Databases and Communication Networks 2

Internal number	INFB5207
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	INFB5217.a
Lecturer	Prof. Dr. Zoltán Nochta
Scope	3.0 ECTS points, 2.0 Contact hours 90 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	INFB5217.b
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 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 with Laboratory	
Internal number	INFB5307
Coordinator	Prof. Dr. Christian Pape
Scope	5.0 ECTS points, 3.0 Contact hours
Placement	5th Semester
Pre-requisites with regard to content	none
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	Individual exams

Lecture Computer Graphics

Internal number	INFB5317
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	Written Exam 90 Min. (graded)

Comments	
Lecture Computer Graphics Laboratory	
Internal number	INFB5327
Lecturer	Prof. Dr. Christian Pape
Scope	3.0 ECTS points, 1.0 Contact hours 90 Stunden gesamt, davon 15 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: - An existing arcade game implementation must be supplemented with its own 2D view component. A simple 2D API like SDL is used for this. - A rudimentary ray tracer based on given basic libraries is to be created. - 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 Student Research Project

Internal number	INFB5407
Coordinator	Prof. Dr. Heiko Körner
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	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	Individual exams

Lecture Student Research Projekt

Internal number	INFB5417
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	Homework 1 Semester (not graded)
Comments	

Lecture Student Research Projekt Colloquium

Internal number	INFB5427
Lecturer	Alle Dozenten

Scope	1.0 ECTS points, 0.0 Contact hours
	30 Stunden gesamt, davon 0 Stunden Kontaktstudium.
Type/mode	Hands-on Experience
Language of instruction	German
Content	The colloquium marks the conclusion of the project work. Students present their results in a short presentation and then take part in a discussion. In doing so, they demonstrate that they are able to explain and defend the problem, the realisation of the work and the solution found in a short, concise form.
Recommended reading	
Exams	Verbal Exam 20 Min. (graded)
Comments	All work will be individual work and will include the presentation, discussion, defense of the work.

Module ERP Systems

Internal number	INFB5507
Coordinator	Prof. Dr. rer. pol. Mathias Philipp
Scope	5.0 ECTS points, 4.0 Contact hours
Placement	5th Semester
Pre-requisites with regard to content	Business Administration and Service Management
Pre-requisites according to the examination regulations	none
Competences	The students shall learn to think in business processes on the basis of integrated ERP systems. They should recognize the interdependence of operational functions, and thus deepen their basic economical knowledge about processes (horizontal integration). Further, the students recognize the need for vertical integration as a prerequisite for the development of ERP systems for management information systems. In addition the students learn architecture, design and development of ERP systems.
Exams	Individual exams

Lecture ERP Systems

Internal number	INFB5517
Lecturer	Prof. Dr. rer. pol. Mathias Philipp
Scope	3.0 ECTS points, 3.0 Contact hours 90 Stunden gesamt, davon 45 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 ERP Laboratory

Internal number	INFB5527
Lecturer	Prof. Dr. rer. pol. Mathias Philipp
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 laboratory is linked to the lecture and serves to apply and deepen the lecture material. The following laboratory exercises are carried out: - SAP ERP navigation, case study to get to know the user interface and operation of the SAP system - Case study on order processing (SD module) to understand the implementation of business processes in complex ERP systems - Customizing case study on reorder point-oriented procurement planning to independently (under supervision) configure a procurement process in the system (company and process customizing) - Short programming task in ABAP to get to know the programming language. Independent processing of the case studies in an SAP ERP system individually or in a group of a maximum of two people. Software: SAP ECC 6.04, data basis: Global Bike Inc. Alternative to the laboratory: Introduction to the ABAP programming language. See I W918.
Recommended reading	Recommended reading: Extensive material for introduction to the topic as well as on each case study. Provisioning is about the blended learning and e-learning platform ILIAS.
Exams	Exercise 1 Semester (not graded)
Comments	Kind of work: Labor participation and preparation of laboratory results. Exercises and case studies from the curriculum GBI powered by t he SAP University Alliances community. Some case studies have been extended to more detailed tasks.

Module Elective courses 1

Internal number	INFB5607
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, 0.0 Contact hours 120 Stunden gesamt, davon 0 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	The BSI's IT-Grundschutz provides a good basis for meeting the challenges of IT security management in a professional manner way to do justice. Students learn how to structure information security, how to systematically look for weak points, and the appropriateness of implementation to examine protective measures and to develop and update security concepts fit the business processes, tasks and organizational structures of a company institution and in general meet recognized standards.
Recommended reading	Lecture slides MC/MR practice questions in ILIAS BSI-Standards zum IT-Grundschutz BSI IT-Grundschutz-Kompendium ISO/IEC 27000 Normenreihe BSI: Online-Kurs IT-Grundschutz Thomas W. Harich: IT-Sicherheitsmanagement - Praxiswissen für IT Security Manager, mitp Verlag Jacqueline Naumann (Autor): ISO/IEC 27001 ISO/IEC 27002 und IT-Grundschutz: Schnelleinstieg Informationssicherheit
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 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 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 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

Internal number	I W772
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	Written Exam 60 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) 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	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	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 Workshop Empirical Software Engineering

Internal number	I Wxyz
Lecturers	Prof. Dr. Zoltán Nochta Prof. Dr. Oliver Waldhorst Prof. Dr. Christian Zirpins
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	- Vorlesungsfolien und Dokumentation in ILIAS - Wohlin, Claes, et al. Experimentation in Software Engineering. Springer Nature, 2024. - 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	INFB6107
Coordinator	Prof. Dr. Dirk Hoffmann
Scope	5.0 ECTS points, 4.0 Contact hours
Placement	6th Semester
Pre-requisites with regard to content	Computer Science 2, Computer Engineering 1, Computer Engineering 2
Pre-requisites according to the examination regulations	Modul Internship
Competences	The lectures in this module impart advanced knowledge in the field of embedded systems. Students know the basic terms in the field of embedded systems and are able to differentiate between different types of real-time systems. With CAN bus, the students have become familiar with a typical communication medium and with CDMA technology, an important coding used, for example, in satellite communication. Students are able to implement typical programming tasks in the field of embedded systems in the C language. During the course, students learn how to use software tools that can be used to measure and optimize the program runtime of the software created.
Exams	Individual exams

Lecture Embedded Software

Internal number	INFB6117
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 Embedded Software Laboratory

Internal number	INFB6127
Lecturer	Prof. Dr. Dirk Hoffmann
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	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 (not graded)
Comments	Practical work

Module Computer architecture and Autonomous Systems

Internal number	INFB6207
Coordinator	Prof. Dr. Martin Sulzmann
Scope	5.0 ECTS points, 4.0 Contact hours
Placement	6th Semester
Pre-requisites with regard to content	Business Administration and Service Management, Computer Engineering 1
Pre-requisites according to the examination regulations	Modul Internship
Competences	Autonomous systems: Students apply concurrent programming methods to the practical implementation of autonomous systems. They gain insight into formal modeling and specification notations for describing and verifying complex autonomous systems. The students are able to use suitable notations depending on the application. Using practical examples, they recognize both the possibilities and the limits of formal methods. Thye apply concurrent programming methods to the practical implementation of autonomous systems. Computer architecture: Students deal with the most important principles of organization and design of microprocessors. Microprocessors are the central building blocks of practically all current computer systems, from smartphones to supercomputers and thus the digital world. The focus is on programming 64-bit ARMv8 processors as well as the logical design of processors using Verilog. In addition to teaching the theoretical basics, a lot of emphasis is placed on practical programming exercises.
Exams	Written Exam 120 Min. (graded)

Lecture Computer architecture

Internal number	INFB6217.a
Lecturers	Prof. Dr. Martin Sulzmann Dr. rer. nat. Peter Altevogt
Scope	3.0 ECTS points, 2.0 Contact hours 90 Stunden gesamt, davon 30 Stunden Kontaktstudium.
Type/mode	Lecture
Language of instruction	German

Content	In the lecture we will deal with the most important principles of organization and design of microprocessors. Microprocessors are the central building blocks of practically all current computer systems, from smartphones to supercomputers and thus of the complete digital world. The focus of the lecture will be the programming of 64-bit ARMv8 processors and the logical design of processors with the help of Verilog. In addition to teaching the theoretical basics, great emphasis is placed on practical programming exercises. The following topics are covered: - Computer Abstractions and Technology - Instructions: Language of the Computer - Arithmetic for Computers - Performance Analysis - Logic Design with Verilog - The Processor - The Memory Hierarchy - Parallel Processors
Recommended reading	Computer Organization and Design : The Hardware/Software Interface , ARM Edition, D.A. Patterson, J.L. Hennessy, Elsevier Inc. 2017
Exams	Module exam
Comments	In general, the lectures start with a discussion of the exercises associated with the previous lecture. Afterwards we address new topics. Questions and feedback are always welcome!

Lecture Autonomous Systems

Internal number	INFB6217.b
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	Students in this course - obtain an overview of methods for formal modelling and verification of autonomous/reactive systems, - get to know programming concepts to master highly concurrent/distributed systems.l Selection of topics covered: (1) Modeling and Verification - Statemachine models Mealy/Moore Communication statemachines Timed statemachines Harel Statecharts - Specification Reguar languages Temporal logic (CTL) - Modelchecking - Testcasegeneration via modelchecking - Run-Time Verification - Coverage criteria - UPPAAL (2) Concurrency and Synchronisation - Shared memory Threads and Locks Lock-free Algorithms Software Transactional Memory - Message-passing Foundations: CSP, Join Haskell, Go

Recommended reading	- Lecture notes and slides - Exercises - Selection of textbooks: Real World Haskell by Bryan O'Sullivan, Don Stewart, and John Goerzen Real-Time Systems and Programming Languages (Fourth Edition) Ada 2005, Real-Time Java and C/Real-Time POSIX by Alan Burns and Andy Wellings Principles of Model Checking Christel Baier and Joost-Pieter Katoen Real-Time UML: Developing Efficient Objects for Embedded Systems (2nd Edition)
Exams	Module exam
Comments	Mix of lecture and theoretical and practical exercises.

Module Communication Competence	
Internal number	INFB6307
Coordinator	Prof. Dr. rer. pol. Mathias Philipp
Scope	6.0 ECTS points, 6.0 Contact hours
Placement	6th Semester
Pre-requisites with regard to content	Internship
Pre-requisites according to the examination regulations	Modul Internship
Competences	After successfully completing the module, students will be able to - analyse technical or scientific publications related to computer science or media, - write their own papers under the guidance of a supervising lecturer on a current computer science-related topic, - present the results of their own work in a lecture and defend them in a subsequent discussion.
Exams	Individual exams

Lecture Seminar

Internal number	INFB6317
Lecturer	Alle Dozenten
Scope	5.0 ECTS points, 5.0 Contact hours 150 Stunden gesamt, davon 75 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	Homework 1 Semester (not 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 Presentation

Internal number	INFB6327
Lecturer	Alle Dozenten

Scope	1.0 ECTS points, 1.0 Contact hours
	30 Stunden gesamt, davon 15 Stunden Kontaktstudium.
Type/mode	Seminar
Language of instruction	German
Content	
Recommended reading	
Exams	Verbal Exam 20 Min. (graded)
Comments	

Module Key Qualification

Internal number	INFB6407
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	Individual exams

Lecture Intercultural Communication

Internal number	INFB6417
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	Exercise 1 Semester (not graded)
Comments	

Lecture Presentation techniques

Internal number	INFB6427

Lecturer	Dr. Martin Holzer
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	Verbal Exam 20 Min. (graded)
Comments	

Lecture Law

Internal number	INFB6437
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	Written Exam 90 Min. (graded)
Comments	

Module Elective courses 2

Internal number	INFB6507
Coordinator	Prof. Dr.-Ing. Holger Vogelsang
Scope	8.0 ECTS points, 8.0 Contact hours
Placement	6th Semester
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	Modul Internship
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 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 IT and media law

Internal number	I W159
Lecturers	RA Josua Neudeck RA Jeremias Held
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	Written Exam 90 Min. (graded)
Comments	RA Josua Neudeck (https://www.vogel-partner.eu/team/josua-neudeck/) RA Jeremias Held (https://www.vogel-partner.eu/team/jeremias-held/)

Lecture Cyber espionage

Internal number	I W165
Lecturer	B.Sc. Florian Dalwigk
Scope	4.0 ECTS points, 0.0 Contact hours 120 Stunden gesamt, davon 0 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) 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	Technological and topological mechanisms for securingnetworks, attack patterns and defense mechanisms againstthem. Basics of, variants of and defense against malicioussoftware. 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 Softwareengineering Special Chapters

Internal number	I W342
Lecturers	Prof. Dr. Thomas Fuchß M.Sc. Alexander Hasel
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 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	Verbal Exam/Concept 20 Min. (graded)
Comments	The lecture will take the form of seminars with exercises.

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 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	M.Sc. Matthias Mruzek-Vering
	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	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	This course covers the following areas.
	1. Embedded software engineering
	2. Programming language design and analysis.
	We will use the Go programming language to cover various aspects of programming language design and analysis.
	- Introduction to Go, a C style language with garbage collection.
	- Type inference
	- Method overloading Go interfaces Connection to other overloading approaches
	- Syntax analysis
	- Program analysis
	- Concurrency Multi-threading Message-passing Shared memory and data races
Recommended reading	- lectures notes and slides
	- exercies
	- online references
Exams	Written Exam 90 Min. (graded)
Comments	Prerequisistes:
	Softwareprojekt + Autonome Systeme

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 New Lecture

Internal number	I Wabc
Lecturer	Prof. Dr. Christine Preisach
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	Hands-on Work 1 Semester (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	Thesis
Language of instruction	German
Content	
Recommended reading	
Exams	Written Exam 90 Min. (graded)
Comments	

Module Elective courses 3

Internal number	INFB7107
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 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 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 Autonomous Systems Labor

Internal number	I W276

Lecturers	Prof. Dr. Norbert Link
	M.Sc. Mickael Cormier
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	I W392
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 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 Project Management

Internal number	I W422
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 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 Teamteaching

Internal number	I W730
Lecturers	Prof. Dr.-Ing. Holger Vogelsang Alle Dozenten
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 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 High Performance Computing

Internal number	I W909
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	I W918
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 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 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	INFB7207
Coordinator	Prof. Dr. Heiko Körner
Scope	5.0 ECTS points, 2.0 Contact hours
Placement	7th Semester
Pre-requisites with regard to content	Man-Machine-Communication, Student Research Project
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	INFB7217
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	INFB7307
Coordinator	Prof. Dr. Heiko Körner
Scope	12.0 ECTS points, 0.0 Contact hours
Placement	7th Semester
Pre-requisites with regard to content	System Software, Business Administration and Service Management, Computer Graphics with Laboratory, Databases and Communication Networks 1, Databases and Communication Networks 2, ERP Systems, Antomation and Declarative Programming, Embedded Software, Computer Science 1, Computer Science 2, Communication Competence, Mathematics 1, Mathematics 2, Man-Machine-Communication, Internship, Internship Preparation and Roundup, Student Research Project, Computer architecture and Autonomous Systems, Key Qualification, Software Engineering and Distributed Systems 2, Software Laboratory, Language Competence, Computer Engineering 1, Computer Engineering 2, Distributed Systems 1 and Theoretical Computer Science 2, 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	INFB7317
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	INFB7407
Coordinator	Prof. Dr. Heiko Körner
Scope	3.0 ECTS points, 0.0 Contact hours
Placement	7th Semester
Pre-requisites with regard to content	Embedded Software, Internship, Internship Preparation and Roundup, Key Qualification, Language Competence, Man-Machine-Communication, Mathematics 1, Mathematics 2, Scientific Working, Software Engineering and Distributed Systems 2, Software Laboratory, Student Research Project, System Software, Elective courses 3, Antomation and Declarative Programming, Business Administration and Service Management, Communication Competence, Computer Engineering 1, Computer Engineering 2, Computer Graphics with Laboratory, Computer Science 1, Computer Science 2, Computer architecture and Autonomous Systems, Databases and Communication Networks 1, Databases and Communication Networks 2, Distributed Systems 1 and Theoretical Computer Science 2, ERP Systems
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	INFB7417
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 that are related to their final thesis. With the final examination, they prove that they have the competence to work independently on novel problems in computer science.
Recommended reading	
Exams	Verbal Exam 20 Min. (not graded)
Comments	