Hochschule Karlsruhe
Faculty for Computer Science and Business
Information Systems
Module manual
Course of studies Computer Science (Master), ER 7

Winter semester 2021/2022

Module Concepts and Designs of interactive Systems	
Internal number	INFM110MI
Coordinator	Prof. Thomas Hinz
Scope	7 ECTS points, 6 Contact hours
Placement	All semesters
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	none
Competences	Students learn theoretical knowledge of designing interactive systems and put their knowledge into practice in constructing prototypes. With knowledge of design principles and concepts they are able to solve design problems. They gain practical experiences on innovative natural user interfaces and interaction in public space and can develop new forms of human-machine interfaces.
Exams	Individual exams
Lecture Design of Interactions	
Internal number	INFM111MI
Lecturer	Prof. Thomas Hinz
Scope	2 ECTS points, 2 Contact hours
Type/mode	Lecture
Language of instruction	German
Content	The students learn a variety of methods and strategies for designing interactive systems and how to apply them. They are able to identify and solve problems in the design of corresponding systems. They deal with the cultural context of interactions and engage in critical reflection about the history of interaction design.
Recommended reading	Script, Literature: - R. Klanten, S. Ehmann, F. Schulze: "Visual Storytelling: Inspiring a New Visual Language", 2011, ISBN-13: 978-3899553758 - R. Klanten, L. Feireiss: "A Touch of Code: Interactive Installations and Experiences", 2011, ISBN-13: 978-3899553314 - J. Sauter, S. Jaschko, J. Ängeslevä: ART+COM: "Medien, Räume und Installationen", 2011, ISBN-13: 978-3899553864 - J. Pannafino: Interdisciplinary Interaction Design: "A Visual Guide to Basic Theories, Models and Ideas for Thinking and Designing for Interactive Web Design and Digital Device Experiences", 2012, ISBN-13: 978-0982634813 - H.-D. Hellige: "Mensch-Computer-Interface: Zur Geschichte und Zukunft der Computerbedienung", 2008, ISBN-13: 978-3899425642 - J. Schenk, G. Rigole: "Mensch-Maschine-Kommunikation: Grundlagen von sprach- und bildbasierten Benutzerschnittstellen", 2010, ISBN-13: 978-3642054563 - R. Dorau: "Emotionales Interaktionsdesign Gesten und Mimik interaktiver Systeme, 2011, ISBN-13: 978-3642031007 - D. Wigdor, D. Wixon: "Brave NUI World: Designing Natural User Interfaces for Touch and Gesture", 2011, ISBN-13: 978-0123822314

Exams	Concept 1 Semester (graded)
Comments	Participation at tuition, in class group work and discussion.
Lecture Interactive Systems Exercise	
Internal number	INFM112MI
Lecturer	Prof. Thomas Hinz
Scope	5 ECTS points, 4 Contact hours
Type/mode	Exercise
Language of instruction	German
Content	The participants apply their theoretical understanding of the conception and design of interactive systems. They design and develop prototypes of interactive systems. The students experiment with innovative forms of human-computer interfaces and their possibilities. They are capable of presenting their results convincingly using multimodal tools, as well as justify them in a methodical and theoretically grounded manner.
Recommended reading	- J. Hunt: "Talk to Me: Design and the Communication between People and Objects", 2011, ASIN: B009XR1NSY - D. Roberts: "Making Things Move: Die Welt bewegen", 2011, ISBN-13: 978-3868991390 - T. Igor, P. Stefan: "Making Things Talk: Die Welt hören, sehen, fühlen", 2012, ISBN-13: 978-3868991628 - G. Borenstein: "Making Things See: 3D vision with Kinect, Processing, Arduino, and MakerBot", 2012, ISBN-13: 978-1449307073 - D. Schmalstieg, T. Höllerer: "Augmented Reality", 2016, ISBN-13 978-0-321-88357-5
Exams	Exercise 1 Semester (not graded)
Comments	- Teamworking - Experiments on design and prototyping - Presentation and discussion of the results

Module Machine learning	
Internal number	INFM110ML
Coordinator	Prof. Dr.-Ing. Astrid Laubenheimer
Scope	7 ECTS points, 6 Contact hours
Placement	All semesters
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	none
Competences	
Exams	Individual exams
Lecture Machine learning	
Internal number	INFM111ML
Lecturers	Prof. Dr. Norbert Link Prof. Dr.-Ing. Astrid Laubenheimer
Scope	4 ECTS points, 4 Contact hours
Type/mode	Lecture
Language of instruction	German
Content	
Recommended reading	
Exams	Written/verbal Exam 12/20 Min. (graded)
Comments	
Lecture Machine learning Exercise	
Internal number	INFM112ML
Lecturers	Prof. Dr. Norbert Link Prof. Dr.-Ing. Astrid Laubenheimer
Scope	3 ECTS points, 2 Contact hours
Type/mode	Exercise
Language of instruction	German
Content	
Recommended reading	
Exams	Exercise 1 Semester (not graded)
Comments	

Module Theory of efficient algorithms	
Internal number	INFM110SE
Coordinator	Prof. Dr. Heiko Körner
Scope	7 ECTS points, 5 Contact hours
Placement	All semesters
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	none
Competences	The three courses in this module teach the design of efficient algorithms in theory and practice. By presenting numerous examples of numerical and graph theory problems, students will learn typical methods for their solution and also how to implement them. Techniques for proving the correctness of an algorithm will be presented. Also, methods for analysing their computational complexity will be given. Moreover, this module attaches importance to modeling and simulation methods. These algorithms are used in many areas of research and industry and enable a computer-assisted design of processes. Therefore, students are introduced to numerical algorithms for interpolation and approximation of mathematical models. The students will implement several corresponding technical problems with parallelized programs on modern high performance computers.
Exams	Written/verbal Exam 120/20 Min. (graded)
Lecture Graph Algorithms	
Internal number	INFM111SE.a
Lecturer	Prof. Dr. Heiko Körner
Scope	3 ECTS points, 2 Contact hours
Type/mode	Lecture
Language of instruction	German
Content	This couse gives an overview of some basic graph algorithms and their applications. The students learn to apply further algorithms and how to implement them. Furthermore, techniques for proving the correctness and complexity of algorithms are thoroughly studied. After a brief theoretical introduction to graphs some fundamental algorithms like depth first search and breadth first search are presented. Other algorithms deal with the detection of strongly connected components, topological sorting and the calculation of shortest paths. Efficient tests concerning the existence of circuits in a graph are also discussed. For this course some basic knowledge of programming and the safe handling of the O-calculus are necessary. Furthermore, the participant is assumed to be familiar with inductive proofs. Both topics are handled in an appendix of the lecture notes.
Recommended reading	The substance of the lecture will be discussed at the blackboard. Lecture notes containing the complete material are also available. Lecture notes, exercises and their solutions are available online.

	Literature: T. H. Cormen, C. E. Leiserson, R. L. Rivest, C. Stein: Introduction to Algorithms. MIT Press, 2001, ISBN 0-262-03293-7.
Exams	Module exam
Comments	Classical lecture. Several exercises deepen the field of study and are discussed in the classroom if desired.
Lecture Modeling and Simulation	
Internal number	INFM111SE.b
Lecturer	Prof. Dr. Britta Nestler
Scope	2 ECTS points, 2 Contact hours
Type/mode	Lecture
Language of instruction	German
Content	
Recommended reading	
Exams	Module exam
Comments	
Lecture Modeling and Simulation Exercise	
Internal number	INFM112SE
Lecturer	Prof. Dr. Britta Nestler
Scope	2 ECTS points, 1 Contact hours
Type/mode	Exercise
Language of instruction	German
Content	
Recommended reading	
Exams	Exercise 1 Semester (not graded)
Comments	

Module New Module	
Internal number	INFM120MI
Coordinator	Prof. Dr. Matthias Wölfel
Scope	7 ECTS points, 6 Contact hours
Placement	All semesters
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	none
Competences	
Exams	Individual exams
Lecture Perception based Interaction	
Internal number	INFM121MI
Lecturer	Prof. Dr. Matthias Wölfel
Scope	3 ECTS points, 3 Contact hours
Type/mode	Lecture
Language of instruction	German
Content	Nowadays machines are already capable of communicating with human beings in a "natural" fashion through the existence of capabilities to understand natural language, recognise hand writing, and for interpreting gestures. However, they are also capable of extending human perception through augmenting situations with additional knowledge ("augmented reality"), i.e. the depiction of information is contextualised according to the situation as perceived by the machine. Examples of this are smartphones and tablets (voice-control, face recognition, "goggle", music recognition), vehicles (driver assistance systems), video game consoles (movement interpretation), but also in work-related contexts (surgery, human-robot-cooperation). The lecture covers the foundations of voice- and gesture recognition, the sensing and recognition of objects in the environment, as well as information presentation. Sample applications (e.g. using the Kinect sensor) allow students to gain deeper understanding of the covered material. Topics include: - system performance of perception-based interaction - sensor systems for the recognition of the environment (sound, video, 3d, touch, acceleration and rotation) - Recognition (object recognition in video and 3d, speech- and behaviour recognition) - interaction models (augmented reality, situation graphs)
Recommended reading	
Exams	Concept 1 Semester (graded)
Comments	
Lecture New Lecture	
Internal number	INFM122MI
Lecturer	Prof. Dr. Matthias Wölfel
Scope	4 ECTS points, 3 Contact hours

Type/mode	Exercise
Language of instruction	German
Content	
Recommended reading	
Exams	Exercise 1 Semester (not graded)
Comments	

Module Data Science	
Internal number	INFM120ML
Coordinator	Prof. Dr. Reimar Hofmann
Scope	7 ECTS points, 5 Contact hours
Placement	All semesters
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	none
Competences	
Exams	Written/verbal Exam 120/20 Min. (graded)
Lecture Data Science	
Internal number	INFM121ML.a
Lecturer	Prof. Dr. Reimar Hofmann
Scope	3 ECTS points, 2 Contact hours
Type/mode	Lecture
Language of instruction	German
Content	
Recommended reading	
Exams	Module exam
Comments	
Lecture Optimization	
Internal number	INFM121ML.b
Lecturer	Prof. Dr.-Ing. Astrid Laubenheimer
Scope	2 ECTS points, 2 Contact hours
Type/mode	Lecture
Language of instruction	German
Content	
Recommended reading	
Exams	Module exam
Comments	
Lecture Optimization Exercise	
Internal number	INFM122ML
Lecturer	Prof. Dr.-Ing. Astrid Laubenheimer
Scope	2 ECTS points, 1 Contact hours
Type/mode	Exercise
Language of instruction	German
Content	
Recommended reading	

Exams	Exercise 1 Semester (not graded)
Comments	

Module Concepts of Programming Languages	
Internal number	INFM120SE
Coordinator	Prof. Dr. Martin Sulzmann
Scope	6 ECTS points, 5 Contact hours
Placement	All semesters
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	none
Competences	Students will get to know various types of programming languages and their underlying concepts as well as optimization methods to efficiently execute programs. Via practical exercises students are exposed to different styles of programming in several programming languages. They are able to judge the usefullness and effectiveness of various programming concepts.
Exams	Written/verbal Exam 90/20 Min. (graded)
Lecture Programming Paradigms	
Internal number	INFM121SE.a
Lecturer	Prof. Dr. Martin Sulzmann
Scope	3 ECTS points, 2 Contact hours
Type/mode	Lecture
Language of instruction	German
Content	Students of this course - obtain an overview of the history of programming languages, - get to know the various styles of programming (paradigms), - explore their commonalities and differences, - get hands on experiences by solving practical problems. List of topics covered includes: - Historical Overview - Procedural languages Block structure Parameter Passing - Object-oriented languages Subtyping Inheritance Overloading - Functional languages Lambda calculus Higher-order functions Algebraic data types and pattern matching - Type systems Deduction (-> Prolog / logic programming) Typinference Polymorphism Static Analysis - Concurrent and distributed programming The Actor model Software Transactional Memory
Recommended reading	- Lecture notes and slides - Exercises - Textbook: Concepts in Programming Languages von John C. Mitchell
Exams	Module exam
Comments	Prerequisites: Experience in a programming language. Mix of lectures (2/3) and practical exercies (1/3)

Lecture Program Optimization	
Internal number	INFM121SE.b
Lecturer	Prof. Dr. Christian Pape
Scope	1 ECTS points, 1 Contact hours
Type/mode	Lecture
Language of instruction	German
Content	
Recommended reading	
Exams	Module exam
Comments	
Lecture Program Optimization Laboratory	
Internal number	INFM122E
Lecturer	Prof. Dr. Christian Pape
Scope	2 ECTS points, 2 Contact hours
Type/mode	Exercise
Language of instruction	German
Content	The students of this course have to - implement complex algorithms with a procedural or object-oriented programming language, - optimize the implementation with specific techniques like CPU-cache optimization or the pardigm of hybridization, - measure and analyze the time and memory consumption of the implemenation, - compare algorithms with respect to different test scenarios, and - documenting and discuss the final results. The computer science problems of this course change from time to time. Typical problems include: - Fast multiplication of polynomials and numbers, - geometric algorithms, or - graph algorithms.
Recommended reading	The exercises and supplementary materials are available electronically (HTML, PDF, partial programms).
Exams	Exercise 1 Semester (not graded)
Comments	Prerequisites: Deep practical knowledge of a procedural or object-oriented programming language like C, C++, C#, or Java. Implementation and testing of basic algorithms in the field of search, graphs and sorting problems. Format: Practical Assignment in a computer laboratory with small introductional parts as a lecture. Support: Individual support by the teachers in the computer lab. Contact outside laboratory time via e-mail or during the hours of the lecturers.

Module New Module	
Internal number	INFM210MI
Coordinator	Prof. Daniel Schwarz
Scope	7 ECTS points, 5 Contact hours
Placement	All semesters
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	none
Competences	
Exams	Individual exams
Lecture New Lecture	
Internal number	INFM211MI
Lecturer	Prof. Daniel Schwarz
Scope	3 ECTS points, 2 Contact hours
Type/mode	Lecture
Language of instruction	German
Content	
Recommended reading	
Exams	Concept 1 Semester (graded)
Comments	
Lecture New Lecture	
Internal number	INFM212MI
Lecturer	Prof. Daniel Schwarz
Scope	4 ECTS points, 3 Contact hours
Type/mode	Exercise
Language of instruction	German
Content	
Recommended reading	
Exams	Exercise 1 Semester (not graded)
Comments	

Module Artificial Intelligence	
Internal number	INFM210ML
Coordinator	Prof. Dr. Patrick Baier
Scope	7 ECTS points, 6 Contact hours
Placement	All semesters
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	none
Competences	
Exams	Individual exams
Lecture Artificial Intelligence	
Internal number	INFM211ML
Lecturer	Prof. Dr. Patrick Baier
Scope	3 ECTS points, 2 Contact hours
Type/mode	Lecture
Language of instruction	German
Content	This lecture introduces current developments and research in the field of artificial intelligence and deep learning. To start with, the foundations of neural networks are shortly repeated to be able to understand the following algorithms that are mainly based on deep learning. Different architectures are introduced, like "Convolutional Neural Networks", "Recurrent Neural Networks" and "LSTMs", and their application in the context of "Computer Vision", "Natural Language Processing" and "Reinforcement Learning" are presented. The outline of the lecture is as follows: - Neural networks and deep learning - CNNs - Object detection, image segmentation - Transfer learning - Sequential models (RNNs, LSTMs, GRUs) - Language models, word embeddings, neural machine translation - Attention mechanism and transformer models - Reinforcement Learning: Basics, Q-learning, DQNs, Alpha Go - Autoencoders and GANs
Recommended reading	
Exams	Written/verbal Exam 60/20 Min. (graded)
Comments	
Lecture Artificial Intelligence Exercise	
Internal number	INFM212ML

Lecturers	M.Sc. Anna Weißhaar Prof. Dr. Patrick Baier
Scope	4 ECTS points, 4 Contact hours
Type/mode	Exercise
Language of instruction	German
Content	This lab implements the theoretical foundations from the lecture into practical tasks. For this, tasks from the following three domains are tackled: * Computer Vision * Natural Language Processing * Reinforcement Learning
Recommended reading	
Exams	Concept 1 Semester (graded)
Comments	Requirements: - Basic knowledge in Python - Basic knowledge in Machine Learning

Module Software Architectures	
Internal number	INFM210SE
Coordinator	Prof. Dr. Thomas Fuchß
Scope	7 ECTS points, 6 Contact hours
Placement	All semesters
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	none
Competences	The students learn how to design and evaluate the architecture of large software systems. This includes, in addition to the logical organization of functions and procedures, the specific decomposition into components and connectors as well as the selection and evaluation of appropriate frameworks.
Exams	Individual exams
Lecture Software Architectures	
Internal number	INFM211SE
Lecturer	Prof. Dr. Thomas Fuchß
Scope	2 ECTS points, 2 Contact hours
Type/mode	Lecture
Language of instruction	German
Content	In the first part of the lecture central modeling techniques for the design of components are developed. In the second part of the lecture well known architectural patterns are examined. Students learn to identify their structures, properties and characteristics to understand and recognize these structures as patterns. The third part of the lecture deals with frameworks. Using various scenarios, the use of architectural frameworks is presented and evaluated.
Recommended reading	
Exams	Written/verbal Exam 60/20 Min. (graded)
Comments	The lecture will take the form of seminars with exercises.
Lecture Parallel Programming	
Internal number	INFM212SE
Lecturer	Dipl.-Ing. Christian Meder
Scope	3 ECTS points, 2 Contact hours
Type/mode	Laboratory Course
Language of instruction	German
Content	
Recommended reading	
Exams	Exercise 1 Semester (not graded)
Comments	
Lecture Software Architectures Laboratory	

Internal number	INFM213SE
Lecturer	M.Sc. Aladdin Özenir
Scope	2 ECTS points, 2 Contact hours
Type/mode	Laboratory Course
Language of instruction	German
Content	
Recommended reading	
Exams	Exercise 1 Semester (not graded)
Comments	

Module Semantic Technologies	
Internal number	INFM130
Coordinator	Prof. Dr. Peter Henning
Scope	6 ECTS points, 4 Contact hours
Placement	1st Semester
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	none
Competences	The succesful handling of the large data volume available in a globalized information infrastructure necessitates its semantic annotation, i.e. data has to be accompanied by meta data that denotes its meaning. XML techniques, in particular the transformation of data according to XSLT style sheets are at the core of these modern concepts. Students acquire abstract and concrete knowledge about XML basics (XML concepts, DTD, Namespaces and DOM) as well as about XSLT basics (XPath, simple transformations, principles of functional programming with XSLT). Students know advanced XML topics (XML Schema, XLink/XPointer), and have dealt with various XSLT applications. Students have abstract and concrete knowledge about the Resource Description Framework RDF, its extension into RDFS and OWL; they know how to write and visualize simple ontologies. Students know machine based reasoning tools and principles of knowledge description, they have performed several reasoning tasks. Students know paradigms of learning and have been introduced to models of thinking and reasoning. The course therefore contributes to the two dimensions technical knowledge and leadership skills. Since it is held in English, participants also improve their key skills.
Exams	Individual exams
Lecture Semantic Technologies	
Internal number	INFM131
Lecturer	Prof. Dr. Peter Henning
Scope	3 ECTS points, 2 Contact hours
Type/mode	Lecture
Language of instruction	English
Content	- XML Basics: Documents and document types, their definition and structure (DTD, Namespaces and Schema) - XSLT Basics: XPath, simple transformations, principles of functional programming with XSLT - XML Schema definitions, XLink, XPointer The Resource Description Framework RDF. Application to simple semantic views on data, extension into RDFS and description of simple ontologies. Modeling of knowledge using OWL.

	Machine based reasoning. Science theory, formal logic and models of thinking.
Recommended reading	Prerequisites: Participants should have basic knowledge of descriptive languages (XML applications), at least should have practical knowledge of Web programming. Participants should have sufficient knowledge of technical English Format Participation necessary in two classroom hours per week, electronic tests and essay writing on selected topics, theoretical self-study on semantic technologies. Counseling Questions during course hours, electronic learning management system ILIAS, weekly online chat in ILIAS, 24 x 7 offline discussion in ILIAS Forum, eMail Powerpoint transparencies, electronic whiteboard notes as PDF, eLearning courses on XML, XSLT, SMIL, additional electronic material for reading and self-assessment. References Geroimenko, V., Chen, C.: Visualizing Information Using SVG and X3D. XML Based Technologies for the XML Based Web (Springer 2004) ISBN 978-1852337902 Geroimenko, V., Chen, C.: Visualizing the Semantic Web. XML-Based Internet and Information Visualization (Springer 2005) ISBN 978-1852339760 Antoniou, G., van Harmelen, F.: A Semantic Web Primer. Cooperative Information Systems (The MIT Press 2004), ISBN 0262012103 Eisenberg, J.: SVG Essentials (O'Reilly 2002) ISBN 978-0596002237 Bulterman,D., Rutledge, L.: Smil 2.0: Interactive Multimedia for Web and Mobile Devices (Springer 2004) ISBN 354020234 Henning, P.A.: Taschenbuch Multimedia (Hanser 2007), ISBN 978-3446409712
Exams	Written Exam 90 Min. (graded)
Comments	
Lecture Semantic Technologies Laboratory	
Internal number	INFM132
Lecturer	Prof. Dr. Peter Henning
Scope	3 ECTS points, 2 Contact hours
Type/mode	Laboratory Course
Language of instruction	English
Content	Topics covered by practical lab problems include: - XML Basics: Document Type Definition and XML Schema definitions. - Advanced XML techniques: Document Object Model and XPath addressing in documents. The transformation of documents using XSLT. Functional programming in XSLT. - Visualization using XML: SVG and GraphML applied to semantically rich XML documents - Resource Description Framework RDF: Creation of RDF documents, transformation of RDF into XML Schema definition - RDFS, OWL: Basics of ontologies and their application - Machine based reasoning and logical problem solution
Recommended reading	Prerequisites: Students should be participants of the "SemanticWeb Technologies" course, at least should have theoretical knowledge of the topics

	covered. Format: Participation in 2 lab hours per week in small groups of 2-3 students, practical self-study and XML programming. Deliverables: Successful completion (upload to ILIAS in time) of 80% of the lab problems. Counseling: Personal counseling during lab hours, electronic learning managment system ILIAS, weekly online chat in ILIAS, 24 x 7 offline discussion in ILIAS forum, eMail References eLearning content and Books mentioned as course material for browsing, XML Editor oXygen in media::lab, Internet research during lab hours
Exams	Exercise 1 Semester (not graded)
Comments	

Module Management Competence	
Internal number	INFM140
Coordinator	Prof. Dr. rer. pol. Mathias Philipp
Scope	7 ECTS points, 6 Contact hours
Placement	1st Semester
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	none
Competences	In this module the students acquire advanced skills to lead projects with budget and personnel responsibility. Special consideration will be the management of computer science departments or data centers. They are both key skills, as well as practical knowledge in their application in accordance with the standards. There are both key skills as well as the practical implementation of skills in accordance to best practice standards.
Exams	Written Exam 120 Min. (graded)
Lecture IT Project Management	
Internal number	INFM141.a
Lecturer	Prof. Dr. Uwe Haneke
Scope	3 ECTS points, 2 Contact hours
Type/mode	Lecture
Language of instruction	German
Content	The lecture will focus on practice oriented project management and highlight special topics like risk or quality management within the context of project management - Agile project management - Requirements specification in IT-projects - Special aspects of network planning in IT-projects - Risk management - Keeping informed: reporting systems in IT-projects - Quality management
Recommended reading	PowerPoint slides, exercise-sheets, case-studies, continuative information on the web-site and in the ILIAS-eLearning-system.
Exams	Module exam
Comments	Lecture with exercises and case studies; eLearning module for the preparation of the course
Lecture IT Service Management	
Internal number	INFM141.b
Lecturer	Prof. Dr. rer. pol. Mathias Philipp
Scope	2 ECTS points, 2 Contact hours
Type/mode	Lecture
Language of instruction	German

Content	Die Vorlesung gliedert sich in die lebenszyklus orientierten Kapitel: - Grundlagen Entrepreneurship - Geschäftsmodell, Geschäftsplanung und unterneherische Handlungsstrategien - Gründungsprozess, Rechtsformen und Rechtsformenvergleich - Businessplan und Finanzierungsarten - Wachstumsmanagement und Unternehmensentwicklung - Unternehmensverkauf Die Studenten sollen unternehmerische Denken und Handeln von der Entwicklung einer Geschäftsidee über die Gründung eines Unternehmens bis zum Verkauf erlernen.
Recommended reading	Lecture material completely on eLearning platform ILIAS and as pdf documents available, blackboard notes for interactive development of central problem positions, LARS-promoted web based training tool for specific preparations and rework of the lectures with multiple choice questions for every process). All together about 160 questions. List of Acronyms and Glossary of Terms, MindMaps for all processes and the complete lecture.
Exams	Module exam
Comments	Teilnahme am seminaristischen Unterricht. Übungen zum Erstellung eines Geschäftsplans, steuerrechtlich korrekten Fakturierung und Auswah der richtigen Gesellschaftsform.
Lecture Leadership Training	
Internal number	INFM142
Lecturer	Dipl. Inform. (FH) Klaus-Dieter Hüttel
Scope	2 ECTS points, 2 Contact hours
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	Exercise 1 Semester (not graded)
Comments	Seminary lecture, block course after the end of the term

Module Project based scientific Project 1	
Internal number	INFM150
Coordinator	Prof. Dr. Peter Henning
Scope	4 ECTS points, 3 Contact hours
Placement	1st Semester
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	none
Competences	In this module, students acquire skills in scientific and/or project based work under close guidance by a professor. The scientific problem or application project is studied continuously throughout the whole term.
Exams	Individual exams
Lecture Project based scientific Project 1	
Internal number	INFM151
Lecturer	Alle Professoren
Scope	4 ECTS points, 3 Contact hours
Type/mode	Hands-on Experience
Language of instruction	German
Content	Problems and projects may be opened by every faculty member, they are advertized on the message board at the beginning of the term. Scientific research problems usually are at the leading edge of computer science research and may be carried out in cooperation with research institutions. Application projects are of particular relevance for the industrial practice and may be carried out in cooperation with an industrial partner.
Recommended reading	According to project requirements.
Exams	Hands-on Work 1 Semester (graded)
Comments	Prerequisites According to project requirements. Format Presence time and group discussion 30 %, self study 70 %. Oral exam 30 Minutes Counseling In general, a weekly project session involving the whole team is scheduled. The counseling amounts to at least one hour per week and student.

Module Special chapters Media Informatics	
Internal number	INFM220MI
Coordinator	Prof. Dr. Matthias Wölfel
Scope	7 ECTS points, 5 Contact hours
Placement	2nd Semester
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	none
Competences	
Exams	Individual exams
Lecture Special chapters Media Informatics	
Internal number	INFM221MI
Lecturers	Prof. Thomas Hinz Prof. Daniel Schwarz Dr. Tim Schlippe Prof. Dr. Matthias Wölfel
Scope	3 ECTS points, 2 Contact hours
Type/mode	Lecture
Language of instruction	German
Content	
Recommended reading	
Exams	Verbal Exam/Concept 20/1 Min./Semester (graded)
Comments	
Lecture Special chapters Media Informatics Exercise	
Internal number	INFM222MI
Lecturers	Prof. Daniel Schwarz Prof. Dr. Matthias Wölfel Prof. Thomas Hinz
Scope	4 ECTS points, 3 Contact hours
Type/mode	Exercise
Language of instruction	German
Content	
Recommended reading	
Exams	Exercise 1 Semester (not graded)
Comments	

Module Special chapters Maschine Learning	
Internal number	INFM220ML
Coordinator	Prof. Dr. Frank Schaefer
Scope	7 ECTS points, 5 Contact hours
Placement	2nd Semester
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	none
Competences	
Exams	Written/verbal Exam 120/20 Min. (graded)
Lecture Applied Cryptography	
Internal number	INFM221ML.a
Lecturer	Prof. Dr. Frank Schaefer
Scope	2 ECTS points, 2 Contact hours
Type/mode	Lecture
Language of instruction	German
Content	In the course the main cryptographic algorithms are presented. Blockciphers (DES, AES), Modes of Operation (ECB, CBC, Countermode), Hash functions, MACs, public key algorithms (RSA, Diffie-Helman, ElGamal) are covered by the lectures. Then we will look at and analyze applications in IT-security, which use cryptography: E/mail-security (eg. PGP, S-MIME), web-security (SSL), network-security (IP-Sec), authentication mechanisms.
Recommended reading	Claudia Eckert: IT-Sicherheit. Konzepte - Verfahren - Protokolle, München, Oldenbourg Wissenschaftsverlag, 2013, 8. Auflage, ISBN 978-3-486-58270-3.
Exams	Module exam
Comments	The course consist of lectures (around 2/3) and exercises (around 1/3). In the exercises the mathematical techniques introduced in the lecture will be trained.
Lecture Coding Theory	
Internal number	INFM221ML.b
Lecturer	Prof. Dr. Dirk Hoffmann
Scope	3 ECTS points, 2 Contact hours
Type/mode	Lecture
Language of instruction	German
Content	This course teaches foundations about codes and codings as well as basic algorithms for source coding, channel coding and line coding. The lecture focuses on the following topics: information and coding theory, data compression, error detecting and correcting codes, limits of data transmission.
Recommended reading	Slides, blackboard, exercise sheets

Exams	Module exam
Comments	Lecture
Lecture Applied Cryptography Exercise	
Internal number	INFM222ML
Lecturer	Prof. Dr. Frank Schaefer
Scope	2 ECTS points, 1 Contact hours
Type/mode	Exercise
Language of instruction	German
Content	
Recommended reading	
Exams	Exercise 1 Semester (not graded)
Comments	

Module Special chapters Software Engineering	
Internal number	INFM220SE
Coordinator	Prof. Dr. Frank Schaefer
Scope	7 ECTS points, 5 Contact hours
Placement	2nd Semester
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	none
Competences	Understanding of the basic techniques used in applied cryptography and modern coding theory
Exams	Written/verbal Exam 120/20 Min. (graded)
Lecture Applied Cryptography	
Internal number	INFM221SE.a
Lecturer	Prof. Dr. Frank Schaefer
Scope	2 ECTS points, 2 Contact hours
Type/mode	Lecture
Language of instruction	German
Content	In the course the main cryptographic algorithms are presented. Blockciphers (DES, AES), Modes of Operation (ECB, CBC, Countermode), Hash functions, MACs, public key algorithms (RSA, Diffie-Helman, ElGamal) are covered by the lectures. Then we will look at and analyze applications in IT-security, which use cryptography: E/mail-security (eg. PGP, S-MIME), web-security (SSL), network-security (IP-Sec), authentication mechanisms.
Recommended reading	Claudia Eckert: IT-Sicherheit. Konzepte - Verfahren - Protokolle, München, Oldenbourg Wissenschaftsverlag, 2013, 8. Auflage, ISBN 978-3-486-58270-3.
Exams	Module exam
Comments	The course consist of lectures (around 2/3) and exercises (around 1/3). In the exercises the mathematical techniques introduced in the lecture will be trained.
Lecture Coding Theory	
Internal number	INFM221SE.b
Lecturer	Prof. Dr. Dirk Hoffmann
Scope	3 ECTS points, 2 Contact hours
Type/mode	Lecture
Language of instruction	German
Content	This course teaches foundations about codes and codings as well as basic algorithms for source coding, channel coding and line coding. The lecture focuses on the following topics: information and coding theory, data compression, error detecting and correcting codes, limits of data transmission.

Recommended reading	Slides, blackboard, exercise sheets
Exams	Module exam
Comments	Lecture
Lecture Applied Cryptography Exercise	
Internal number	INFM222SE
Lecturer	Prof. Dr. Frank Schaefer
Scope	2 ECTS points, 1 Contact hours
Type/mode	Thesis
Language of instruction	German
Content	
Recommended reading	
Exams	Exercise 1 Semester (not graded)
Comments	

Module Mobile and Distributed Systems	
Internal number	INFM230
Coordinator	Prof. Dr. Oliver P. Waldhorst
Scope	7 ECTS points, 6 Contact hours
Placement	2nd Semester
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	none
Competences	This module enables the students to understand and conceptualize mobile and distributed system architectures. They use and understand the terminology of components, layers, interfaces and standards. Students have command of functional as well as non-functional requirements upon the system and software architecture. Distribution, integration and the interaction of different technologies are also understood.
Exams	Written Exam 120 Min. (graded)
Lecture Mobile Systems	
Internal number	INFM231.a
Lecturer	Prof. Dr. Oliver P. Waldhorst
Scope	2 ECTS points, 2 Contact hours
Type/mode	Lecture
Language of instruction	German
Content	Within the course "mobile systems" the students learn the basics and concepts of mobile computing. The first part of the course introduces the problems and challenges, which one has to solve in mobile computing. The course focuses on mobility support on higher levels. Different variants of client-server architectures are compared, and treated in principle. Also caching strategies, transaction models, and concurrency control concepts are discussed. In the second part the basics of wireless communication and cellular networks are established. Beside the different variants of medium access, infrastructure and services of global cell phone standards (GSM, UMTS, LTE) are discussed, as well as their potential for mobile applications.
Recommended reading	Slides, textbooks, and other literature:

	- Schiller, J. Mobile Communications - Addison-Wesley, 2000. - Walke, B., Althoff M. P. und Seidenberg, P. UMTS - Ein Kurs - Schlembach, 2002. - Pitoura, E and Samaras, G. Data Management for Mobile Computing - Kluwer, 1998. - Roth, J. Mobile Computing: Grundlagen, Technik, Konzepte - dpunkt.verlag, 2002. - Höpfner, H., Türker, C. und König-Ries, B. Mobile Datenbanken und Informationssysteme - dpunkt.verlag, 2005 - Fuchß, Th. Mobile Computing: Grundlagen und Konzepte für mobile Anwendungen - München: Hanser Fachbuchverlag, 2009.
Exams	Module exam
Comments	The lecture will take the form of seminars with exercises.
Lecture Distributed Systems	
Internal number	INFM231.b
Lecturer	Prof. Dr. Christian Zirpins
Scope	2 ECTS points, 2 Contact hours
Type/mode	Lecture
Language of instruction	German
Content	The lecture provides the basic knowledge for the design of distributed information systems. The starting point form general system and software architecture issues, regardless of concrete technologies. Then follows a central theme of the concept of middleware. There is a distinction with regard to application, communication and message-oriented middleware made. As a first concrete technology and to clarify the knowledge learned will be dealt with Web services.
Recommended reading	Powerpoint transparencies, blackboard notes, exercise sheets. Literature: - Hammerschall: Verteilte Informationssysteme (Pearson Studium, 2005 , ISBN 3- 8273 - 7096 -5) - Sebastian Abeck et al. "Verteilte Systeme und Anwendungen" - Ralf Reussner, Wilhelm Hasselbring"Handbuch derSoftware-Architektur"
Exams	Module exam
Comments	Seminaristic lecture, exercises
Lecture Distributed Systems Laboratory	
Internal number	INFM232
Lecturer	Prof. Dr. Christian Zirpins
Scope	3 ECTS points, 2 Contact hours
Type/mode	Laboratory Course
Language of instruction	German
Content	The model is defined jointly for the Distributed Systems Laboratory and the Graphical User Interfaces Laboratory. In this laboratory course, the work is focused on back end development, whereas front end and user interface are developed in the Graphical user Interfaces Laboratory. The concrete problem description is based on current industrial topics, therefore changes in each semester.

Recommended reading	Powerpoint transparencies, tutorial papers for frameworks
Exams	Laboratory Work 1 Semester (not graded)
Comments	Prerequisites Java Web and application components. Persistence layer and DBMS Format Presence time with supported teamwork in the laboratory 50 %, self-study 50 %. Oral exam and presentation. Counseling 2 hours guidance in the lab, introductory lecture, contact hours also according to individual schedule, eMail.

Module Project based scientific Project 2	
Internal number	INFM240
Coordinator	Prof. Dr. Peter Henning
Scope	8 ECTS points, 5 Contact hours
Placement	2nd Semester
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	none
Competences	This module is the continuation of the course "Scientific or project based work I". In this module, students study a scientific problem or application project continuously throughout the whole term. The project may be, but is not necessarily so, a continuation of the problem studied in the first part of the course. In parallel, the students prepare a scientific talk open to the faculty.
Exams	Individual exams
Lecture Project based scientific Project 2	
Internal number	INFM241
Lecturer	Alle Professoren
Scope	6 ECTS points, 3 Contact hours
Type/mode	Hands-on Experience
Language of instruction	German
Content	Problems and projects may be opened by every faculty member, they are advertized on the message board at the beginning of the term. Scientific research problems usually are at the leading edge of computer science research and may be carried out in cooperation with research institutions. Application projects are of particular relevance for the industrial practice and may be carried out in cooperation with an industrial partner.
Recommended reading	According to project requirements.
Exams	Hands-on Work 1 Semester (graded)
Comments	Prerequisites According to project requirements. Format Presence time and group discussion 30 %, self study 70 %. Oral exam 30 Minutes Counseling In general, a weekly project session involving the whole team is scheduled. The counseling amounts to at least one hour per week and student.
Lecture Seminar	
Internal number	INFM242
Lecturer	Alle Professoren
Scope	2 ECTS points, 2 Contact hours
Type/mode	Seminar
Language of instruction	German
Content	According to requirements of counseling professor, in general as extension of

	the scientific or project based work.
Recommended reading	According to project requirements.
Exams	Presentation 20 Min. (graded)
Comments	Preparation of the oral presentation, written report on the subject of the talk. Exam consists of 20 minutes of scientific talk.

Module Thesis with Colloquium	
Internal number	INFM310
Coordinator	Prof. Dr. Peter Henning
Scope	30 ECTS points, 0 Contact hours
Placement	3rd Semester
Pre-requisites with regard to content	none
Pre-requisites according to the examination regulations	none
Competences	The Master's Thesis is the final work of the Master's Program in computer science. It serves as a proof of the acquired skills by addressing and solving a scientic or application problem independently. In general, this is carried out in cooperation with a private company or a public research institution. In particular, within a Master's Thesis the student has to reacher deeper and more completely into his or her field of work, than within a Bachelor's Thesis. Moreover, the Master's Thesis has to contain an abstraction of the field of work that is consistent with a scientific attitude.
Exams	Individual exams
Lecture Thesis	
Internal number	INFM311
Lecturer	Alle Professoren
Scope	29 ECTS points, 0 Contact hours
Type/mode	Thesis
Language of instruction	German
Content	
Recommended reading	
Exams	Master Thesis 6 Months (graded)
Comments	
Lecture Thesis Defense	
Internal number	INFM312
Lecturer	Alle Professoren
Scope	1 ECTS points, 0 Contact hours
Type/mode	Colloquium
Language of instruction	German
Content	
Recommended reading	
Exams	Verbal Exam 30 Min. (not graded)
Comments	