UNIVERSITÄT ZU LÜBECK

Module Guide for the Study Path

Bachelor Media Informatics 2020

Version from 3. April 2023

mathematics

computer science

psychology

media informatics

Robotics and Autonomous Systems

design

MA1000-KP08, MA1000 - Linear Algebra and Discrete Structures 1 (LADS1)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	8

Course of study, specific field and term:

- Minor in Teaching Mathematics, Bachelor of Arts 2023 (compulsory), mathematics, 3rd semester
- Bachelor CLS 2023 (compulsory), mathematics, 1st semester
- Bachelor Biophysics 2024 (compulsory), mathematics, 1st semester
- Bachelor Biophysics 2024 (compulsory), mathematics, 1st semester
- Bachelor MES 2020 (compulsory: aptitude test), mathematics, 1st semester
- Bachelor Media Informatics 2020 (compulsory), mathematics, 3rd semester
- Bachelor Computer Science 2019 (compulsory: aptitude test), mathematics, 1st semester
- Bachelor Robotics and Autonomous Systems 2020 (compulsory: aptitude test), mathematics, 1st semester
- Bachelor Medical Informatics 2019 (compulsory: aptitude test), mathematics, 1st semester
- Minor in Teaching Mathematics, Bachelor of Arts 2017 (compulsory), mathematics, 3rd semester
- Bachelor Computer Science 2016 (compulsory: aptitude test), mathematics, 1st semester
- Bachelor CLS 2016 (compulsory), mathematics, 1st semester
- Bachelor IT-Security 2016 (compulsory), mathematics, 1st semester
- Bachelor Robotics and Autonomous Systems 2016 (compulsory: aptitude test), mathematics, 1st semester
- Bachelor Biophysics 2016 (compulsory: aptitude test), mathematics, 1st semester
- Bachelor Medical Informatics 2014 (compulsory: aptitude test), mathematics, 1st semester
- Bachelor MES 2014 (compulsory: aptitude test), mathematics, 1st semester
- Bachelor Media Informatics 2014 (compulsory: aptitude test), mathematics, 1st semester
- Bachelor Computer Science 2014 (compulsory: aptitude test), mathematics, 1st semester
- Bachelor Medical Informatics 2011 (compulsory: aptitude test), mathematics, 1st semester
- Bachelor Computer Science 2012 (compulsory: aptitude test), mathematics, 1st semester
- Bachelor MES 2011 (compulsory), mathematics, 1st semester
- Bachelor CLS 2010 (compulsory), mathematics, 1st semester

Classes and lectures:

- Linear Algebra and Discrete Structures 1 (lecture, 4 SWS)
- Linear Algebra and Discrete Structures 1 (exercise, 2 SWS)

Workload:

- 125 Hours private studies and exercises
- 90 Hours in-classroom work
- 25 Hours exam preparation

Contents of teaching:

- Fundamentals: logic, sets, mappings
- Relations, equivalence relations, orderings
- Proof by induction
- Groups: fundamentals, finite groups, permutations, matrices
- Rings, fields, congruencies
- Complex numbers: calculus, representation, roots of unity
- Vector spaces: bases, dimension, scalar product, norms

Qualification-goals/Competencies:

- Students understand the fundamental concepts of linear algebra.
- They understand basic thought processes and methods of proof.
- They can explain fundamental relationships in linear algebra.
- They can apply fundamental concepts and methods of proof to algebraic problems.
- They have an understanding of abstract thought processes.
- Interdisciplinary qualifications:
- Students have basic competency in modelling.
- They can transfer fundamental theoretical concepts to similar applications.
- They can work on elementary mathematics problems within a team.
- They can present elementary solutions to their problems to a group.

Grading through:

- written exam

Is requisite for:

- Linear Algebra and Discrete Structures 2 (MA1500-KP08, MA1500)

Responsible for this module:

- Prof. Dr. rer. nat. Jan Modersitzki

Teacher:

- Institute of Mathematics and Image Computing
- Prof. Dr. rer. nat. Jan Modersitzki
- Prof. Dr. rer. nat. Jan Lellmann

Literature:

- G. Fischer: Lineare Algebra: Eine Einführung für Studienanfänger - Vieweg+Teubner
- G. Strang: Lineare Algebra - Springer
- K. Jänich: Lineare Algebra - Springer
- D. Lau: Algebra und diskrete Mathematik I + II - Springer
- G. Strang: Introduction to Linear Algebra - Cambridge Press
- K. Rosen: Discrete Mathematics and Its Applications - McGraw-Hill

Language:

- offered only in German

Notes:

Prerequisites for attending the module:
- None

Prerequisites for the exam:
- Successful completion of homework assignments during the semester
- Successful completion of e-tests during the semester
- Presentation of homework assignment

Module exam:
- MA1000-L1: Linear Algebra and Discrete Structures 1, written exam, 90 min, 100 % of module grade

MA2000-KP08, MA2000 - Analysis 1 (Ana1KP08)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	8

Course of study, specific field and term:

- Bachelor CLS 2023 (compulsory), mathematics, 1st semester
- Minor in Teaching Mathematics, Bachelor of Arts 2023 (compulsory), mathematics, 5th semester
- Bachelor Biophysics 2024 (compulsory: aptitude test), mathematics, 1st semester
- Bachelor MES 2020 (compulsory: aptitude test), mathematics, 1st semester
- Bachelor Media Informatics 2020 (compulsory: aptitude test), mathematics, 1st semester
- Bachelor Computer Science 2019 (compulsory), mathematics, 1st semester
- Bachelor Robotics and Autonomous Systems 2020 (compulsory: aptitude test), mathematics, 1st semester
- Bachelor Medical Informatics 2019 (compulsory), mathematics, 1st semester
- Minor in Teaching Mathematics, Bachelor of Arts 2017 (compulsory), mathematics, 5th semester
- Bachelor Computer Science 2016 (compulsory), mathematics, 1st semester
- Bachelor CLS 2016 (compulsory), mathematics, 1st semester
- Bachelor Robotics and Autonomous Systems 2016 (compulsory: aptitude test), mathematics, 1st semester
- Bachelor IT-Security 2016 (compulsory), mathematics, 1st semester
- Bachelor Biophysics 2016 (compulsory: aptitude test), mathematics, 1st semester
- Bachelor Medical Informatics 2014 (compulsory), mathematics, 1st semester
- Bachelor Media Informatics 2014 (compulsory), mathematics, 1st semester
- Bachelor MES 2014 (compulsory: aptitude test), mathematics, 1st semester
- Bachelor Computer Science 2014 (compulsory), mathematics, 1st semester
- Bachelor Medical Informatics 2011 (compulsory), mathematics, 3rd semester
- Bachelor CLS 2010 (compulsory), mathematics, 1st semester
- Bachelor MES 2011 (compulsory), mathematics, 1st semester
- Bachelor Computer Science 2012 (compulsory), mathematics, 3rd semester

Classes and lectures:

- Analysis 1 (lecture, 4 SWS)
- Analysis 1 (exercise, 2 SWS)

Workload:

- 125 Hours private studies
- 90 Hours in-classroom work
- 25 Hours exam preparation

Contents of teaching:

- Sequences and series
- Functions and continuity
- Differentiability, Taylor series
- Metric and normalized spaces, basic topological concepts
- Multivariate differential calculus

Qualification-goals/Competencies:

- Students understand the basic terms of analysis, especially the concept of convergence.
- Students understand the basic thoughts and proof techniques and are able to use them for the analytical treatment of scientifially or technically motivated problems.
- Students can explain basic relationships in real analysis.
- Students can apply the basic concepts and proof techniques of differential calculus.
- Students have an understanding for abstract structures.
- Interdisciplinary qualifications:
- Students have a basic competence in modeling.
- Students can transfer theoretical concepts to similar applications.
- Students can work as a group on elementary mathematical problems.

Grading through:

- written exam

Is requisite for:

- Analysis 2 (MA2500-KP09)
- Analysis 2 (MA2500-KP08)

- Analysis 2 (MA2500-KP05, MA2500-MLS)
- Analysis 2 (MA2500-KP04, MA2500)

Responsible for this module:

- Prof. Dr. rer. nat. Jürgen Prestin

Teacher:

- Institute for Mathematics

- Prof. Dr. rer. nat. Jürgen Prestin
- Dr. rer. nat. Jörn Schnieder

Literature:

- K. Fritzsche: Grundkurs Analysis 1 + 2
- H. Heuser: Lehrbuch der Analysis 1 + 2
- K. Burg, H. Haf, F. Wille, A. Meister: Höhere Mathematik für Ingenieure
- R. Lasser, F. Hofmaier: Analysis 1 + 2

Language:

- offered only in German

Notes:

Admission requirements for taking the module:
- None

Admission requirements for participation in module examination(s):
- Successful completion of homework assignments during the semester
- Successful completion of e-tests

Modul exam:
- MA2000-L1: Analysis 1, written exam, 90 min, 100 % of module grade

CS1000-KP10, CS1000SJ14 - Introduction to Programming (EinfProg14)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	10

Course of study, specific field and term:

- Bachelor Media Informatics 2020 (compulsory: aptitude test), computer science, 1st semester
- Bachelor Computer Science 2019 (compulsory: aptitude test), foundations of computer science, 1st semester
- Bachelor Robotics and Autonomous Systems 2020 (compulsory), foundations of computer science, 1st semester
- Bachelor Computer Science 2016 (compulsory: aptitude test), foundations of computer science, 1st semester
- Bachelor Robotics and Autonomous Systems 2016 (compulsory), computer science, 1st semester
- Bachelor IT-Security 2016 (compulsory: aptitude test), computer science, 1st semester
- Bachelor Media Informatics 2014 (compulsory: aptitude test), computer science, 1st semester
- Bachelor Computer Science 2014 (compulsory: aptitude test), foundations of computer science, 1st semester

Classes and lectures:

- Introduction to Programming (lecture, 2 SWS)
- Introduction to Programming (exercise, 1 SWS)
- Lab course Java (lecture, 1 SWS)
- Lab course Java (exercise, 2 SWS)
- Java project (programming project, 2 SWS)

Workload:

- 130 Hours private studies
- 120 Hours in-classroom work
- 30 Hours work on project
- 20 Hours exam preparation

Contents of teaching:

- Basic concepts of computer science: representation of information and numbers, hardware, software, operating systems, applications
- Algorithm, Specification, Program
- Syntax und Semantics of Programming Languages
- Basic concepts of imperative and OO programming
- Techniques of secure programming
- Programming in Java including term-long project
- Development environment for Java

Qualification-goals/Competencies:

- Students can easily calculate in 2, 8 and 16 number systems and convert numbers into each other in these systems.
- Students can convert rational and real numbers into floating point numbers and vice versa.
- Students can explain the principles of text encoding in ASCII, Unicode, and UTF-8.
- Students can independently represent the term 'algorithm' and important properties.
- Students can explain the structure and semantics of imperative programs.
- Students master the technique of reading and understanding imperative algorithms and writing them down for simple problems.
- Students can apply basic algorithmic techniques such as iteration and recursion.
- Students are basically able to apply safe programming techniques.
- Students can design, implement and test simple simple programs
- Students can develop and implement solutions satisfying commonly accepted quality standards
- Students can implement limited, but no longer small software development projects in a team.

Grading through:

- written exam
- successful addressing of the project goals

Is requisite for:

- Lab Course Software Engineering (CS2301-KP06, CS2301)
- Software Engineering (CS2300-KP06, CS2300SJ14)
- Algorithms and Data Structures (CS1001-KP08, CS1001)

Responsible for this module:

- Prof. Dr. Stefan Fischer

Teacher:

- Institute of Telematics

- Prof. Dr. Stefan Fischer

Literature:

- H. P. Gumm and M. Sommer: Einführung in die Informatik - Oldenbourg, 10. Auflage, 2012
- G. Goos und W. Zimmermann: Vorlesungen über Informatik (Band 1 und 2) - Springer-Verlag, 2006
- D. J. Barnes und M. Kölling: Java lernen mit BlueJ - Objects first - eine Einführung in Java - 6. Auflage, Pearson Studium, 2017
- T. Stark und G. Krüger: Handbuch der Java-Programmierung - 5. Auflage, Addison-Wesley, 2007
- R. Sedgewick und K. Wayne: Einführung in die Programmierung mit Java - Pearson Studium

Language:

- offered only in German

Notes:

From WS2019 / 20:
Partial Examination CS1000-L1: Introduction to Programming and Programming Course (graded exam, 8 credits)
Partial exam CS1000-L2: Java project (ungraded internship, 2 credits)

Prerequisites for attending the module:
- None

Prerequisites for the exam in CS1000-L1:
- Successful completion of homework assignments during the semester.

Prerequisites for the exam in CS1000-L2:
- None

CS1001-KP08, CS1001 - Algorithms and Data Structures (AuD)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	8

Course of study, specific field and term:

- Bachelor CLS 2023 (compulsory), foundations of computer science, 2nd semester
- Bachelor MES 2020 (optional subject), computer science / electrical engineering
- Bachelor Media Informatics 2020 (compulsory), computer science, 2nd semester
- Bachelor Computer Science 2019 (compulsory: aptitude test), foundations of computer science, 2nd semester
- Bachelor Robotics and Autonomous Systems 2020 (compulsory), computer science, 2nd semester
- Bachelor Medical Informatics 2019 (compulsory), computer science, 2nd semester
- Bachelor Computer Science 2016 (compulsory: aptitude test), foundations of computer science, 2nd semester
- Bachelor CLS 2016 (compulsory), foundations of computer science, 2nd semester
- Bachelor Robotics and Autonomous Systems 2016 (compulsory), computer science, 2nd semester
- Bachelor IT-Security 2016 (compulsory: aptitude test), computer science, 2nd semester
- Bachelor Medical Informatics 2014 (compulsory), computer science, 2nd semester
- Bachelor MES 2014 (optional subject), computer science / electrical engineering, 4th or 6th semester
- Bachelor Media Informatics 2014 (compulsory), foundations of computer science, 2nd semester
- Bachelor Computer Science 2014 (compulsory: aptitude test), foundations of computer science, 2nd semester
- Bachelor Medical Informatics 2011 (compulsory), computer science, 2nd semester
- Bachelor MES 2011 (compulsory), foundations of computer science, 4th semester
- Bachelor CLS 2010 (compulsory), foundations of computer science, 2nd semester
- Bachelor Computer Science 2012 (compulsory: aptitude test), foundations of computer science, 2nd semester

Classes and lectures:

- Algorithms and Data Structures (lecture, 4 SWS)
- Algorithms and Data Structures (exercise, 2 SWS)

Workload:

- 125 Hours private studies
- 90 Hours in-classroom work
- 25 Hours exam preparation

Contents of teaching:

- Sorting, algorithm analysis, heaps
- Distribution sort
- Priority queues
- Sets
- Sets
- Sets of strings
- Disjoint sets
- Associating objects
- Graphs
- Search graph for game playing
- Dynamic Programming principle, greedy algorithms
- Optimization problems, sequence alignment (longest common subsequence), knapsack problem, planning and layout problems, determining change coins, notion of completeness of algorithms
- String matching
- Hard problems
- Pruning and subgraph isomorphism
- Approximation

Qualification-goals/Competencies:

- The students can explain the central ideas, define the relevant concepts and explain the functioning of algorithms with help of application scenarios for all the items listed in contents of teaching.

Grading through:

- written exam

Is requisite for:

- Databases (CS2700-KP04, CS2700)
- Lab Course Software Engineering (CS2301-KP06, CS2301)

- Software Engineering (CS2300-KP06, CS2300SJ14)
- Theoretical Computer Science (CS2000-KP08, CS2000)
- Algorithm Design (CS3000-KP04, CS3000)

Requires:

- Introduction to Programming (CS1000-KP08, CS1000SJ14-MML/MI, CS1000SJ14-MIW)
- Introduction to Programming (CS1000-KP10, CS1000SJ14)

Responsible for this module:

- Prof. Dr. rer. nat. habil. Ralf Möller

Teacher:

- Institute of Information Systems
- Prof. Dr. rer. nat. habil. Ralf Möller

Literature:

- Thomas H. Cormen, Charles E. Leiserson, Ronald Rivest, Clifford Stein: Algorithmen - Eine Einführung - Oldenbourg Verlag, 2013

Language:

- offered only in German

Notes:

Admission requirements for taking the module:
- None (The competencies of the modules listed under 'Requires' are needed for this module, but are not a formal prerequisite.)

Admission requirements for participation in module examination(s):
- Successful completion of exercise sheets as specified at the beginning of the semester.

Module exam(s):
- CS1001-L1: Algorithms and Data Structures, written exam, 90min, 100% of the module grade.

CS1002-KP04, CS1002 - Introduction to Logics (Logik)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	4

Course of study, specific field and term:

- Bachelor MES 2014 (optional subject), computer science / electrical engineering
- Bachelor Media Informatics 2020 (compulsory), computer science, 2nd semester
- Bachelor Computer Science 2019 (compulsory), foundations of computer science, 2nd semester
- Bachelor Robotics and Autonomous Systems 2020 (optional subject), computer science, 5th or 6th semester
- Bachelor Medical Informatics 2019 (compulsory), computer science, 2nd semester
- Bachelor Media Informatics 2014 (optional subject), computer science, 5th or 6th semester
- Bachelor Computer Science 2016 (compulsory), foundations of computer science, 3rd semester
- Bachelor Robotics and Autonomous Systems 2016 (optional subject), computer science, 5th or 6th semester
- Bachelor IT-Security 2016 (compulsory), computer science, 2nd semester
- Bachelor Medical Informatics 2014 (compulsory), computer science, 3rd semester
- Bachelor Computer Science 2014 (compulsory), foundations of computer science, 3rd semester
- Bachelor Medical Informatics 2011 (compulsory), computer science, 1st semester
- Bachelor MES 2011 (optional subject), computer science, 3rd semester
- Bachelor CLS 2010 (optional subject), computer science, 6th semester
- Bachelor Computer Science 2012 (compulsory), foundations of computer science, 1st semester

Classes and lectures:

- Introduction to Logic (lecture, 2 SWS)
- Introduction to Logic (exercise, 1 SWS)

Workload:

- 65 Hours private studies and exercises
- 45 Hours in-classroom work
- 10 Hours exam preparation

Contents of teaching:

- Key concepts of syntax: alphabet, string, term, formula
- Key concepts of semantics: assignment, structure, model
- Key concepts of proof calculus: axioms, proofs
- Formlization and coding of problems
- Validating correctness and satisfiability of formalizations
- Syntax and semantics of propositional logic
- Syntax and semantics of predicate logig
- Proof caculi

Qualification-goals/Competencies:

- Students are abel to explain the concepts of syntax and semantics for the examples of prepositional and predicate logic
- They are able to apply formal systems and proof systems
- They are able to transfer methods of mathematical logic to simple practical problems
- They are abel to formalize discrete problems
- They are able to modify proof templates in order to create simple proofs

Grading through:

- written exam

Responsible for this module:

- Prof. Dr. rer. nat. Till Tantau

Teacher:

- Institute for Theoretical Computer Science
- Prof. Dr. rer. nat. Till Tantau
- Prof. Dr. Rüdiger Reischuk

Literature:

- Uwe Schöning: Logik für Informatiker - Spektrum Verlag, 1995
- Kreuzer, Kühlig: Logik für Informatiker - Pearson Studium, 2006

Language:

- offered only in German

Notes:

Admission requirements for taking the module:
- None

Admission requirements for participation in module examination(s):
- Successful completion of exercise slips as specified at the beginning of the semester.

Module Exam(s):
- CS1002-L1: Introduction to Logic, portfolio exam: a total of 70 points for written exercises down during the course of the semester, 30 points for the written exam at the end. The grade is calculated as follows: 50 to 54 points for a 4.0, then 55 to 59 points for a 3.7 and so on until the end 95 to 100 points for a 1.0.

CS1200-KP06, CS1200SJ14 - Fundamentals of Computer Engineering 1 (TGI1)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	6

Course of study, specific field and term:

- Bachelor MES 2020 (compulsory), computer science, 4th semester
- Bachelor Media Informatics 2020 (compulsory), computer science, 2nd semester
- Bachelor Computer Science 2019 (compulsory), foundations of computer science, 2nd semester
- Bachelor Robotics and Autonomous Systems 2020 (compulsory: aptitude test), computer science, 2nd semester
- Bachelor Medical Informatics 2019 (optional subject), computer science, 4th to 6th semester
- Bachelor Computer Science 2016 (compulsory), foundations of computer science, 2nd semester
- Bachelor Robotics and Autonomous Systems 2016 (compulsory: aptitude test), computer science, 2nd semester
- Bachelor IT-Security 2016 (compulsory), computer science, 2nd semester
- Bachelor Biophysics 2016 (optional subject), computer science, 6th semester
- Bachelor Medical Informatics 2014 (compulsory), computer science, 2nd semester
- Bachelor Media Informatics 2014 (compulsory), computer science, 2nd semester
- Bachelor MES 2014 (compulsory), foundations of computer science, 4th semester
- Bachelor Computer Science 2014 (compulsory), foundations of computer science, 2nd semester

Classes and lectures:

- Fundamentals of Computer Engineering 1 (lecture, 2 SWS)
- Fundamentals of Computer Engineering 1 (exercise, 2 SWS)

Workload:

- 100 Hours private studies
- 60 Hours in-classroom work
- 20 Hours exam preparation

Contents of teaching:

- Von-Neumann computer
- Switching algebra and switching functions
- Technological realization
- Combinatorial and sequential circuits
- Memories
- Microprocessors
- Assembler programming
- Microcontrollers
- Input/Output programming
- Basic processor architectures

Qualification-goals/Competencies:

- The students can explain the principal organization of a computer and the execution of a program according to the Von-Neumann principle.
- They can elucidate the principal functioning of combinatorial and sequential circuits and describe them formally using switching algebra.
- They can demonstrate the basic circuits for the technological realization of logic gates with bipolar and MOS transistors.
- They can explain the structure and operation of registers and memories.
- They can elucidate the instruction set of a microprocessor exemplarily and to be able to use it for assembly programming.
- Sie können die Ein/Ausgabe-Schnittstellen eines Mikrocontrollers beschreiben und in Assemblersprache programmieren (mit Polling bzw. Interrupt).
- They can program microcontrollers for simple applications in assembly language and in C.
- They can discuss and compare basic processor architectures and their instruction sets.

Grading through:

- written exam

Is requisite for:

- Embedded Systems (CS2101-KP04, CS2101)
- Computer Architecture (CS2100-KP04, CS2100SJ14)
- Fundamentals of Computer Engineering 2 (CS1202-KP06, CS1202)

Responsible for this module:

- Prof. Dr.-Ing. Mladen Berekovic

Teacher:

- Institute of Computer Engineering

- Dr.-Ing. Kristian Ehlers
- Prof. Dr.-Ing. Mladen Berekovic

Literature:

- C. Hamacher, Z. Vranesic, S. Zaky, N. Manjikian: Computer Organisation and Embedded Systems - McGraw-Hill 2012
- M. M. Mano, C. R. Kime: Logic and Computer Design Fundamentals - Pearson 2007
- D. A. Patterson, J. L. Hennessy: Computer Organisation & Design - The Hardware/Software Interface - Morgan Kaufmann 2011
- T. Ungerer, U. Brinkschulte: Mikrocontroller und Mikroprozessoren - Springer 2010

Language:

- offered only in German

Notes:

Admission requirements for taking the module:
- None

Admission requirements for participation in module examination(s):
- Successful completion of practical exercises as specified at the beginning of the semester.

Module examination(s):
- CS1200-L1: Technical Foundations of Computer Science 1, written exam 120min, 100% of module grade.

CS1202-KP06, CS1202 - Fundamentals of Computer Engineering 2 (TGI2)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	6

Course of study, specific field and term:

- Bachelor MES 2020 (compulsory), computer science, 5th semester
- Bachelor Media Informatics 2020 (optional subject), computer science, 5th or 6th semester
- Bachelor Computer Science 2019 (compulsory), foundations of computer science, 3rd semester
- Bachelor Robotics and Autonomous Systems 2020 (compulsory), computer science, 3rd semester
- Bachelor Medical Informatics 2019 (optional subject), computer science, 4th to 6th semester
- Bachelor Computer Science 2016 (compulsory), foundations of computer science, 3rd semester
- Bachelor Robotics and Autonomous Systems 2016 (compulsory), computer science, 3rd semester
- Bachelor Medical Informatics 2014 (optional subject), computer science, 5th or 6th semester
- Bachelor Media Informatics 2014 (optional subject), computer science, 5th or 6th semester
- Bachelor MES 2014 (compulsory), foundations of computer science, 5th semester
- Bachelor Computer Science 2014 (compulsory), foundations of computer science, 3rd semester
- Bachelor IT-Security 2016 (optional subject), specific, Arbitrary semester

Classes and lectures:

- Fundamentals of Computer Engineering 2 (lecture, 2 SWS)
- Fundamentals of Computer Engineering 2 (exercise, 2 SWS)

Workload:

- 100 Hours private studies
- 60 Hours in-classroom work
- 20 Hours exam preparation

Contents of teaching:

- Design of combinatorial circuits
- Design of sequential circuits
- Hardware description languages
- Register-transfer languages
- Data paths
- Control units
- Microprogramming
- CPUs
- Semiconductor components and circuit families
- Integrated circuits
- Programmable logic (CPLDs, FPGAs)
- CAD-tools for circuit design

Qualification-goals/Competencies:

- The students can formally describe and design combinatorial and sequential circuits on gate level.
- They can use hardware description languages, particularly VHDL, for the modelling of simple circuits.
- They can formally describe and design sequential circuits with control unit and data path on register-transfer level.
- They can exploit microprogramming for the realization of control units.
- They can design simple processors (CPUs).
- They can elucidate and judge the most important technologies for the realization of simple digital circuits (bipolar, MOS, CMOS).
- They can describe and judge integrated circuits, in particular programmable logic like FPGAs.
- They can use CAD-tools to design, to simulate and to implement digital circuits on FPGAs.

Grading through:

- written exam

Is requisite for:

- Computer-Aided Design of Digital Circuits (CS3110-KP04, CS3110)

Requires:

- Fundamentals of Computer Engineering 1 (CS1200-KP06, CS1200SJ14)

Responsible for this module:

- Prof. Dr.-Ing. Mladen Berekovic

Teacher:

- Institute of Computer Engineering

- Dr.-Ing. Kristian Ehlers
- Prof. Dr.-Ing. Mladen Berekovic

Literature:

- T.L. Floyd: Digital Fundamentals - A Systems Approach - Pearson 2012
- M. M. Mano, C. R. Kime: Logic and Computer Design Fundamentals - Pearson 2007
- C. H. Roth, L.L. Kinney: Fundamentals of Logic Design - Cengage Learning 2009

Language:

- offered only in German

Notes:

Prerequisites for attending the module:
- None

Prerequisites for the exam:
- Successful completion of homework assignments during the semester
- continuous, successful participation in practical course

CS2000-KP08, CS2000 - Theoretical Computer Science (TI)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	8

Course of study, specific field and term:

- Bachelor Media Informatics 2020 (compulsory), computer science, 3rd semester
- Bachelor Computer Science 2019 (compulsory), foundations of computer science, 3rd semester
- Bachelor Robotics and Autonomous Systems 2020 (optional subject), computer science, 5th or 6th semester
- Bachelor Medical Informatics 2019 (compulsory), computer science, 3rd semester
- Bachelor Computer Science 2016 (compulsory), foundations of computer science, 3rd semester
- Bachelor Robotics and Autonomous Systems 2016 (optional subject), computer science, 5th or 6th semester
- Bachelor IT-Security 2016 (compulsory), computer science, 3rd semester
- Bachelor MES 2011 (optional subject), computer science, 5th semester
- Bachelor Medical Informatics 2014 (compulsory), computer science, 3rd semester
- Bachelor Computer Science 2014 (compulsory), foundations of computer science, 3rd semester
- Bachelor Media Informatics 2014 (compulsory), computer science, 3rd semester
- Bachelor Medical Informatics 2011 (compulsory), computer science, 3rd semester
- Bachelor Computer Science 2012 (compulsory), foundations of computer science, 3rd semester

Classes and lectures:

- Theoretical Computer Science (lecture, 4 SWS)
- Theoretical Computer Science (exercise, 2 SWS)

Workload:

- 135 Hours private studies and exercises
- 90 Hours in-classroom work
- 15 Hours exam preparation

Contents of teaching:

- Formalization of problems using languages
- formal grammars
- regular languages, finite automata
- context free language, push down automata
- sequential computational models: Turing machines, register machines
- sequential complexity classes
- simulations, reductions, completeness
- satisfiability problem, NP-completeness
- (In-)decidability and enumerability
- halting problem and Church-Turing thesis

Qualification-goals/Competencies:

- Students are able to present the theoretical foundation of syntax and operational semantics of programming languages
- They are able to transform formalizations using theorems of theoretical computer science.
- They can classify problems according to their computational complexity
- They are able to model algorithmic problems and solve them using appropriate tools
- They can judge what computer science can and cannot achieve in principle

Grading through:

- written exam and course achievements

Is requisite for:

- Parallel Computing (CS3051-KP04, CS3051)

Requires:

- Algorithms and Data Structures (CS1001-KP08, CS1001)
- Introduction to Programming (CS1000-KP08, CS1000SJ14-MML/MI, CS1000SJ14-MIW)
- Introduction to Programming (CS1000-KP10, CS1000SJ14)

Responsible for this module:

- Prof. Dr. Rüdiger Reischuk

Teacher:

- Institute for Theoretical Computer Science

- Prof. Dr. Rüdiger Reischuk
- Prof. Dr. rer. nat. Till Tantau
- Prof. Dr. Maciej Liskiewicz

Literature:

- J. Hopcroft, R. Motwani, J. Ullman: Introduction to Automata Theory, Languages and Computation - Addison Wesley, 2001

Language:

- offered only in German

Notes:

Admission requirements for taking the module:
- None (the competences of the modules indicated under

CS2100-KP04, CS2100SJ14 - Computer Architecture (RA14)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	4

Course of study, specific field and term:

- Bachelor Media Informatics 2020 (optional subject), computer science, 5th or 6th semester
- Bachelor Computer Science 2019 (compulsory), foundations of computer science, 4th semester
- Bachelor Robotics and Autonomous Systems 2020 (optional subject), computer science, 5th or 6th semester
- Bachelor Medical Informatics 2019 (optional subject), computer science, 4th to 6th semester
- Bachelor Computer Science 2016 (compulsory), foundations of computer science, 4th semester
- Bachelor Robotics and Autonomous Systems 2016 (optional suject), computer science, 4th semester
- Bachelor IT-Security 2016 (compulsory), computer science, 4th semester
- Bachelor Medical Informatics 2014 (optional subject), computer science, 5th or 6th semester
- Bachelor Computer Science 2014 (compulsory), foundations of computer science, 4th semester

Classes and lectures:

- Computer Architecture (lecture, 2 SWS)
- Computer Architecture (exercise, 1 SWS)

Workload:

- 60 Hours private studies
- 45 Hours in-classroom work
- 15 Hours exam preparation

Contents of teaching:

- Basic terms and concepts
- Processor architectures
- Computer components
- Parallel computer architectures
- Multiprocessors, multicomputer
- Vector processors, array processors
- Performance evaluation

Qualification-goals/Competencies:

- The students are able to elucidate the microarchitecture of modern processors and the corresponding methods for performance enhancement (caches, pipelining, VLIW, multi/manycore, virtualization etc.).
- They are able to explain important computer components (busses, storage hierachies, I/O-units).
- They are able to discuss and compare the most important parallel computer architectures (multiprocessors, multicomputers, vector computers, array computers etc.).
- They are able to judge and make use of methods for performance evaluation (benchmarks, monitoring, queuing models etc.).

Grading through:

- Written or oral exam as announced by the examiner

Requires:

- Fundamentals of Computer Engineering 1 (CS1200-KP06, CS1200SJ14)

Responsible for this module:

- Prof. Dr.-Ing. Mladen Berekovic

Teacher:

- Institute of Computer Engineering
- Prof. Dr.-Ing. Mladen Berekovic

Literature:

- J.L. Hennessy, D.A. Patterson: Computer Architecture - A Quantitative Approach - Morgan Kaufmann 2011
- D.A. Patterson, J.L. Hennessy: Rechnerorganisation und -entwurf - Die Hardware/Software-Schnittstelle - Pearson Studium 2012
- W. Stallings: Computer Organization and Architecture - Pearson Education 2012
- A.S. Tanenbaum, T. Austin: Structured Computer Organization - Pearson Education 2012

Language:

- offered only in German

Notes:

Admission requirements for taking the module:
- None (the competencies of the modules listed under

CS2150-KP08, CS2150SJ14 - Operating Systems and Networks (BSNetze14)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	8

Course of study, specific field and term:

- Bachelor Media Informatics 2020 (compulsory), computer science, 4th semester
- Bachelor Computer Science 2019 (compulsory), foundations of computer science, 4th semester
- Bachelor Robotics and Autonomous Systems 2020 (compulsory), computer science, 4th semester
- Bachelor Medical Informatics 2019 (compulsory), computer science, 4th semester
- Bachelor Computer Science 2016 (compulsory), foundations of computer science, 4th semester
- Bachelor Robotics and Autonomous Systems 2016 (compulsory), computer science, 4th semester
- Bachelor IT-Security 2016 (compulsory), computer science, 4th semester
- Bachelor Media Informatics 2014 (compulsory), foundations of computer science, 4th semester
- Bachelor Medical Informatics 2014 (compulsory), computer science, 4th semester
- Bachelor Computer Science 2014 (compulsory), foundations of computer science, 4th semester

Classes and lectures:

- Operating Systems and Networks (lecture, 4 SWS)
- Operating Systems and Networks (exercise, 2 SWS)

Workload:

- 130 Hours private studies
- 90 Hours in-classroom work
- 20 Hours exam preparation

Contents of teaching:

- Tasks and Structure
- Historical Overview of Computer and Operating Systems
- Coding of Symbols and Numbers
- Foundations of Operating Systems
- Processes, Inter-Process Communication and Process Management
- Storage Management
- Input / Output
- Files and File Systems
- Examples (UNIX, Windows, mobile OS)
- Computer Networks and the Internet
- Application Layer
- Transport Layer
- Network Layer
- Link and Physical Layer

Qualification-goals/Competencies:

- Students know about the main concepts of operating systems.
- Students are able to judge, which OS concepts can be appropriately applied to novel computing architectures.
- Students are able to apply the most important strategies and algorithms for operating systems.
- At the end of the course, students know the most important concepts ofcomputer networks
- Students know the importance of the different layers of the OSI andInternet protocol suite along with the most important protocols and services of each layer
- The students are able decide which network technologies to use to meetthe requirements of any given application scenario
- The students know how the Internet works and are able to program smallapplications
- Students can apply the most important methods and algorithms from thefield of networks

Grading through:

- written exam

Responsible for this module:

- Prof. Dr. Stefan Fischer

Teacher:

- Institute of Telematics
- Prof. Dr. Stefan Fischer

- Dr. rer. nat. Florian-Lennert Lau

Literature:

- Andrew S. Tanenbaum: Moderne Betriebssysteme - 3., aktualisierte Auflage, Pearson, April 2009
- James Kurose, Keith Ross: Computer Networking - Der Top-Down-Ansatz - Pearson Studim, 2012
- Andrew S. Tanenbaum: Computernetzwerke - Pearson Studium, 2012

Language:

- offered only in German

Notes:

Admission requirements for taking the module:
- None

Admission requirements for participation in module examination(s):
- Successful completion of exercise assignments as specified at the beginning of the semester.

Module Exam(s):
- CS2150-L1: Operating Systems and Networks, written exam, 90min, 100% of the module grade.

CS2250-KP04 - Cybersecurity (CyberSec04)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	4

Course of study, specific field and term:

- Bachelor MES 2020 (optional subject), computer science / electrical engineering
- Bachelor Media Informatics 2020 (optional subject), computer science, 5th or 6th semester
- Bachelor Computer Science 2019 (compulsory), foundations of computer science, 4th semester
- Bachelor Robotics and Autonomous Systems 2020 (optional subject), computer science, 5th or 6th semester
- Bachelor Medical Informatics 2019 (optional subject), computer science, 4th to 6th semester

Classes and lectures:

- Cybersecurity (lecture, 2 SWS)
- Cybersecurity (exercise, 1 SWS)

Workload:

- 60 Hours private studies and exercises
- 40 Hours in-classroom work
- 20 Hours exam preparation

Contents of teaching:

- Security problems in IT systems
- Security threats, risk analysis and defense mechanisms
- Software and application security
- Security of operating systems
- Security of databases and web applications
- Privacy
- Security oriented development, evaluation and penetration testing
- Legal, etical and economic aspects

Qualification-goals/Competencies:

- Students can independently identify security risks of software systems and explain the common security solutions from the areas discussed in the course.
- They can explain the basic methods in the area of cybersecurity and apply them to case studies.
- They can independently perform security analyses for simple scenarios.
- They are able to identify methods for eliminating weak points and implement concrete solutions.

Grading through:

- Written or oral exam as announced by the examiner

Responsible for this module:

- Prof. Dr. Thomas Eisenbarth

Teacher:

- Institute for IT Security
- Prof. Dr. Thomas Eisenbarth

Literature:

- C. Paar, J. Pelzl: Understanding Cryptography - Springer, 2008
- D. Gollmann: Computer Security - Third Edition, Wiley, 2011
- R. Anderson: Security Engineering - Second Edition, Wiley, 2008
- M. Bishop: Introduction to Computer Security - Addison-Wesley, 2005

Language:

- offered only in German

Notes:

Admission requirements for taking the module:
- None

Admission requirements for participation in module examination(s):
- Successful completion of exercise sheets as specified at the beginning of the semester.

Module Exam(s):
- CS2250-L1 Cybersecurity, written exam, 90min, 100% of module grade.

The courses of this module are also part of CS2250-KP08.

CS2300-KP06, CS2300SJ14 - Software Engineering (SWEng14)

Duration:	Turnus of offer:	Credit points:	Max. group size:
1 Semester	each winter semester	6	12

Course of study, specific field and term:

- Bachelor Media Informatics 2020 (compulsory), computer science, 3rd semester
- Bachelor Computer Science 2019 (compulsory), foundations of computer science, 3rd semester
- Bachelor Robotics and Autonomous Systems 2020 (compulsory), computer science, 3rd semester
- Bachelor Medical Informatics 2019 (compulsory), computer science, 3rd semester
- Bachelor Robotics and Autonomous Systems 2016 (compulsory), computer science, 3rd semester
- Bachelor IT-Security 2016 (compulsory), computer science, 3rd semester
- Bachelor Biophysics 2016 (optional subject), computer science, 5th semester
- Bachelor Computer Science 2016 (compulsory), foundations of computer science, 3rd semester
- Bachelor Media Informatics 2014 (compulsory), foundations of computer science, 3rd semester
- Bachelor Medical Informatics 2014 (compulsory), computer science, 3rd semester
- Bachelor Computer Science 2014 (compulsory), foundations of computer science, 3rd semester

Classes and lectures:

- Software Engineering (lecture, 3 SWS)
- Software Engineering (exercise, 1 SWS)

Workload:

- 100 Hours private studies and exercises
- 60 Hours in-classroom work
- 20 Hours exam preparation

Contents of teaching:

- overview on major fields of software engineering
- Software development, software process models
- Project plan and workload estimation
- Software management and quality assurance
- System Analysis and requirements analysis
- Basics of UML
- Software architectures and design patterns
- Validation and verification
- Legal aspects: copyright, standards, liability, licenses

Qualification-goals/Competencies:

- The students understand software design as an engineering process.
- They can argue about major software process models.
- They can explain important techniques and factors of software management.
- They can describe and evaluate measures for quality ensurance.
- They are able to model software systemson different levels of abtraction.
- They can apply the basic concepts of object-oriented modelling and design.
- They are able to apply design patterns in a useful way.
- They can discuss about legal aspects of software development.

Grading through:

- Written or oral exam as announced by the examiner

Is requisite for:

- Safe Software (CS3250-KP08)
- Lab Course Software Engineering (CS2301-KP06, CS2301)

Requires:

- Algorithms and Data Structures (CS1001-KP08, CS1001)
- Introduction to Programming (CS1000-KP10, CS1000SJ14)

Responsible for this module:

- Prof. Dr. Martin Leucker

Teacher:

- Institute of Software Technology and Programming Languages
- Prof. Dr. Martin Leucker

Literature:

- H. Balzert: Lehrbuch der Software-Technik: Software-Entwicklung - Spektrum Akademischer Verlag 2001
- B. Brügge, A. H. Dutoit: Objektorientierte Softwaretechnik mit UML, Entwurfsmustern und Java - Pearson Studium 2004
- I. Sommerville: Software Engineering - Addison-Wesley 2006
- B. Oestereich: Analyse und Design mit der UML 2.1 - Objektorientierte Softwareentwicklung - Oldenbourg 2006
- D. Bjorner: Software Engineering 1-3 - Springer 2006

Language:

- offered only in German

Notes:

Admission requirements for taking the module:
- None (the competences of the modules mentioned under Requires are needed for this module, but are not a formal prerequisite).

Admission requirements for participation in module examination(s):
- Successful completion of exercises as specified at the beginning of the semester.

Module exam(s):
- CS2300-L1: Software Engineering, written exam, 90min, 100% of the module grade.

Passing this module is a formal requirement for participation in the module CS2301-KP06 Lab Course Software Engineering. It is recommended to do the internship directly in the following semester.

CS2301-KP06, CS2301 - Lab Course Software Engineering (SWEngPrakt)

Duration:	Turnus of offer:	Credit points:	Max. group size:
1 Semester	each summer semester	6 (Typ A)	12

Course of study, specific field and term:

- Bachelor Media Informatics 2020 (compulsory), computer science, 4th semester
- Bachelor Computer Science 2019 (compulsory), foundations of computer science, 4th semester
- Bachelor Robotics and Autonomous Systems 2020 (compulsory), computer science, 4th semester
- Bachelor Medical Informatics 2019 (compulsory), computer science, 4th semester
- Bachelor Computer Science 2016 (compulsory), foundations of computer science, 4th semester
- Bachelor Robotics and Autonomous Systems 2016 (compulsory), computer science, 4th semester
- Bachelor IT-Security 2016 (compulsory), computer science, 4th semester
- Bachelor Media Informatics 2014 (compulsory), foundations of computer science, 4th semester
- Bachelor Medical Informatics 2014 (compulsory), computer science, 4th semester
- Bachelor Computer Science 2014 (compulsory), foundations of computer science, 4th semester

Classes and lectures:

- Lab Course Software Engineering (practical course, 4 SWS)

Workload:

- 60 Hours in-classroom work
- 60 Hours group work
- 50 Hours work on project
- 10 Hours oral presentation and discussion (including preparation)

Contents of teaching:

- Realization of a software system
- Project management and team work
- Design, implementation and testing

Qualification-goals/Competencies:

- The students are able to systematically design software systems whose implemention meets the requirements, using object oriented techniques.
- They can use UML and CASE tools.
- They can decide how to advance their software in a sensible way.
- They can contribute their experience in the realization of a software development project in further projects.
- They have the qualification to present artefacts, to comply tostandards and to observe time limits.
- They are qualified to work in a team and to reflect their social skills.

Grading through:

- continuous, successful participation in practical course
- presentation
- successful addressing of the project goals
- documentation

Requires:

- Introduction to Programming (CS1000-KP10, CS1000SJ14)
- Algorithms and Data Structures (CS1001-KP08, CS1001)
- Software Engineering (CS2300-KP06, CS2300SJ14)

Responsible for this module:

- Prof. Dr. Martin Leucker

Teacher:

- Institute of Software Technology and Programming Languages
- Prof. Dr. Martin Leucker

Literature:

- H. Balzert: Lehrbuch der Softwaretechnik: Softwaremanagement - Spektrum Akademischer Verlag 2008

- B. Brügge, A. H. Dutoit: Objektorientierte Softwaretechnik mit UML, Entwurfsmustern und Java - Pearson Studium 2004
- I. Sommerville: Software Engineering - Addison-Wesley 2012
- B. Oestereich: Analyse und Design mit der UML 2.3 - Objektorientierte Softwareentwicklung - Oldenbourg 2009

Language:

- offered only in German

Notes:

Admission requirements for taking the module:
- Passing the module CS2300-KP06 Software Engineering is a prerequisite for taking this module.

It is recommended to take this practical course directly after CS2300-KP06 Software Engineering.

Admission requirements for participation in module examination(s):
- Successful participation in the internship as specified at the beginning of the semester.

Module Exam(s):
- CS2301-L1: Internship Software Engineering, graded internship, 100% of module grade.

CS2700-KP04, CS2700 - Databases (DB)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	4

Course of study, specific field and term:

- Bachelor MES 2020 (optional subject), computer science / electrical engineering
- Bachelor Media Informatics 2020 (compulsory), computer science, 5th semester
- Bachelor Computer Science 2019 (compulsory), foundations of computer science, 3rd semester
- Bachelor Robotics and Autonomous Systems 2020 (optional subject), computer science, 5th or 6th semester
- Bachelor Medical Informatics 2019 (compulsory), computer science, 3rd semester
- Bachelor Computer Science 2016 (compulsory), foundations of computer science, 4th semester
- Bachelor Robotics and Autonomous Systems 2016 (optional subject), computer science, 5th or 6th semester
- Bachelor IT-Security 2016 (compulsory), computer science, 3rd semester
- Bachelor Biophysics 2016 (optional subject), computer science, 6th semester
- Bachelor MES 2011 (optional subject), computer science, 4th or 6th semester
- Bachelor Medical Informatics 2014 (compulsory), computer science, 4th semester
- Bachelor MES 2014 (optional subject), computer science / electrical engineering, 4th or 6th semester
- Bachelor Media Informatics 2014 (compulsory), foundations of computer science, 4th semester
- Bachelor Computer Science 2014 (compulsory), foundations of computer science, 4th semester
- Bachelor Medical Informatics 2011 (compulsory), computer science, 2nd semester
- Master CLS 2010 (optional subject), computer science, 2nd semester
- Bachelor CLS 2010 (optional subject), computer science, 6th semester
- Bachelor Computer Science 2012 (compulsory), foundations of computer science, 4th semester

Classes and lectures:

- Databases (lecture, 2 SWS)
- Databases (exercise, 1 SWS)

Workload:

- 55 Hours private studies
- 45 Hours in-classroom work
- 20 Hours exam preparation

Contents of teaching:

- Introduction, conceptual view of database systems, conceptual data modeling with the Entity-Relationship (ER) modeling language
- The relational data model* Referential integrity, keys, foreign keys, functional dependencies (FDs)* Canonical mapping of entity types and relationships into the relational data model* Update, insertions, and deletion anomalies* Relational algebra as a query language* Database normalization, closure w.r.t. FD set, canonical cover of FD sets, normal forms, correct and dependency preserving decomposition of relation schemata, multi-value dependencies, inclusion dependencies
- Practical query language: SQL* Selection, projection, join, aggregation, grouping, sorting, difference, relational algebra in SQL* Data management* Integrity constraints
- Storage structures and database architecture* Characteristics of storage media, I/O complexity* DBMS architecture: disk space manager, buffer manager, files and access methods, record allocation strategies (row-wise, column-wise, mixed)
- Query processing* Indexing techniques, ISAM index, B+-tree index, hash index* Sorting: Two-way merge sort, blockwise processing, selection trees, query execution plans, join operator: nested loops join, blockwise nested loops join, index-based joins, sort-merge join, partition-based join with hashing* Addition operators: grouping and duplicate elimination, selection, projection, pipeline principle
- Datalog* Syntax, semantics, treatment of negation (stratification)* Evaluation strategies (naive, semi naive, magic set transformation)
- Query optimization* Cost metrics, Estimating sizes of intermediate tables, selectivity* Join optimization, physical plan properties, interesting orders, query transformation* Index cuts, bitmap indexes
- Transactions and recovery* ACID, anomalies, serializability, locks, 2-phase commit protocol, concurrent access to index structures, isolation levels* Implementation of transaction w.r.t. ACID, shadow pages, write ahead log, snapshots

Qualification-goals/Competencies:

- For all subjects mentioned in the course contents under the indents students should name the central ideas, which can define relevant terms and explain the functioning of algorithms by means of application examples.

Grading through:

- written exam

Is requisite for:

- Nonstandard Databases and Data Mining (CS3130-KP08)
- Nonstandard Database Systems (CS3202-KP04, CS3202)

Requires:

- Algorithms and Data Structures (CS1001-KP08, CS1001)
- Introduction to Programming (CS1000-KP08, CS1000SJ14-MML/MI, CS1000SJ14-MIW)
- Introduction to Programming (CS1000-KP10, CS1000SJ14)

Responsible for this module:

- Prof. Dr. rer. nat. habil. Ralf Möller

Teacher:

- Institute of Information Systems
- Prof. Dr. rer. nat. habil. Ralf Möller

Literature:

- A. Kemper, A, Eickler: Datenbanksysteme - Eine Einführung - Oldenbourg-Verlag

Language:

- offered only in German

Notes:

Admission requirements for taking the module:
- None (the competences of the modules mentioned under "requires" are needed for this module, but are not a formal prerequisite).

Admission requirements for participation in module examination(s):
- Successful completion of exercise sheets as specified at the beginning of the semester.

Module Exam(s):
- CS2700-L1: Databases, written exam, 90min, 100% of the module grade.

CS3050-KP04, CS3050 - Coding and Security (CodeSich)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	4

Course of study, specific field and term:

- Bachelor Computer Science 2019 (optional subject), major subject informatics, Arbitrary semester
- Bachelor Computer Science 2019 (compulsory), Canonical Specialization Web and Data Science, 2nd semester
- Bachelor Computer Science 2019 (optional subject), Canonical Specialization SSE, 2nd semester
- Bachelor Media Informatics 2020 (optional subject), computer science, 5th or 6th semester
- Bachelor Robotics and Autonomous Systems 2020 (optional subject), computer science, 6th semester
- Bachelor Medical Informatics 2019 (optional subject), computer science, 4th to 6th semester
- Bachelor Computer Science 2016 (optional subject), major subject informatics, Arbitrary semester
- Bachelor Computer Science 2016 (optional subject), Canonical Specialization Web and Data Science, 2nd semester
- Bachelor Computer Science 2016 (optional subject), Canonical Specialization SSE, 2nd semester
- Bachelor Robotics and Autonomous Systems 2016 (optional subject), computer science, 6th semester
- Bachelor IT-Security 2016 (compulsory), IT-Security, 4th semester
- Bachelor Medical Informatics 2014 (optional subject), computer science, 5th or 6th semester
- Bachelor Media Informatics 2014 (optional subject), computer science, 5th or 6th semester
- Master CLS 2010 (optional suject), computer science, Arbitrary semester

Classes and lectures:

- Coding and Security (lecture, 2 SWS)
- Coding and Security (exercise, 1 SWS)

Workload:

- 65 Hours private studies and exercises
- 45 Hours in-classroom work
- 10 Hours exam preparation

Contents of teaching:

- information, entropie
- discrete sources and channels
- coding systems, error-tolerant codes
- codes for digital media, compression
- threats to IT-systems
- formal definition of security properties
- security primitives

Qualification-goals/Competencies:

- The students can explain and apply the basics of information and coding theory
- They can explain the concept of information.
- They are able to model information sources and communication networks.
- They know the most important codes and are familiar with their specific design principles and properties.
- They know basic scenarios of attacks and protection methods.

Grading through:

- written exam

Requires:

- Linear Algebra and Discrete Structures 1 (MA1000-KP08, MA1000)

Responsible for this module:

- Prof. Dr. Rüdiger Reischuk

Teacher:

- Institute for Theoretical Computer Science

- Prof. Dr. Rüdiger Reischuk
- Prof. Dr. Maciej Liskiewicz

Literature:

- D. Hoffmann: Einführung in die Informations- und Codierungstheorie - Springer Vieweg 2014

- D. Salomon: Coding for Data and Computer Communications - Springer 2005
- D. Salomon: Data Privacy and Security - Springer 2003
- M. Stamp: Information Security: Principles and Practice - Wiley 2006
- R. Roth: Introduction to Coding Theory - Cambridge Univ. Press 2006

Language:

- German and English skills required

Notes:

Admission requirements for taking the module:
- None (the competencies of the modules listed under

CS3051-KP04, CS3051 - Parallel Computing (ParallelVa)

Duration:	Turnus of offer:	Credit points:
1 Semester	normally each year in the summer semester	4

Course of study, specific field and term:

- Bachelor Computer Science 2019 (optional subject), major subject informatics, Arbitrary semester
- Bachelor Computer Science 2019 (optional subject), Canonical Specialization SSE, 4th semester
- Bachelor Media Informatics 2020 (optional subject), computer science, 5th or 6th semester
- Bachelor Robotics and Autonomous Systems 2020 (optional subject), computer science, 5th or 6th semester
- Bachelor Computer Science 2016 (optional subject), Canonical Specialization Web and Data Science, 4th semester
- Bachelor Computer Science 2016 (optional subject), major subject informatics, Arbitrary semester
- Bachelor Computer Science 2016 (optional subject), Canonical Specialization SSE, 4th semester
- Bachelor Robotics and Autonomous Systems 2016 (optional subject), computer science, 5th or 6th semester
- Bachelor IT-Security 2016 (optional subject), computer science, Arbitrary semester
- Master Medical Informatics 2014 (optional subject), computer science, 1st or 2nd semester
- Bachelor Computer Science 2014 (optional subject), central topics of computer science, 5th or 6th semester
- Master Computer Science 2012 (optional subject), advanced curriculum programming, 2nd and 3rd semester
- Bachelor Computer Science 2012 (optional subject), central topics of computer science, 5th or 6th semester
- Master Computer Science 2012 (optional subject), advanced curriculum algorithmics and complexity theory, 2nd or 3rd semester

Classes and lectures:

- Parallel Computing (lecture, 2 SWS)
- Parallel Computing (exercise, 1 SWS)

Workload:

- 65 Hours private studies and exercises
- 45 Hours in-classroom work
- 10 Hours exam preparation

Contents of teaching:

- Parallel architectures
- Programming language support for parallel programming
- Design methodologies for parallel algorithms
- Implementation of parallel algorithms
- Parallel search and sorting
- Parallel graph algorithms
- Parallel formula evaluation
- Speedup, efficiency, parallel complexity classes
- Limits of parallelism and lower bounds

Qualification-goals/Competencies:

- Studentes are able to describe the design and function of parallel systems.
- They are able to design and implement parallel algorithms.
- They are able to analyze parallel systems and programs.
- They are able to describe the limits of parallel systems.

Grading through:

- Viva Voce or test

Requires:

- Theoretical Computer Science (CS2000-KP08, CS2000)

Responsible for this module:

- Prof. Dr. rer. nat. Till Tantau

Teacher:

- Institute for Theoretical Computer Science
- Prof. Dr. rer. nat. Till Tantau

Literature:

- Jaja: An Introduction to Parallel Algorithms - Addison Wesley, 1992

- Quinn: Parallel Programming in C with MPI and OpenMP - McGraw Hill, 2004

Language:

- offered only in German

Notes:

Admission requirements for taking the module:
- None (the competencies of the modules listed under

CS3052-KP04, CS3052 - Programming Languages and Type Systems (ProgLan14)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	4

Course of study, specific field and term:

- Bachelor Computer Science 2019 (optional subject), major subject informatics, Arbitrary semester
- Bachelor Computer Science 2019 (optional subject), Canonical Specialization Web and Data Science, 3rd semester
- Bachelor Computer Science 2019 (compulsory), Canonical Specialization SSE, 3rd semester
- Bachelor Media Informatics 2020 (optional subject), computer science, 5th or 6th semester
- Bachelor Media Informatics 2014 (optional subject), computer science, 5th or 6th semester
- Bachelor Computer Science 2016 (optional subject), major subject informatics, Arbitrary semester
- Bachelor Computer Science 2016 (compulsory), Canonical Specialization SSE, 3rd semester
- Bachelor Computer Science 2012 (optional subject), central topics of computer science, 5th or 6th semester
- Bachelor Computer Science 2012 (compulsory), specialization field IT security and safety, 4th semester
- Master Computer Science 2012 (compulsory), advanced curriculum programming, 2nd or 3rd semester
- Bachelor IT-Security 2016 (optional subject), computer science, Arbitrary semester
- Bachelor CLS 2010 (optional suject), computer science, 5th or 6th semester
- Bachelor Computer Science 2014 (optional subject), central topics of computer science, 5th semester
- Bachelor Computer Science 2014 (compulsory), specialization field IT security and safety, 5th semester

Classes and lectures:

- Progamming Languages and Type Systems (lecture, 2 SWS)
- Progamming Languages and Type Systems (exercise, 1 SWS)

Workload:

- 60 Hours private studies and exercises
- 45 Hours in-classroom work
- 15 Hours exam preparation

Contents of teaching:

- Overview on programming languages
- Syntactic description of programming languages
- Language elements for data structures
- Type systems for programming languages
- Language elements for control structures
- Language elements for abstraction and modularization
- Typing and type systems
- Semantics of programming languages
- Language paradigms
- Language elements for concurrent programming
- Tools for programming languages

Qualification-goals/Competencies:

- The students can characterize major programming languages and can compare their application domains.
- They can understand, adapt and extend syntacic and semantic descriptions of programming languages.
- They can analyse the structure and principles of programming languages.
- They can learn on their own and classify new language elements.
- They can argue on the support of type systems for writing correct programs.
- The can evaluate possible programming languages for an application.

Grading through:

- Written or oral exam as announced by the examiner

Requires:

- Linear Algebra and Discrete Structures 1 (MA1000-KP08, MA1000)
- Algorithms and Data Structures (CS1001-KP08, CS1001)
- Introduction to Programming (CS1000-KP10, CS1000SJ14)

Responsible for this module:

- Prof. Dr. Martin Leucker

Teacher:

- Institute of Software Technology and Programming Languages

- Dr. Annette Stümpel
- Prof. Dr. Martin Leucker

Literature:

- K.C. Louden: Programming Languages: Principles and Practice - Course Technology 2011
- J.C. Mitchell: Concepts in Programming Languages - Cambridge University Press 2003
- T.W. Pratt, M.V. Zelkowitz: Programming Languages: Design and Implementation - Prentice Hall 2000
- R.W. Sebesta: Concepts of Programming Languages - Pearson Education 2012
- R. Sethi: Programming Languages: Concepts and Constructs - Addison-Wesley 2003
- D.A. Watt: Programming Language Design Concepts - John Wiley & Sons 2004
- G. Winskel: The Formal Semantics of Programming Languages - MIT Press 1993

Language:

- German and English skills required

Notes:

Admission requirements for taking the module:
- None (the competencies of the modules listed under

CS3100-KP08, CS3100SJ14 - Signal Processing (SignalV14)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	8

Course of study, specific field and term:

- Master CLS 2023 (compulsory), mathematics, 1st semester
- Bachelor Biophysics 2024 (compulsory), computer science, 5th semester
- Bachelor Robotics and Autonomous Systems 2020 (compulsory), Robotics and Autonomous Systems, 5th semester
- Bachelor Computer Science 2019 (optional subject), major subject informatics, Arbitrary semester
- Bachelor Computer Science 2019 (compulsory), Canonical Specialization Bioinformatics and Systems Biology, 5th semester
- Bachelor MES 2020 (compulsory), computer science, 5th semester
- Bachelor Media Informatics 2020 (optional subject), computer science, 5th or 6th semester
- Bachelor Medical Informatics 2019 (optional subject), computer science, 4th to 6th semester
- Bachelor Computer Science 2014 (compulsory), specialization field robotics and automation, 5th semester
- Bachelor Computer Science 2014 (compulsory), specialization field bioinformatics, 5th semester
- Bachelor Computer Science 2016 (compulsory), Canonical Specialization Bioinformatics, 5th semester
- Bachelor Computer Science 2016 (optional subject), major subject informatics, Arbitrary semester
- Bachelor Computer Science 2016 (compulsory), Canonical Specialization Web and Data Science, 5th semester
- Master CLS 2016 (compulsory), mathematics, 1st semester
- Bachelor Robotics and Autonomous Systems 2016 (compulsory), Robotics and Autonomous Systems, 5th semester
- Bachelor IT-Security 2016 (optional subject), computer science, Arbitrary semester
- Bachelor Biophysics 2016 (compulsory), computer science, 5th semester
- Bachelor Medical Informatics 2014 (compulsory), computer science, 5th semester
- Bachelor MES 2014 (compulsory), computer science, 5th semester
- Bachelor Media Informatics 2014 (optional subject), computer science, 5th or 6th semester
- Bachelor Computer Science 2014 (optional subject), central topics of computer science, 5th semester

Classes and lectures:

- Signal Processing (lecture, 2 SWS)
- Signal Processing (exercise, 1 SWS)
- Image Processing (lecture, 2 SWS)
- Image Processing (exercise, 1 SWS)

Workload:

- 110 Hours private studies
- 90 Hours in-classroom work
- 40 Hours exam preparation

Contents of teaching:

- Linear time-invariant systems
- Impulse response
- Convolution
- Fourier transform
- Transfer function
- Correlation and energy density of deterministic signals
- Sampling
- Discrete-time signals and systems
- Discrete-time Fourier transform
- z-Transform
- FIR and IIR filters
- Block diagrams
- FIR filter design
- Discrete Fourier transform (DFT)
- Fast Fourier transform (FFT)
- Characterization and processing of random signals
- Introduction, interest of visual information
- 2D Sampling
- Image enhancement
- Edge detection
- Multiresolution concepts: Gaussian and Laplacian Pyramid, wavelets
- Principles of image compression
- Segmentation
- Morphological image processing

- Students work self-actingly and independently with regard to the roles of GSP of the University of Lübeck.

Qualification-goals/Competencies:

- Students are able to explain the fundamentals of linear system theory.
- They are able to define and competently explain the essential elements of signal processing mathematically.
- They will have a command of mathematical methods for the description and analysis of continuous-time and discrete-time signals and systems.
- They are able to design digital filters and know various structures for their implementation.
- They are able to explain the basic techniques for describing and processing of random signals.
- They will have basic knowledge of two-dimensional system theory.
- They are able to describe the main techniques for image analysis and image enhancement.
- They are able to apply the learned principles in practice.

Grading through:

- written exam

Responsible for this module:

- Prof. Dr.-Ing. Alfred Mertins

Teacher:

- Institute for Signal Processing
- Prof. Dr.-Ing. Alfred Mertins

Literature:

- A. Mertins: Signaltheorie: Grundlagen der Signalbeschreibung, Filterbänke, Wavelets, Zeit-Frequenz-Analyse, Parameter- und Signalschätzung - Springer-Vieweg, 3. Auflage, 2013
- A. K. Jain: Fundamentals of Digital Image Processing - Prentice Hall, 1989
- Rafael C. Gonzalez, Richard E. Woods: Digital Image Processing - Prentice Hall 2003

Language:

- offered only in German

Notes:

Prerequisites for attending the module:
- None

Prerequisites for the exam:
- Successful completion of homework assignments during the semester (at least 50% of max. points).

Module exam:
- CS3100-L1: Signal Processing, written exam, 90 min, 100% of module grade

CS3115-KP04, CS5156-KP04, CS5156 - System Architectures for Multimeda (SysArchMM)

Duration:	Turnus of offer:	Credit points:
1 Semester	normally each year in the summer semester	4

Course of study, specific field and term:

- Bachelor Media Informatics 2020 (optional subject), computer science, 5th or 6th semester
- Bachelor Computer Science 2019 (optional subject), major subject informatics, Arbitrary semester
- Master Medical Informatics 2014 (optional subject), computer science, 1st or 2nd semester
- Master Media Informatics 2014 (optional subject), computer science, Arbitrary semester
- Master Computer Science 2012 (optional subject), advanced curriculum signal and image processing, 2nd or 3rd semester
- Master Computer Science 2012 (optional subject), specialization field software systems engineering, 3rd semester
- Master Computer Science 2012 (optional subject), advanced curriculum parallel and distributed system architecutres, 2nd or 3rd semester
- Master Computer Science 2012 (optional subject), specialization field media informatics, 2nd or 3rd semester
- Bachelor IT-Security 2016 (optional subject), specific, Arbitrary semester

Classes and lectures:

- System Architectures for Multimedia (lecture, 2 SWS)
- System Architectures for Multimedia (exercise, 1 SWS)

Workload:

- 55 Hours private studies
- 45 Hours in-classroom work
- 20 Hours exam preparation

Contents of teaching:

- Performance requirements of multimedia systems on computer and systems
- Instruction set extensions for x86 processors
- System architecture of game consoles and multimedia systems
- Hardware structures for the realization of basic image and video processing operations
- System integration of hardware accelerators
- Programming of multimedia applications with OpenGL
- Protection and authentication of multimedia data

Qualification-goals/Competencies:

- Students are able to categorize instruction set extensions of processors for multimedia applications.
- They are able to discuss the characteristics of the system structure of game consoles and multimedia systems.
- They are able to implement image and video processing algorithms in software by making best use of instruction set extensions.
- They are able to evaluate the usefulness of specific processor architectures and system structures for the realization of multimedia systems.
- They are able to determine appropriate hardware structures for the implementation of image and video processing algorithms.
- They are able to write simple graphic applications with OpenGL.

Grading through:

- see Notes

Responsible for this module:

- Prof. Dr.-Ing. Mladen Berekovic

Teacher:

- Institute of Computer Engineering
- Prof. Dr.-Ing. Mladen Berekovic

Literature:

- P. A. Henning: Taschenbuch Multimedia - München: Fachbuchverlag Leipzig 2007
- A. S. Tanenbaum: Moderne Betriebssysteme - München: Pearson 2009
- D. G. Bailey: Design for Embedded Image Processing on FPGAs - Wiley & Sons 2011
- D. Kusswurm: Modern x86 Assembly Language Programming - Apress 2015
- A. Nischwitz, M. Fischer, P. Haberäcker, G. Socher: Computergrafik und Bildverarbeitung - Vieweg + Teubner, 2011

Language:

- offered only in German

Notes:

Admission requirements for taking the module:
- None

Admission requirements for participation in module examination(s):
- Successful completion of exercise assignments as specified at the beginning of the semester

Module Exam(s):
- CS3115-L1: System Architectures for Multimeda, oral exam, 100% of the module grade

CS3204-KP04, CS3204 - Artificial Intelligence 1 (KI1)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	4

Course of study, specific field and term:

- Bachelor Robotics and Autonomous Systems 2020 (compulsory), Robotics and Autonomous Systems, 6th semester
- Bachelor Computer Science 2019 (optional subject), major subject informatics, Arbitrary semester
- Bachelor MES 2020 (optional subject), computer science / electrical engineering
- Bachelor Media Informatics 2020 (optional subject), computer science, 5th or 6th semester
- Bachelor Medical Informatics 2019 (optional subject), computer science, 4th to 6th semester
- Bachelor MES 2014 (optional subject), computer science / electrical engineering
- Bachelor Computer Science 2016 (optional subject), major subject informatics, Arbitrary semester
- Bachelor Computer Science 2016 (compulsory), Canonical Specialization Web and Data Science, 6th semester
- Bachelor Robotics and Autonomous Systems 2016 (compulsory), Robotics and Autonomous Systems, 6th semester
- Bachelor IT-Security 2016 (optional subject), computer science, Arbitrary semester
- Bachelor Biophysics 2016 (optional subject), computer science, 6th semester
- Bachelor Medical Informatics 2014 (optional subject), computer science, 5th or 6th semester
- Bachelor Media Informatics 2014 (optional subject), computer science, 5th or 6th semester
- Bachelor Computer Science 2014 (optional subject), central topics of computer science, 6th semester
- Bachelor Computer Science 2014 (compulsory), specialization field robotics and automation, 6th semester
- Bachelor Medical Informatics 2011 (optional subject), Applied computer science, 4th to 6th semester
- Bachelor CLS 2010 (optional subject), computer science, 6th semester
- Bachelor MES 2011 (optional subject), medical engineering science, 6th semester
- Bachelor Computer Science 2012 (compulsory), specialization field robotics and automation, 4th semester
- Bachelor Computer Science 2012 (optional subject), central topics of computer science, 5th or 6th semester

Classes and lectures:

- Artificial Intelligence (lecture, 2 SWS)
- Artificial Intelligence (exercise, 2 SWS)

Workload:

- 55 Hours private studies
- 45 Hours in-classroom work
- 20 Hours exam preparation

Contents of teaching:

- Part 1: Search strategiesAs an introduction and a prerequisite for most of the principles of artificial intelligence search strategies are introduced and explained. We will introduce uninformed, informed, local search, adversial search as well as heuristic search. The concept of agents will be presented.
- Part 2: Learning and reasoningRevision of the foundations of mathematical logic and probability. Principles of machine learning (supervised and unsupervised) are introduced. An introduction to fuzzy logic is also included.
- Part 3: Applications of artificial intelligenceTypical applications in the fields or robotics, machine vision, and industrial image and data processing are identified. Ethical issues and risks of the development of artificial intelligence are discussed.

Qualification-goals/Competencies:

- The students are able to handle scope-oriented tutorials with a mathematical background in a team, and timely.
- They have developed an understanding for the benefits and disadvantages of the different search and problem solving techniques.
- The students are in a position to choose and apply independently appropriate algorithms for search and learning issues.
- They have gained an insight into the complex development of systems with artificial intelligence and the distinction of its various forms.
- The students have an understanding of the risks and possible technological consequences of the development of systems with strong AI.

Grading through:

- written exam

Requires:

- Analysis 2 (MA2500-KP04, MA2500)
- Algorithms and Data Structures (CS1001-KP08, CS1001)

Responsible for this module:

- Prof. Dr. rer. nat. Floris Ernst

Teacher:

- Institute for Robotics and Cognitive Systems
- MitarbeiterInnen des Instituts
- Prof. Dr. rer. nat. Floris Ernst

Literature:

- G. Görz (Hrsg.): Handbuch der Künstlichen Intelligenz - München: Oldenbourg Wissenschaftsverlag, 2003
- C-M. Bishop: Pattern Recognition and Machine Learning - Springer Verlag, 2007
- Russell/Norvig: Artificial Intelligence: a modern approach - (3rd Ed.), Prentice Hall, 2009
- Mitchell: Machine Learning - McGraw-Hill, 1997
- Luger: Artificial Intelligence: Structures and Strategies for Complex Problem Solving - (6th Ed.), Addison-Wesley, 2008

Language:

- offered only in German

Notes:

Admission requirements for taking the module
- None (the competences of the modules mentioned under Requires are needed for this module, but are not a formal prerequisite).

Admission requirements for participation in module examination(s):
- Successful completion of exercises as specified at the beginning of the semester.

Moduel Exam(s):
- CS3204-L1: Artificial Intelligence, written exam, 90min, 100% of the module grade

CS3250-KP08 - Safe Software (SichereSW)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	8

Course of study, specific field and term:

- Bachelor Computer Science 2019 (optional subject), Canonical Specialization Web and Data Science, 5th semester
- Bachelor Computer Science 2019 (optional subject), major subject informatics, Arbitrary semester
- Bachelor Computer Science 2019 (compulsory), Canonical Specialization SSE, 5th semester
- Bachelor Media Informatics 2020 (optional subject), computer science, 5th or 6th semester
- Bachelor Computer Science 2016 (optional subject), major subject informatics, Arbitrary semester
- Bachelor Computer Science 2016 (compulsory), Canonical Specialization SSE, 5th semester
- Bachelor IT-Security 2016 (compulsory), IT-Security, 5th semester

Classes and lectures:

- Safe Software (lecture, 4 SWS)
- Safe Software (exercise, 2 SWS)

Workload:

- 120 Hours private studies
- 90 Hours in-classroom work
- 30 Hours exam preparation

Contents of teaching:

- Measures for improving software safety
- Definition of central techniques such as static analysis, model checking, testing, runtime verification
- Techniques for program analysis
- Operation of model checkers
- Test procedures
- Verification at runtime
- Application of the techniques
- Theorem proving
- Tools

Qualification-goals/Competencies:

- The students can describe and classify measures for the improvement of software safety.
- They can explain the principles of central verification techniques.
- They can compare various methods for software testing.
- They can motivate the use of various techniques for improving software safety.
- They can assess the effect of these techniques on the safety of certain software.
- They are familiar with common tools for the verification of software and they can familiarize themselves with new developments.

Grading through:

- Written or oral exam as announced by the examiner

Requires:

- Theoretical Computer Science (CS2000-KP08, CS2000)
- Introduction to Logics (CS1002-KP04, CS1002)
- Software Engineering (CS2300-KP06, CS2300SJ14)

Responsible for this module:

- Prof. Dr. Martin Leucker

Teacher:

- Institute of Software Technology and Programming Languages
- Prof. Dr. Martin Leucker

Literature:

- A.R. Bradley, Z. Manna: The Calculus of Computation - Springer, 2007
- F. Nielson, H.R. Nielson, C. Hankin: Principles of Program Analysis - Springer 2010
- C. Baier, J.-P. Katoen: Principles of Model Checking - MIT Press, 2008
- D. Peled: Software Reliability Methods - Springer, 2001

Language:

- English, except in case of only German-speaking participants

Notes:

Admission requirements for taking the module:
- None (the competencies of the modules listed under

CS3420-KP04, CS3420 - Cryptology (Krypto14)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	4

Course of study, specific field and term:

- Master CLS 2023 (optional subject), computer science, 3rd semester
- Bachelor Computer Science 2019 (optional subject), major subject informatics, Arbitrary semester
- Bachelor Media Informatics 2020 (optional subject), computer science, 4th or 6th semester
- Bachelor Robotics and Autonomous Systems 2020 (optional subject), computer science, 5th or 6th semester
- Bachelor Medical Informatics 2019 (optional subject), computer science, 4th to 6th semester
- Bachelor Computer Science 2016 (optional subject), major subject informatics, Arbitrary semester
- Master CLS 2016 (optional subject), computer science, 3rd semester
- Bachelor Robotics and Autonomous Systems 2016 (optional subject), computer science, 5th or 6th semester
- Bachelor IT-Security 2016 (compulsory), IT-Security, 3rd semester
- Bachelor Medical Informatics 2014 (optional subject), computer science, 5th or 6th semester
- Bachelor Computer Science 2014 (optional subject), central topics of computer science, 5th or 6th semester

Classes and lectures:

- Cryptology (lecture, 2 SWS)
- Cryptology (exercise, 1 SWS)

Workload:

- 65 Hours private studies and exercises
- 45 Hours in-classroom work
- 10 Hours exam preparation

Contents of teaching:

- history of cryptography, classical systems
- mathematical and algorithmic basics
- design principles for cryptographic applications
- symmetric crypto systems
- public key crypto systems, digital signatures
- efficient implementation of crypto systems
- methods in cryptoanalysis
- cryptographic protocols

Qualification-goals/Competencies:

- The students are able to model and analyze IT security.
- They know basic cryptographic primitives and protocols.
- They can recognize cryptographic weakness.
- They can apply standard techniques in cryptology.
- They can explain and assess the historical and social significance of encrypting information.

Grading through:

- written exam

Responsible for this module:

- Prof. Dr. Rüdiger Reischuk

Teacher:

- Institute for Theoretical Computer Science
- Prof. Dr. Rüdiger Reischuk
- Prof. Dr. Maciej Liskiewicz

Literature:

- J von zur Gathen: CryptoSchool - Springer 2015
- A. Beutelspacher, H. Neumann, T. Schwarzpaul: Kryptopgrafie in Theorie und Praxis - Vieweg 2005
- D. Wätjen: Kryptographie - Springer 2018
- J. Katz, Y. Lindell: Introduction to Modern Cryptography - Chapman & Hall, 2008
- C. Bauer: Secret History - The Story of Cryptology - CRC Press 2013
- B. Schneier: Applied Cryptography - J. Wiley 1996

Language:

- English, except in case of only German-speaking participants

Notes:

Admission requirements for taking the module:
- None

Admission requirements for participation in module examination(s):
- Successful completion of exercise sheets as specified at the beginning of the semester

Module exam(s):
- CS3420-L1: Cryptology, written exam, 90 minutes, 100% of module grade

PY1802-KP08 - Statistics and Methods of User Research (SMNF)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	8

Course of study, specific field and term:

- Bachelor Media Informatics 2020 (compulsory), psychology, 2nd semester

Classes and lectures:

- Statistics and Methods of User Research (lecture, 2 SWS)
- Statistics and Methods of User Research (seminar, 2 SWS)
- Statistics and Methods of User Research (exercise, 1 SWS)

Workload:

- 120 Hours private studies and exercises
- 90 Hours in-classroom work
- 30 Hours (see module parts)

Contents of teaching:

- EMPIRICAL METHODS OF USER RESEARCH:
- - Basic scientific understanding (including, theories and literature, reception of empirical studies) and evaluations in the development process.
- - Research designs and experimental designs in user research.
- - Planning, organization and implementation of user studies (incl. data analysis)
- - Population and samples
- - Ethics
- - Operationalization and data collection methods (incl. scale levels, questionnaire construction, qualitative methods)
- STATISTICS OF USER RESEARCH:
- - Data preparation and data visualization
- - Descriptive statistics methods (e.g., central tendency values and dispersion measures)
- - Methods of inferential statistics (parametric and non-parametric methods)
- - Principles of statistical hypothesis testing (including preconditions and power analyses/effect sizes)
- - Statistical analysis of correlation and difference hypotheses
- - Other statistical methods (e.g. chi-square test)
- - Presentation, interpretation and discussion of statistical results
- - Use of statistical software

Qualification-goals/Competencies:

- Students can refer to, present and explain basic concepts of quantitative data analysis, that are of central importance for the collection, evaluation and interpretation of psychological data in the context of human-centered design.
- The students can transfer scientific questions into concrete experimental plans of quantitative and qualitative user research and structure them into subtasks.
- Students can independently select suitable methods from the pool of existing quantitative and qualitative methods/scales in the field of user research.
- Students can carry out data collection and subject acquisition themselves in practice.
- Students can evaluate data using typical statistical programs and have basic skills required for qualitative data evaluation.
- Students can interpret statistical results independently and appropriately.

Grading through:

- Participation in research studies
- written exam

Responsible for this module:

- Prof. Dr. phil. André Calero Valdez

Teacher:

- Institute for Multimedia and Interactive Systems
- Prof. Dr. phil. André Calero Valdez

Literature:

- Eid, M., Gollwitzer, M., & Schmitt, M.: Statistik und Forschungsmethoden - (4th ed.). Weinheim: Beltz. 2015
- Field, A., Miles, J., & Field, Z.: Discovering Statistics Using R - London: Sage. 2012

Language:

- offered only in German

Notes:

To pass the module, a total of 30 hours must be proven as study participation hours, which can be completed in psychological experiments or user studies of media informatics.

Admission requirements for the module:
- None

Admission requirements for the examination:
- The examination prerequisites (e.g. successful completion of exercises, lectures in seminars, etc.) can be determined at the beginning of the semester. If preliminary work has been defined, it must have been completed and positively assessed before the initial examination.

Partial examinations:
PY1802-L1 Statistics and methods of user research (written exam, graded, 7 CP)
PY1802-L2 ST hours (ungraded self-study, 1 KP)

PY2210-KP04, PY2210 - Perception and Cognition in HCI (KogPsy)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	4

Course of study, specific field and term:

- Bachelor Media Informatics 2020 (compulsory), psychology, 1st semester
- Master Entrepreneurship in Digital Technologies 2020 (optional subject), interdisciplinary competence, Arbitrary semester
- Bachelor Media Informatics 2014 (compulsory), psychology, 3rd semester

Classes and lectures:

- Psychology of Perception and Cognition (lecture, 2 SWS)
- Psychology of Perception and Cognition (seminar, 1 SWS)

Workload:

- 75 Hours private studies and exercises
- 45 Hours in-classroom work

Contents of teaching:

- History of cognitive psychology
- Attention
- Visual perception
- Hearing
- Skin senses, haptic and tactile perception
- Psychophysics
- Expertise, learning, memory, and knowledge
- Reasoning and problem solving
- Judgment, decision making

Qualification-goals/Competencies:

- The students can understand, classify, and use cognitive psychological scientific contributions.
- They are able to describe processes of media use and human-machine-interaction referring to basic cognitive functions, to judge demands to users, and to account for them in the design of media and technological systems.
- They know how to evaluate technological systems and interactive media with methods from cognitive psychology.

Grading through:

- portfolio exam

Responsible for this module:

- Prof. Dr. rer. nat. Thomas Franke

Teacher:

- Institute for Multimedia and Interactive Systems
- Prof. Dr. rer. nat. Thomas Franke
- MitarbeiterInnen des Instituts

Literature:

- J.R. Anderson: Kognitive Psychologie (7. Auflage) - Heidelberg: Spektrum, 2013
- E. B. Goldstein: Wahrnehmungspsychologie (9. Auflage) - Heidelberg: Spektrum, 2014

Language:

- offered only in German

Notes:

Prerequisites for attending the module:
- None

Prerequisites for the exam:
- Successful completion of homework assignments during the semester.

Exams:
- PY2210-L1: Wahrnehmung und Kognition in MCI, Klausur, 90min, 100% der Modulnote

Replaces PY2210-KP04 Psychology of Perception and Cognition

PY2904-KP04, PY2904 - Media Psychology (MedienPsy)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	4

Course of study, specific field and term:

- Bachelor Psychology 2013 (optional subject), psychology, Arbitrary semester
- Bachelor Media Informatics 2020 (compulsory), psychology, 4th semester
- Bachelor Psychology 2016 (optional subject), psychology, Arbitrary semester
- Bachelor Biophysics 2016 (optional subject), no specific field, 6th semester
- Bachelor Psychology 2020 (optional subject), psychology, Arbitrary semester
- Bachelor Media Informatics 2014 (compulsory), psychology, 4th semester

Classes and lectures:

- Media Psychology (lecture, 2 SWS)
- Media Psychology (seminar, 1 SWS)

Workload:

- 75 Hours private studies and exercises
- 45 Hours in-classroom work

Contents of teaching:

- Media selection, media use, media reception
- Media effects
- Media competency
- Persuasive technology, gamification
- Advertising, social networks
- Public Relations
- Human-computer interaction, companion technologies

Qualification-goals/Competencies:

- The students can explicate theories and findings of media psychology using digital media as examples.
- They are able to draw conclusions from media psychology s scientific contributions regarding multimedia and interactive media and to judge media use and media effects based on knowledge of media psychology.
- They are able to analyse and to evaluate digital media with methods from media psychology.

Grading through:

- portfolio exam - the concrete examination elements and their weights will be published in the course

Responsible for this module:

- Prof. Dr. rer. nat. Thomas Franke

Teacher:

- Institute for Multimedia and Interactive Systems
- Prof. Dr. rer. nat. Thomas Franke
- MitarbeiterInnen des Instituts

Literature:

- B. Batinic & M. Appel (Hrsg.): Medienpsychologie - Heidelberg: Springer, 2008
- S. Trepte & L. Reinecke: Medienpsychologie - Stuttgart: Kohlhammer, 2013
- :

Language:

- offered only in German

Notes:

Prerequisites for attending the module:
- None

Prerequisites for the exam:
- Successful completion of homework assignments during the semester.

Exam(s):
- PY2904-L1 Medienpsychologie, Portfolioprüfung, semesterbegleitend, 100% der Modulnote

PY3210-KP04 - Gamification (Gamific)

Duration:	Turnus of offer:	Credit points:
1 Semester	irregularly	4

Course of study, specific field and term:

- Bachelor Media Informatics 2020 (optional subject), psychology, 5th or 6th semester
- Bachelor Media Informatics 2014 (optional subject), psychology, 5th or 6th semester

Classes and lectures:

- Gamification (lecture, 1 SWS)
- Gamification (seminar, 1 SWS)

Workload:

- 60 Hours in-classroom work
- 20 Hours Multimedia contribution
- 20 Hours private studies
- 20 Hours written report

Contents of teaching:

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-

Qualification-goals/Competencies:

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-
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-

Grading through:

- see Notes
- project work
- successful addressing of the project goals

Responsible for this module:

- Prof. Dr. rer. pol. Moreen Heine

Teacher:

- Institute for Multimedia and Interactive Systems
- Dr. rer. nat. Daniel Wessel

Literature:

- :

Language:

- German and English skills required

CS1600-KP04, CS1600 - Introduction to Media Informatics (EinMedien)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	4

Course of study, specific field and term:

- Bachelor Media Informatics 2020 (compulsory: aptitude test), media informatics, 1st semester
- Bachelor Media Informatics 2014 (compulsory: aptitude test), media informatics, 1st semester
- Bachelor CLS 2010 (optional subject), computer science, 5th or 6th semester
- Bachelor Computer Science 2012 (compulsory), specialization field media informatics, 1st semester
- Bachelor IT-Security 2016 (optional subject), interdisciplinary, Arbitrary semester

Classes and lectures:

- Introduction to Media Informatics (lecture, 2 SWS)
- Introduction to Media Informatics (exercise, 1 SWS)

Workload:

- 55 Hours private studies
- 45 Hours in-classroom work
- 20 Hours exam preparation

Contents of teaching:

- Overview of the lecture
- Social context
- Terms and theories of media
- Milestones of media technology
- Interactive media technologies
- Multimeda applications
- Human-centered media
- Designing interactive media
- Development processes for interactive media
- Ethics of new media
- Summary

Qualification-goals/Competencies:

- The students know the structure and the most important contents of media informatics.
- They are prepared for the following media informatics lectures.
- They know the main tasks and fields of work in media informatics.
- They know the challenges and requirements of designing interactive multimedia systems.

Grading through:

- Oral examination

Is requisite for:

- Interaction Design and User Experience (CS2600-KP08, CS2600SJ14)

Responsible for this module:

- Prof. Dr.-Ing. Nicole Jochems

Teacher:

- Institute for Multimedia and Interactive Systems
- Prof. Dr.-Ing. Nicole Jochems

Literature:

- M. Herczeg: Einführung in die Medieninformatik - Oldenbourg-Verlag, 2007
- R. Malaka et al.: Medieninformatik - Eine Einführung - Pearson Verlag, 2009
- :

Language:

- offered only in German

Notes:

Prerequisites for attending the module:
- None

Prerequisites for the exam:
- Successful completion of project work as stated at the beginning of the semester

Exam(s):
- CS1600-L1: Einführung in die Medieninformatik, Klausur, 90min, 100% der Modulnote

CS1601-KP04, CS1601 - Basics of Multimedia Systems (MMTechnik)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	4

Course of study, specific field and term:

- Bachelor Biophysics 2016 (optional subject), computer science, 5th semester
- Bachelor Computer Science 2019 (optional subject), major subject informatics, Arbitrary semester
- Bachelor Media Informatics 2020 (compulsory), media informatics, 3rd semester
- Bachelor Robotics and Autonomous Systems 2020 (optional subject), media informatics, 5th or 6th semester
- Bachelor Computer Science 2016 (optional subject), major subject informatics, Arbitrary semester
- Bachelor Robotics and Autonomous Systems 2016 (optional subject), computer science, 4th or 6th semester
- Bachelor IT-Security 2016 (optional subject), computer science, Arbitrary semester
- Bachelor Media Informatics 2014 (compulsory), media informatics, 3rd semester
- Bachelor Computer Science 2014 (optional subject), central topics of computer science, 5th semester
- Bachelor Computer Science 2012 (optional subject), central topics of computer science, 6th semester
- Bachelor CLS 2010 (optional subject), computer science, 6th semester
- Bachelor Computer Science 2012 (compulsory), specialization field media informatics, 2nd semester

Classes and lectures:

- Basics of Multimedia Systems (lecture, 2 SWS)
- Basics of Multimedia Systems (exercise, 1 SWS)

Workload:

- 55 Hours private studies
- 45 Hours in-classroom work
- 20 Hours exam preparation

Contents of teaching:

- Sensation and Perception
- Analog Media Technology
- Digitalisation
- Digital Audio, Image and Video Technology
- Media storage (compression / formats)
- Media Transmission (Broadcast / Streaming)

Qualification-goals/Competencies:

- Students are able to present to essential functions and principles of multimedia systems.
- They are able to judge possibilities and limitations of human perception.
- They are able to classify the conditions and technologies for capturing, processing, storing, transmitting and perception of multimedia.
- They can balance the specific advantages and disadvantages of analog and digital media technology.
- They are able to apply appropriate technical components and processes for the design of multimedia systems.

Grading through:

- Written or oral exam as announced by the examiner

Responsible for this module:

- Prof. Dr.-Ing. Andreas Schrader

Teacher:

- Institute of Telematics
- Prof. Dr.-Ing. Andreas Schrader

Literature:

- Thomas Görne: Tontechnik - 4. Auflage, Hanser 2014
- Ulrich Schmidt: Professionelle Videotechnik - 6. Auflage, Springer 2013

Language:

- English, except in case of only German-speaking participants

Notes:

Admission requirements for taking the module:
- None

Admission requirements for participation in module examination(s):
- Successful completion of exercise slips as specified at the beginning of the semester.

Module Exam(s):
- CS1601-L1 Fundamentals of Multimedia Technology, as determined by the instructor: Written exam, 90min, 100% of module grade OR oral exam, 100% of module grade.

CS2200-KP04, CS2200 - Software Ergonomics (SoftErgo)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	4

Course of study, specific field and term:

- Bachelor Media Informatics 2020 (compulsory), media informatics, 2nd semester
- Bachelor Psychology 2016 (optional subject), computer science, Arbitrary semester
- Bachelor Psychology 2013 (optional subject), computer science, Arbitrary semester
- Bachelor Media Informatics 2014 (compulsory), media informatics, 2nd semester
- Bachelor Medical Informatics 2011 (optional subject), software engineering, 4th to 6th semester
- Bachelor Computer Science 2012 (compulsory), foundations of computer science, 2nd semester
- Bachelor IT-Security 2016 (optional subject), specific, Arbitrary semester

Classes and lectures:

- Software Ergonomics (lecture, 2 SWS)
- Software Ergonomics (exercise, 1 SWS)

Workload:

- 55 Hours private studies
- 45 Hours in-classroom work
- 20 Hours exam preparation

Contents of teaching:

- Motivation and introduction
- Fundamentals of Ergonomics - Effects of work
- Fundamentals of Ergonomics - Work systems
- Cognition and memory
- User analysis and user modeling
- Models for human-computer systems
- Temporal behavior of interactive systems
- Quality criteria for interactive systems
- Evaluation of interactive systems
- Legal conditions
- Summary

Qualification-goals/Competencies:

- The students know the basic theories, models and criteria for user- and application-centered interactive multimedia systems.
- They are able to transfer this knowledge into development processes and to evaluate interactive systems systematically.
- They can describe work systems as well as applications in education and entertainment in a user- and task-centered way.

Grading through:

- written exam

Responsible for this module:

- Prof. Dr. phil. André Calero Valdez

Teacher:

- Institute for Multimedia and Interactive Systems
- Prof. Dr. phil. André Calero Valdez

Literature:

- M. Herczeg: Software-Ergonomie - 4. Auflage, München: Oldenbourg-Verlag, 2018

Language:

- offered only in German

Notes:

Prerequisites for attending the module:
- None

Prerequisites for the exam:
- Successful completion of homework assignments as stated at the beginning of the course

Exams:
- CS2200-L1 Software-Ergonomie, Klausur, 90min, 100% der Modulnote

CS2602-KP08 - Interactive Systems (InterSys)

Duration:	Turnus of offer:	Credit points:
2 Semester	normally each term	8

Course of study, specific field and term:

- Bachelor IT-Security 2016 (optional subject), specific, Arbitrary semester
- Bachelor Computer Science 2019 (optional subject), major subject informatics, Arbitrary semester
- Bachelor Media Informatics 2020 (compulsory), media informatics, 3rd and 4th semester

Classes and lectures:

- Interactive Systems (lecture, 4 SWS)
- Interactive Systems (exercise, 2 SWS)

Workload:

- 120 Hours private studies
- 90 Hours in-classroom work
- 30 Hours exam preparation

Contents of teaching:

- Introduction and overview
- Web programming: basics HTML, CSS, Javascript
- Web Programming: Asynchronity and AJAX
- Web Programming: Web-Frameworks
- Web Programming: Enterprise Web
- Programming of graphics and animations
- Computer games: Introduction and Serious Games
- Computer games: Concepts for design and programming
- Computer games: Programming with an engine
- Computer games: Rendering
- Computer Games: Augmented und Virtual Reality
- Java programming: Interactive systems with Java
- Java programming: models, architectures and interfaces
- Java Programming: Libraries for Interactive Systems
- Java Programming: GUI Programming Concepts
- Mobile Programming: Native Apps and Android Concepts
- Mobile Programming: Android Programming
- Mobile Programming: Web Apps and Hybrid Apps
- Content-Management-Systems: Typoscript
- Summary and outlook

Qualification-goals/Competencies:

- Students will have a comprehensive overview of programming interactive systems for the Web, mobile devices, and desktop systems.
- Students have the theoretical foundations and practical experience to implement concepts for interactive multimedia computer applications.
- You can evaluate the programming of complex 3D worlds and modern technologies using computer games and AR and VR as examples.

Grading through:

- written exam

Responsible for this module:

- Prof. Dr. phil. André Calero Valdez

Teacher:

- Institute for Multimedia and Interactive Systems
- Prof. Dr. phil. André Calero Valdez
- MitarbeiterInnen des Instituts

Literature:

- M. Herczeg: Interaktionsdesign - München: Oldenbourg-Verlag, 2006
- M. Herczeg: Software-Ergonomie: Grundlagen der Mensch-Computer-Kommunikation - 4. Auflage, München: de

Grutyper/Oldenbourg-Wissenschaftsverlag, 2018

Language:

- offered only in German

Notes:

Admission requirements for taking the module:
- None

Admission requirements for participation in module examination(s):
- Successful completion of exercises as stated at the beginning of the semester

Exam(s):
- CS2602-L1 Interactive Systems, written exam, 90min, 100% of the module grade

CS3201-KP04, CS3201 - Usability Engineering (UsabUXEng)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	4

Course of study, specific field and term:

- Bachelor Media Informatics 2020 (compulsory), media informatics, 5th semester
- Bachelor Computer Science 2019 (optional subject), major subject informatics, Arbitrary semester
- Bachelor Computer Science 2019 (compulsory), Canonical Specialization SSE, 5th semester
- Bachelor Robotics and Autonomous Systems 2020 (optional subject), computer science, 5th or 6th semester
- Bachelor Computer Science 2016 (optional subject), major subject informatics, Arbitrary semester
- Bachelor Computer Science 2016 (compulsory), Canonical Specialization SSE, 5th semester
- Bachelor Robotics and Autonomous Systems 2016 (optional subject), computer science, 5th or 6th semester
- Bachelor IT-Security 2016 (optional subject), computer science, Arbitrary semester
- Bachelor Media Informatics 2014 (compulsory), media informatics, 5th semester
- Bachelor Computer Science 2014 (optional subject), central topics of computer science, 5th semester
- Bachelor Medical Informatics 2011 (optional subject), software engineering, 4th to 6th semester
- Bachelor Computer Science 2012 (compulsory), specialization field media informatics, 6th semester
- Bachelor Computer Science 2012 (optional subject), central topics of computer science, 6th semester

Classes and lectures:

- Usability Engineering (lecture, 2 SWS)
- Usability-Engineering (exercise, 1 SWS)

Workload:

- 55 Hours private studies
- 45 Hours in-classroom work
- 20 Hours exam preparation

Contents of teaching:

- Introduction and motivation
- Cognitive Systems Engineering
- Software and Usability Engineering
- Ability-Based and Inclusive Design
- Interdisciplinary teams and social processes
- cost-benefit analysis
- Task analysis
- User analysis
- Organizational and contextual analysis
- Modeling and design of interactive systems
- Criteria for interactive systems
- Evaluation of interactive systems
- Summary

Qualification-goals/Competencies:

- Students are able to explain the basic user-centered development processes for interactive multimedia systems.
- They are able to apply and adapt basic processes for specific projects and needs.
- They are able to explain that these processes are influenced by formal und informal requirements as well as social structures and behaviors.

Grading through:

- written exam

Requires:

- Software Ergonomics (CS2200-KP04, CS2200)

Responsible for this module:

- Prof. Dr. phil. André Calero Valdez

Teacher:

- Institute for Multimedia and Interactive Systems
- Prof. Dr. phil. André Calero Valdez

Literature:

- Deborah J. Mayhew: The Usability Engineering Lifecycle - Morgan Kaufmann Publ., 1999
- Mary B. Rosson, John M. Carroll: Usability Engineering: Scenario-Based Development of Human-Computer Interaction - Morgan Kaufmann Publ., 2002
- Karen Holtzblatt, Hugh Beyer: Contextual Design. Defining Customer-Centered Systems - Morgan Kaufmann Publ., 1997

Language:

- offered only in German

Notes:

Replaces CS3201-KP04 Usability-Engineering.

Prerequisites for attending the module:
- None

Prerequisites for the exam:
- Successful completion of homework assignments as stated at the beginning of the course

Exam(s):
- CS3201-L1 Usability- und UX-Engineering, Klausur, 90min, 100% der Modulnote

CS3205-KP04, CS3205 - Computer Graphics (CompGrafik)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	4

Course of study, specific field and term:

- Master CLS 2023 (Module part of a compulsory module), MML with specialization in Image Processing, 2nd semester
- Bachelor Computer Science 2019 (optional subject), major subject informatics, Arbitrary semester
- Bachelor MES 2020 (optional subject), computer science / electrical engineering
- Bachelor Media Informatics 2020 (compulsory), media informatics, 6th semester
- Bachelor Robotics and Autonomous Systems 2020 (optional subject), computer science, 5th or 6th semester
- Bachelor Medical Informatics 2019 (optional subject), computer science, 4th to 6th semester
- Bachelor Computer Science 2016 (optional subject), major subject informatics, Arbitrary semester
- Bachelor Robotics and Autonomous Systems 2016 (optional subject), computer science, 5th or 6th semester
- Bachelor IT-Security 2016 (optional subject), computer science, Arbitrary semester
- Bachelor Medical Informatics 2014 (optional subject), computer science, 5th or 6th semester
- Bachelor MES 2014 (optional subject), computer science / electrical engineering, 4th or 6th semester
- Bachelor Media Informatics 2014 (compulsory), media informatics, 6th semester
- Bachelor Computer Science 2014 (optional subject), central topics of computer science, 5th or 6th semester
- Bachelor Medical Informatics 2011 (optional subject), computer science, 4th to 6th semester
- Master Computer Science 2012 (optional subject), advanced curriculum imaging systems, 2nd or 3rd semester
- Bachelor CLS 2010 (optional subject), mathematics, 6th semester
- Bachelor Computer Science 2012 (optional subject), central topics of computer science, 5th or 6th semester
- Master CLS 2010 (optional subject), mathematics, 2nd semester
- Bachelor Computer Science 2012 (compulsory), specialization field media informatics, 5th or 6th semester

Classes and lectures:

- Computer Graphics (lecture, 2 SWS)
- Computer Graphics (exercise, 1 SWS)

Workload:

- 55 Hours private studies
- 45 Hours in-classroom work
- 20 Hours exam preparation

Contents of teaching:

- Geometric transformations in 2D and 3D
- Homogeneous coordinates
- Transformations between Cartesian coordinate systems
- Planar and perspective projections
- Polygonal models
- Illumination models and shading methods
- Texture Mapping
- Culling and clipping
- Hidden line and surface removal
- Raster graphics algorithms
- Ray tracing
- Shadows, reflections and transparency
- Basics of graphics programming with OpenGL and GLSL

Qualification-goals/Competencies:

- Students know the basic concepts, algorithms and methods in computer graphics
- They are able to implement and apply principle algorithms
- They are able to explain the learned techniques and to assess their possibilities and limitations

Grading through:

- written exam

Requires:

- Linear Algebra and Discrete Structures 2 (MA1500-KP08, MA1500)
- Linear Algebra and Discrete Structures 1 (MA1000-KP08, MA1000)

Responsible for this module:

- Prof. Dr. rer. nat. habil. Heinz Handels

Teacher:

- Institute of Medical Informatics
- Dr. rer. nat. Jan Ehrhardt

Literature:

- Foley et. al: Grundlagen der Computergrafik - Addison-Wesley, 1994

Language:

- offered only in German

Notes:

Admission requirements for taking the module:
- None (the competences of the modules listed under "requires" are needed for this module, but are not a formal prerequisite)

Admission requirements for participation in module examination(s):
- Successful completion of exercise slips and programming projects as specified at the beginning of the semester

Module exam(s):
- CS3205-L1: Computer Graphics, written exam, 90 min, 100 % of module grade

CS3210-KP08, CS3210 - Bachelor Project Media Informatics (BProDesign)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	8

Course of study, specific field and term:

- Bachelor Media Informatics 2020 (compulsory), media informatics, 5th semester
- Bachelor Media Informatics 2014 (compulsory), media informatics, 5th semester

Classes and lectures:

- Bachelor Project Media Informatics (project work, 6 SWS)

Workload:

- 150 Hours group work
- 30 Hours oral presentation (including preparation)
- 30 Hours written report
- 20 Hours work on project
- 10 Hours in-classroom work

Contents of teaching:

- Team-based planning and realization of a user-centered system design process ranging from analyzing the context of use to deployment while observing standards and deadlines
- Practice of text-, image-, video-, audio- and 3D-animation processing as well as corresponding tools and programming languages
- Documentation and presentation of project work
- Scientific presentation of the project work and presentation of an

Qualification-goals/Competencies:

- The students are able to accomplish a complete development process for the production of an interactive multimedia systems in practice.
- They are able to assess and apply media- and interaction-related methods and tools.
- They have the methodological competence to analyze complex tasks, divide them into sub-tasks and implement them based on division of labor.
- They possess the communication skills to write down and present their results in an appropriate way.

Grading through:

- presentation
- project work
- internship report
- Elevator Pitch
- B-Certificate (not graded)

Responsible for this module:

- Prof. Dr.-Ing. Nicole Jochems

Teacher:

- Institute for Multimedia and Interactive Systems
- Prof. Dr.-Ing. Nicole Jochems
- MitarbeiterInnen des Instituts

Literature:

- M. Burhardt: Einführung in das Projektmanagement - Publicis Publ. 2013
- M. B. Rosson & J. M. Carroll: Usability engineering. Scenario-based development of human-computer interaction - Morgan Kaufmann series in interactive technologies, 1st ed. San Fancisco: Academic Press, 2002

Language:

- offered only in German

Notes:

Prerequisites for attending the module:
- None

Prerequisites for the exam:
- None

Exam(s):
- CS3210-L1 Bachelor-Projekt Medieninformatik, Praktikum, semesterbegleitend, B-Schein

Replaces CS3210-KP08 Bachelor-Projekt UI- und Media Design.

CS3220-KP03 - Scientific Working (WissArbeit)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	3 (Typ B)

Course of study, specific field and term:

- Bachelor Media Informatics 2020 (compulsory), media informatics, 5th semester
- Bachelor Media Informatics 2014 (compulsory), interdisciplinary competence, 5th semester

Classes and lectures:

- CS3220-V: Scientific Working (lecture, 1 SWS)
- CS3220-S:Scientific Working (seminar, 1 SWS)

Workload:

- 55 Hours private studies
- 30 Hours in-classroom work

Contents of teaching:

- Scientific work and research
- Developing ideas
- Process-oriented work
- Research and review
- Written work
- Evaluation and empiricism
- Presentation and speech

Qualification-goals/Competencies:

- The students can obtain a solid grounding a scientific topic, from literature research till evaluation.
- They are able to present the results in a written documentation and in a talk in an understandable way.
- The can present and discuss a scientific topic.

Grading through:

- continuous, successful participation in course

Is requisite for:

- Bachelor Thesis Media Informatics (CS3992, CS3992-KP15)

Responsible for this module:

- Prof. Dr.-Ing. Nicole Jochems

Teacher:

- Institute for Multimedia and Interactive Systems
- Dr. rer. nat. Daniel Wessel
- MitarbeiterInnen des Instituts

Language:

- offered only in German

Notes:

Prerequisites for attending the module:
- None

Prerequisites for the exam:
- None

CS3230-KP04 - Design thinking in practice (DeThPr)

Duration:	Turnus of offer:	Credit points:
1 Semester	irregularly in the winter semester	4

Course of study, specific field and term:

- Bachelor Media Informatics 2020 (optional subject), media informatics, 5th or 6th semester
- Bachelor Media Informatics 2014 (optional subject), media informatics, 5th or 6th semester

Classes and lectures:

- Design Thinking in Practice (block practical course, 3 SWS)

Workload:

- 45 Hours in-classroom work
- 35 Hours private studies
- 20 Hours written report
- 20 Hours oral presentation (including preparation)

Contents of teaching:

- Basics of Design Thinking and Google Venture Sprints
- Application of problem analysis and problem definition techniques
- Application of techniques for generating ideas and solving problems
- Application of decision making techniques
- Development of a (digital) prototype
- User validation of the prototype in the usability lab
- Iteration of the prototype and retrospective

Qualification-goals/Competencies:

- The students are familiar with the methods of Design Thinking and Google Venture Sprints and can evaluate the application possibilities and limitations of the methods.
- The students are able to divide the methods of Design Thinking and Google Venture Sprints into meaningful subtasks.
- They can apply the subtasks of the methods practically (e.g. problem description, idea development, idea selection, prototype development using Axure RP or proto.io, carrying out user studies).

Grading through:

- presentation
- project work
- documentation

Responsible for this module:

- Prof. Dr.-Ing. Nicole Jochems

Teacher:

- Institute for Multimedia and Interactive Systems

Literature:

- Jake Knapp: Sprint: How to Solve Big Problems and Test New Ideas in Just Five Days
- Jeanne Liedtka and Tim Ogilvie: Designing for Growth: A Design Thinking Toolkit for Managers

Language:

- German, except in case of only English-speaking participants

Notes:

Prerequisites for attending the module:
- None

Prerequisites for the exam:
- Successful completion of assignments during the semester

Exam(s):
- CS3230-L1 Design-Thinking in der Praxis, mündliche Prüfung, 100% der Modulnote

CS3240-KP04 - New web technologies and use in practice (WebTecPr)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	4

Course of study, specific field and term:

- Bachelor Media Informatics 2020 (optional subject), media informatics, 5th or 6th semester
- Bachelor Media Informatics 2014 (optional subject), media informatics, 5th or 6th semester

Classes and lectures:

- New webtechnologies and usage in practice (lecture, 2 SWS)
- New webtechnologies and usage in practice (exercise, 1 SWS)

Workload:

- 70 Hours private studies
- 50 Hours in-classroom work

Contents of teaching:

- Introduction and overview
- Valuation and improvement of existing code
- Code debugging
- Development of a client-server architecture
- Handling of HTML, CSS and Javascript
- Design and development of different web projects
- Handling of Javascript and CSS-Frameworks

Qualification-goals/Competencies:

- The students are able to analyse and improve existing web source code
- They have knowledge of different web technologies and their useful application
- They have the skills to independently develop a web project
- They have the skills to use methods of web technologies

Grading through:

- exercises and project assignments
- practical exam

Responsible for this module:

- Prof. Dr.-Ing. Nicole Jochems

Teacher:

- Institute for Multimedia and Interactive Systems

Language:

- German, except in case of only English-speaking participants

Notes:

Prerequisites for attending the module:
- None

Prerequistes for attending the exam:
- None

Exam(s):
- CS3240-L1 Neue Webtechnologien und Einsatz in der Praxis, Praktische Prüfungen, semesterbegleitend, B-Schein

CS3260-KP04 - Recent topics of Media Informatics (ThemMedien)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	4

Course of study, specific field and term:

- Bachelor Media Informatics 2020 (optional subject), media informatics, 5th or 6th semester

Classes and lectures:

- Recent topics of Media Informatics (lecture, 2 SWS)
- Recent topics of Media Informatics (exercise, 1 SWS)

Workload:

- 55 Hours private studies
- 45 Hours in-classroom work
- 20 Hours exam preparation

Contents of teaching:

- Current research results and applications of techniques from the field of media informatics

Qualification-goals/Competencies:

- Students have in-depth knowledge of current developments and the current state of research in the field of media informatics and the development of modern interactive systems.
- They can weigh the pros and cons of different media informatics approaches against each other
- They can judge ethical aspects of their work.

Grading through:

- as announced by examiner

Responsible for this module:

- Prof. Dr. rer. pol. Moreen Heine

Teacher:

- Institute for Multimedia and Interactive Systems

- Prof. Dr. rer. pol. Moreen Heine
- MitarbeiterInnen des Instituts

Literature:

- : - Current conference contributions on the topics of the event will be announced in the lectures.

Language:

- German, except in case of only English-speaking participants

Notes:

Prerequisites for attending the module:
- None

Prerequisites for the exam:
- Successful completion of homework assignments as stated at the beginning of the course

Exam(s):
- Will be announced at the beginning of the semester

CS3270-KP04 - Electronic Government - Basics and Application (EGov)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	4

Course of study, specific field and term:

- Bachelor Media Informatics 2014 (optional subject), media informatics, 5th or 6th semester
- Bachelor Media Informatics 2020 (optional subject), media informatics, 5th or 6th semester

Classes and lectures:

- Electronic Government - Basics and Application (lecture, 2 SWS)
- Electronic Government - Basics and Application (exercise, 1 SWS)

Workload:

- 55 Hours private studies
- 45 Hours in-classroom work
- 20 Hours exam preparation

Contents of teaching:

- Foundations Electronic Government
- Strategies
- Uses
- Process management
- Project management
- Interoperability and Integration
- Data security and data protection
- Acceptance
- Current Topics

Qualification-goals/Competencies:

- The students are familiar with the basic definitions and characteristics of e-government, its application in various areas of government and the principles of the design, development and use of e-government applications.
- The students are able to assess the challenges and limitations in e-government.
- Students are able to consider and integrate the perspectives of the various disciplines associated with e-government.
- Students can present and discuss their work results.

Grading through:

- Written exam or written report as announced by the examiner

Responsible for this module:

- Prof. Dr. rer. pol. Moreen Heine

Teacher:

- Institute for Multimedia and Interactive Systems
- Prof. Dr. rer. pol. Moreen Heine

Literature:

- Wirtz, B. W. (Ed.). (2010): E-Government: Grundlagen, Instrumente, Strategien - Gabler
- Bogumil, J., & Jann, W. (2009): Verwaltung und Verwaltungswissenschaft in Deutschland. Einführung in die Verwaltungswissenschaft. - 2., völlig überarbeitete Auflage
- : - Further literature will be announced in the course.

Language:

- German, except in case of only English-speaking participants

Notes:

Prerequisites for attending the module:
- None

Prerequisites for the exam:
- None

Exam(s):
- CS3270-L1 Electronic Government - Grundlagen und Anwendungen, Seminarvortrag, 30% der Modulnote
- CS3270-L1 Electronic Government - Grundlagen und Anwendungen, Hausarbeit, 70% der Modulnote

CS3280-KP04, CS3280 - Bachelor Seminar Media Informatics (BSemMedien)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	4 (Typ B)

Course of study, specific field and term:

- Bachelor Media Informatics 2020 (compulsory), media informatics, 5th semester
- Bachelor Media Informatics 2014 (compulsory), interdisciplinary competence, 5th semester

Classes and lectures:

- Bachelor Seminar (seminar, 2 SWS)

Workload:

- 60 Hours work on an individual topic with written and oral presentation
- 30 Hours private studies
- 30 Hours in-classroom work

Contents of teaching:

- Familiarization in a scientific topic
- Working on a scientific topic and its answers for problems
- Presentation and discussion of the topic

Qualification-goals/Competencies:

- The students can obtain a solid grounding a scientific topic.
- They are able to present the results in a written documentation and in a talk in an understandable way.
- They can present and discuss a scientific topic.

Grading through:

- presentation
- term paper

Responsible for this module:

- Prof. Dr. rer. pol. Moreen Heine

Teacher:

- Institute for Multimedia and Interactive Systems
- Prof. Dr. rer. pol. Moreen Heine
- Dr. rer. nat. Daniel Wessel

Literature:

- Topic and literature are chosen indiviually.:

Language:

- German and English skills required

Notes:

Prerequisites for attending the module:
- None

Prerequisites for the exam:
- None

Exam(s):
- CS3280-L1 Bachelor-Seminar Medieninformatik, Seminarvortrag, 50% der Modulnote
- CS3280-L1 Bachelor-Seminar Medieninformatik, Hausarbeit, 50% der Modulnote

CS3992, CS3992-KP15 - Bachelor Thesis Media Informatics (BScMedien)

Duration:	Turnus of offer:	Credit points:
1 Semester	each semester	15

Course of study, specific field and term:

- Bachelor Media Informatics 2020 (compulsory), media informatics, 6th semester
- Bachelor Media Informatics 2014 (compulsory), media informatics, 6th semester

Classes and lectures:

- Bachelor Thesis Media Informatics (supervised self studies, 1 SWS)
- Colloquium (presentation (incl. preparation), 1 SWS)

Workload:

- 360 Hours research for and write up of a thesis
- 90 Hours oral presentation and discussion (including preparation)

Contents of teaching:

- independent scientific work on a limited task in media informatics and its applications
- scientific presentation on the problem and the solution developed

Qualification-goals/Competencies:

- The students are able to apply the expertise acquired to new problems using established methods and solve them independently.
- They possess the communication skills to write down and present their results in an appropriate way.

Grading through:

- Written report
- colloquium

Responsible for this module:

- Studiengangsleitung Medieninformatik

Teacher:

- Institute for Multimedia and Interactive Systems
- Institutes of the Department of Computer Science/ Engineering
- Alle prüfungsberechtigten Dozentinnen/Dozenten des Studienganges

Literature:

- is selected individually:

Language:

- thesis can be written in German or English

Notes:

From the credit points of the module 12 credit points are awarded for the actual work, the remaining credit points for the preparation and execution of the colloquium.

Prerequisites for attending the module:
- see study programme regulations (e.g. certain minimum number of credit points reached)

CS5610-KP04, CS5610 - Computer-Supported Teaching and Learning (CGLehrLern)

Duration:	Turnus of offer:	Credit points:
1 Semester	every summer semester	4

Course of study, specific field and term:

- Bachelor Media Informatics 2020 (optional subject), media informatics, 5th or 6th semester
- Bachelor Media Informatics 2014 (optional subject), computer science, 5th or 6th semester
- Master Computer Science 2012 (optional subject), specialization field media informatics, 2nd and 3rd semester

Classes and lectures:

- Computer-Supported Teaching and Learning (lecture, 2 SWS)
- Computer-Supported Teaching and Learning (exercise, 1 SWS)

Workload:

- 75 Hours private studies
- 45 Hours in-classroom work

Contents of teaching:

- Introduction to the course
- Introduction to the field of application and research
- Pedagogical foundations
- Overview Digital teaching-learning scenarios
- Digital transformation within the university context
- Learning spaces and learning environments
- Classification of educational technologies
- Standards for teaching and learning technologies
- Development processes
- Learning Analytics
- Gamification
- Legal framework

Qualification-goals/Competencies:

- Students are able to summarize fundamentals, principles and applications of computer-based teaching and learning systems.
- They are able to analyze trends and developments in the field and to assess them with regard to their use in concrete application contexts.
- They have the ability to familiarize themselves with an existing open source system and to develop it further independently along the applicable specifications.

Grading through:

- portfolio exam - the concrete examination elements and their weights will be published in the course

Responsible for this module:

- Prof. Dr.-Ing. Nicole Jochems

Teacher:

- Institute for Multimedia and Interactive Systems
- Prof. Dr.-Ing. Nicole Jochems
- MitarbeiterInnen des Instituts

Literature:

- H. Kritzenberger: Multimediale und Interaktive Lernräume - München: Oldenbourg, 2005
- J. Haake, G. Schwabe & M. Wessner: CSCL-Kompendium 2.0 - München: Oldenbourg, 2012
- S. Schön, M. Ebner: Lehrbuch für Lernen und Lehren mit Technologien - Berlin, epubli 2. Auflage, 2013

Language:

- offered only in German

Notes:

Prerequisites for attending the module:
- None

Prerequisites for the exam:
- None

Exam(s):
- CS5610-L1 Computergestütztes Lernen und Lehren, Portfolio exam, 100% of the module grade

CS5615-KP04, CS5615 - Computer-Supported Cooperative Work (CSCW) in Safety-Critical Contexts (CGKoop)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	4

Course of study, specific field and term:

- Bachelor Media Informatics 2020 (optional subject), media informatics, 5th or 6th semester
- Bachelor IT-Security 2016 (optional subject), computer science, Arbitrary semester
- Bachelor Media Informatics 2014 (optional subject), media informatics, 5th or 6th semester
- Master Computer Science 2012 (optional subject), specialization field media informatics, 2nd or 3rd semester

Classes and lectures:

- Computer-Supported Cooperative Work (CSCW) in Safety-Critical Contexts (lecture, 2 SWS)
- Computer-Supported Cooperative Work (CSCW) in Safety-Critical Contexts (exercise, 1 SWS)

Workload:

- 55 Hours private studies
- 45 Hours in-classroom work
- 20 Hours exam preparation

Contents of teaching:

- Introduction
- Socio-technical systems
- Designing groupware
- Classifying groupware
- Supporting awareness
- Supporting communication
- Supporting coordination
- Supporting teams
- Supporting communities
- Technical integration
- User interfaces for groupware

Qualification-goals/Competencies:

- The students know the basics, principles and applications of computer-supported cooperative work (CSCW) and how to apply them.
- They can describe representative platforms and systems for CSCW.
- They are able to analyze, design, implement and evaluate CSCW systems in an application- and user-oriented way.

Grading through:

- Written or oral exam as announced by the examiner

Responsible for this module:

- Prof. Dr. rer. nat. Tilo Mentler

Teacher:

- Institute for Multimedia and Interactive Systems
- Prof. Dr. rer. nat. Tilo Mentler

Literature:

- T. Gross & M. Koch: Computer-Supported Cooperative Work - München: Oldenbourg-Verlag, 2007
- D. Coleman: Groupware - Collaborative Strategies for Corportate LANSs and Intranets - San Francisco: Prentice-Hall 1997
- G. Schwabe et al.(Hrsg.): CSCW-Kompendium - Berlin: Springer 2001
- F. Lehner, S. Dustdar (Hrsg.): Telekooperation in Unternehmen - Wiesbaden: Deutscher Universitäts-Verlag 1997
- M. Beaudouin-Lafon (Hrsg.): Computer-Supported Cooperative Work - New York: Wiley 1998

Language:

- offered only in German

Notes:

Admission requirements for taking the module:
- None

Admission requirements for participation in module examination(s):
- Successful completion of exercises as specified at the beginning of the semester.

Module examination(s):
- CS5615-L1 Computer-aided cooperation in safety-critical systems, written exam, 90min, 100% of the module grade.

CS5660-KP04 - Music and Computer (MusikComp)

Duration:	Turnus of offer:	Credit points:
1 Semester	every summer semester	4

Course of study, specific field and term:

- Bachelor Media Informatics 2020 (optional subject), media informatics, 5th or 6th semester
- Bachelor Media Informatics 2014 (optional subject), computer science, 5th or 6th semester
- Master Computer Science 2012 (optional subject), specialization field media informatics, 2nd or 3rd semester

Classes and lectures:

- Music and Computer (lecture, 2 SWS)
- Music and Computer (exercise, 1 SWS)

Workload:

- 55 Hours private studies
- 45 Hours in-classroom work
- 20 Hours exam preparation

Contents of teaching:

- Introduction, Overview, Scientific, Artificial and Ordinary Background
- History of Music Technology
- Analog and Digital Soundrecording
- Audio-Software (theory and practice)
- Analog Soundproduction, Electrical Instruments, Electronic Music aud Synthesizer
- Digital Soundsynthesis, Virtual Studio Technology (theory and practice)
- nalog and Digital Soundcontrolling, MIDI-Technology
- MIDI-Software, esp. Sequenzer (theory and practice)
- Musical Programming, Interactive Performance (theory and practice)
- Interface-Technology
- Digital Performance

Qualification-goals/Competencies:

- The students know the theories, methods and technologies for digital music and its production.
- They can analyse, plan, implement and evaluate applications of digital music together with musicians as well as with experts from musical science and from audio technology.

Grading through:

- Written or oral exam as announced by the examiner

Responsible for this module:

- Prof. Dr.-Ing. Nicole Jochems

Teacher:

- Institute for Multimedia and Interactive Systems
- PD Dr. habil. Joachim Stange-Elbe

Literature:

- Peter Manning: Electronic and Computer Music - Oxford University Press, 2013

Language:

- offered only in German

Notes:

Prerequisites for attending the module:
- None

Prerequisites for the exam:
- None

Exam(s):
- CS5660-L1 Musik und Computer, Klausur, 90min, 100% der Modulnote

CS2110-KP04, CS2110 - Mobile Robots (MobilRob14)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	4

Course of study, specific field and term:

- Bachelor Robotics and Autonomous Systems 2020 (compulsory), Robotics and Autonomous Systems, 4th semester
- Bachelor Computer Science 2019 (optional subject), major subject informatics, Arbitrary semester
- Bachelor Media Informatics 2020 (optional subject), Robotics and Autonomous Systems, 5th or 6th semester
- Bachelor Computer Science 2016 (optional subject), major subject informatics, Arbitrary semester
- Bachelor Robotics and Autonomous Systems 2016 (compulsory), Robotics and Autonomous Systems, 4th semester
- Bachelor Computer Science 2014 (compulsory), specialization field robotics and automation, 5th semester
- Bachelor IT-Security 2016 (optional subject), specific, Arbitrary semester

Classes and lectures:

- Mobile Robots (lecture, 2 SWS)
- Mobile Robots (exercise, 1 SWS)

Workload:

- 55 Hours private studies
- 45 Hours in-classroom work
- 20 Hours exam preparation

Contents of teaching:

- Reactive behaviour
- Sensors
- Actuators, kinematics of the drives
- Hybrid deliberative/reactive behaviour
- Strategies of actions
- maps, self-localization
- Routing and navigation
- Robot learning
- Multi-robots
- Human-robot interaction
- Currentds trends, sample robots

Qualification-goals/Competencies:

- The students are able to describe and classify the various AI paradigms for mobile robots (reactive, deliberative, hybrid).
- They are able to explain and evaluate the most important sensors and actuators for mobile robots.
- They are able to describe and apply the basic methods of self-localization, planning and navigation in mobile robotics.
- They are able to iscuss the basic approaches for robot learning as well as multi-robot and human-robot interaction.
- They are able to elucidate the state of the art and current trends in mobile robotics by sample robots.
- They are able to design and program mobile robots.

Grading through:

- Written or oral exam as announced by the examiner

Responsible for this module:

- Prof. Dr.-Ing. Mladen Berekovic

Teacher:

- Institute of Computer Engineering
- Dr. rer. nat. Javad Ghofrani

Literature:

- J. Hertzberg, K. Lingemann, A. Nüchter: Mobile Roboter - Springer Vieweg 2012
- R. R. Murphy: Introduction to AI Robotics - Cambridge, MA: The MIT Press 2000
- R. Siegwart, I. R. Nourbakhsh: Introduction to Autonomous Mobile Robots - Cambridge, MA: The MIT Press 2011

Language:

- offered only in German

Notes:

Prerequisites for attending the module:
- None

Prerequisites for the exam:
- continuous, successful participation in practical course

CS2500-KP04, CS2500 - Robotics (Robotik)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	4

Course of study, specific field and term:

- Bachelor Robotics and Autonomous Systems 2020 (compulsory), Robotics and Autonomous Systems, 3rd semester
- Bachelor Computer Science 2019 (optional subject), major subject informatics, Arbitrary semester
- Bachelor MES 2020 (optional subject), computer science / electrical engineering
- Bachelor Media Informatics 2020 (optional subject), Robotics and Autonomous Systems, 5th or 6th semester
- Bachelor Medical Informatics 2019 (optional subject), medical computer science, 4th to 6th semester
- Bachelor Computer Science 2016 (optional subject), major subject informatics, Arbitrary semester
- Bachelor Robotics and Autonomous Systems 2016 (compulsory), Robotics and Autonomous Systems, 3rd semester
- Bachelor IT-Security 2016 (optional subject), computer science, Arbitrary semester
- Bachelor MES 2014 (optional subject), computer science / electrical engineering, 5th semester
- Bachelor Medical Informatics 2014 (optional subject), medical computer science, 5th or 6th semester
- Bachelor Computer Science 2014 (optional subject), central topics of computer science, 5th semester
- Bachelor Computer Science 2014 (compulsory), specialization field robotics and automation, 3rd semester
- Bachelor Medical Informatics 2011 (optional subject), Applied computer science, 4th to 6th semester
- Bachelor Computer Science 2012 (optional subject), central topics of computer science, 5th semester
- Master CLS 2010 (optional subject), computer science, 3rd semester
- Bachelor MES 2011 (optional subject), medical engineering science, 3rd or 5th semester
- Bachelor Computer Science 2012 (compulsory), specialization field robotics and automation, 3rd semester

Classes and lectures:

- Robotics (lecture, 2 SWS)
- Robotics Exercise (exercise, 2 SWS)

Workload:

- 60 Hours in-classroom work
- 60 Hours private studies

Contents of teaching:

- Description of serial robotic systems: This part includes the basic components like different types of joints, sensors and actors. Exemplarily, the differing kinematic types are introduced. Also, the mathematical backgrounds are presented, necessary for the description of robots. The direct and inverse kinematics for typical 6-jointed industrial robots is explained.
- Parallel robot systems: This part deals with the transfer of the results and mathematical models of part 1 onto robotic systems with parallel kinematics.
- Movement: Robot movements along trajectories/geometric paths are analyzed. Different techniques of path planning are presented as well as methods to determine the configuration space and to perform velocity planning and kinematics.
- Robot Control: Techniques of control theory and examples of programming techniques in robotics are introduced. Sensor and systems calibration as a typical application of robotics is explained in detail.

Qualification-goals/Competencies:

- The students are able to solve application-oriented exercises with mathematical background self-dependent, timely and in team work.
- They have gained basic understanding for the kinematic features of serial and simple parallel robots (includes knowledge of transformations, Euler-/Tail-Bryan-Angles, quaternions, etc.)
- They made first experiences with the programming of simple robotic applications.
- They comprehend the complexity and necessity for different path and dynamic planning techniques.
- The students gained an insight into simple methods for system and sensor calibration.

Grading through:

- written exam

Is requisite for:

- Lab Course Robotics and Automation (CS3501-KP04, CS3501)

Requires:

- Analysis 1 (MA2000-KP08, MA2000)
- Linear Algebra and Discrete Structures 1 (MA1000-KP08, MA1000)

Responsible for this module:

- Prof. Dr. rer. nat. Floris Ernst

Teacher:

- Institute for Robotics and Cognitive Systems
- Prof. Dr.-Ing. Achim Schweikard
- Prof. Dr. rer. nat. Floris Ernst

Literature:

- A. Schweikard, F. Ernst: Medical Robotics - Springer Verlag, 2015
- M. Spong et al.: Robot Modeling and Control - Wiley & Sons, 2005
- H.-J. Siegert, S. Bocionek:: Robotik: Programmierung intelligenter Roboter - Springer Verlag, 1996
- J.-P. Merlet: Parallel Robots - Springer Verlag, 2006
- M. Haun: Handbuch Robotik - Springer Verlag, 2007
- S. Niku: Introduction to Robotics: Analysis, Control, Applications - Wiley & Sons, 2010

Language:

- offered only in German

Notes:

Admission requirements for taking the module:
- None (the competencies of the modules listed under

RO5300-KP06 - Humanoid Robotics (HumRob)

Duration:	Turnus of offer:	Credit points:
1 Semester	irregularly	6

Course of study, specific field and term:

- Master Biophysics 2019 (optional subject), Elective, 1st or 2nd semester
- Bachelor Media Informatics 2020 (optional subject), Robotics and Autonomous Systems, 5th or 6th semester
- Bachelor Robotics and Autonomous Systems 2020 (optional subject), Robotics and Autonomous Systems, 5th or 6th semester
- Bachelor Medical Informatics 2019 (optional subject), medical computer science, 4th to 6th semester
- Bachelor Medical Informatics 2014 (optional subject), Robotics and Autonomous Systems, 5th or 6th semester
- Bachelor Media Informatics 2014 (optional subject), Robotics and Autonomous Systems, 5th or 6th semester
- Bachelor IT-Security 2016 (optional subject), Robotics and Autonomous Systems, Arbitrary semester
- Bachelor Robotics and Autonomous Systems 2016 (optional subject), Robotics and Autonomous Systems, 5th or 6th semester

Classes and lectures:

- Humanoid Robotics (lecture, 2 SWS)
- Humanoid Robotics (exercise, 2 SWS)

Workload:

- 100 Hours private studies
- 60 Hours in-classroom work
- 20 Hours exam preparation

Contents of teaching:

- Walking and locomotion
- Soft Robotics
- Action planning
- Processing heterogeneous and uncertain knowledge
- Image processing and sensor technology for humanoid robots
- Integration of planning and sensor systems
- Learning for humanoid robots
- Interaction between humans and humanoid robots

Qualification-goals/Competencies:

- The students acquire the ability to solve application-oriented exercises from robotics, with a focus on running (humanoid) robots with a mathematical background, independently and on time in a group.
- You have a basic understanding of the kinematic properties of humanoid robots
- You understand the complexity and necessity of knowledge processing and sensor data analysis for robotics applications
- You have gained insight into learning procedures for planning action sequences of humanoid robots, including dynamic processes
- You understand the hazards and risks involved in the interaction of humans and humanoid robots

Grading through:

- Written or oral exam as announced by the examiner

Responsible for this module:

- Prof. Dr.-Ing. Achim Schweikard

Teacher:

- Institute for Robotics and Cognitive Systems
- MitarbeiterInnen des Instituts

Literature:

- Murray, Li and Sastry: A mathematical introduction to robotic manipulation - CRC Press 1994
- B. Siciliano, L. Sciavicco: Robotics: Modelling,Planning and Control - Springer 2009
- Kevin M. Lynch and Frank C. Park: MODERN ROBOTICS, MECHANICS, PLANNING, AND CONTROL - Cambridge University Press 2017
- Bishop: Pattern Recognition and Machine Learning - Springer 2006
- Barber: Bayesian Reasoning and Machine Learning - Cambridge University Press 2007

Language:

- offered only in English

Notes:

Admission requirements for taking the module:
- None

Admission requirements for participation in module examination(s):
- Successful completion of exercise assignments as specified at the beginning of the semester

Module Exam(s):
- RO5300-L1: Humanoid Robotics, Form of examination is specified at the beginning of the semester, 100% of the module grade

CS1150-KP04 - Media design and media production (MMp)

Duration:	Turnus of offer:	Credit points:
1 Semester	each winter semester	4

Course of study, specific field and term:

- Bachelor Media Informatics 2020 (compulsory), design, 1st semester

Classes and lectures:

- Media design and media production (lecture, 2 SWS)
- Media design and media production (exercise, 1 SWS)

Workload:

- 70 Hours private studies
- 30 Hours in-classroom work
- 20 Hours exam preparation

Contents of teaching:

- Introduction and Definitions
- Design as process, as experiment and as heuristic
- Colors
- Pixel Based Graphics
- Vector Based Graphics
- Digital Photography and Scanning
- Digital Audio Design
- Digital Video Composition
- 3D Graphic and Stereoscopy for VR/AR/video
- Aspects of Design in Computer Graphic, Audio and Video

Qualification-goals/Competencies:

- Based on current design practice, students can evaluate production engineering methods and tools for the production of interactive multimedia computer applications.
- They have the competence to evaluate and use production methods and tools for the production of (interactive) media.
- They acquire basic knowledge about findings and methods of media design and media creation.

Grading through:

- portfolio exam - the concrete examination elements and their weights will be published in the course

Responsible for this module:

- Prof. Dr. rer. nat. Hans-Christian Jetter

Teacher:

- Institute for Multimedia and Interactive Systems

Literature:

- Bühler, Schlaich, Sinner: Visuelle Kommunikation - Springer Vieweg, 2017
- Bühler, Schlaich, Sinner: Digitale Farbe - Springer Vieweg, 2018
- Bühler, Schlaich, Sinner: Digitales Bild - Springer Vieweg, 2017
- Bühler, Schlaich, Sinner: Typografie - Springer Vieweg, 2017
- Bühler, Schlaich, Sinner: Printdesign - Springer Vieweg, 2018
- Bühler, Schlaich, Sinner: AV-Medien - Springer Vieweg, 2018

Language:

- German, except in case of only English-speaking participants

Notes:

Prerequisites for attending the module:
- None

Prerequisites for the exam:
- Successful completion of homework assignments as stated at the beginning of the course

Exam(s):
- CS1150-L1 Mediendesign und Medienproduktion, Klausur, 90 min

CS2600-KP08, CS2600SJ14 - Interaction Design and User Experience (IDE)

Duration:	Turnus of offer:	Credit points:
1 Semester	each summer semester	8

Course of study, specific field and term:

- Bachelor Media Informatics 2020 (compulsory), design, 4th semester
- Bachelor Robotics and Autonomous Systems 2020 (optional subject), computer science, 5th or 6th semester
- Bachelor Computer Science 2016 (optional subject), major subject informatics, Arbitrary semester
- Bachelor Robotics and Autonomous Systems 2016 (optional subject), computer science, 5th or 6th semester
- Bachelor Computer Science 2014 (optional subject), central topics of computer science, 6th semester
- Bachelor Media Informatics 2014 (compulsory), media informatics, 4th semester

Classes and lectures:

- Interaction Design (lecture, 4 SWS)
- Interaction Design (exercise, 2 SWS)

Workload:

- 120 Hours private studies
- 90 Hours in-classroom work
- 30 Hours exam preparation

Contents of teaching:

- Introduction and overview
- A short history of Human Computer Interaction (
- Definition and distinction: Software Ergonomics vs Usability Engineering vs Interaction Design
- Usability as design goal: central models and ISO norms, fundamentals of software ergonomic and cognition (a brief review of Software Ergonomics)
- User Experience (UX) as new design goal: Models and background (i.e. pleasurable products, hedonistic and pragmatic quality, emotional design)
- UX as aesthetic and emotional appeal
- UX as ergonomic factor, dark patterns
- Process models for Interaction Design: From Human-Centered Design based on the ISO-Norm to the simplified Four-Phase-Model
- Iterative Design as mental models in action: Design Model, User Model and System Image
- Phase 1 of Interaction Design: 'Understand' (Practical methods of design ethnography and context analysis; representation of users and tasks)
- Phase 2 of Interaction Design: 'design' (system's paradigms: HCI as conversation, HCI as model-world, Direct Manipulation, Tangible Interaction, Proxemic Interaction, Virtual Reality; Sketching User Experiences for idea generation and solution development; design principles and guidelines as decision support, i.e. Normans' principles, gestalt laws, Human Interface Guidelines; theoretical models and techniques from research vs. design practice)
- Phase 3 of Interaction Design 'Build' (basic principles of Prototyping; Low- vs. High-Fidelity-Prototyping; Time vs. Fidelity: Sketching, Paper Prototyping, Wireframes/Click-Through, Dynamic Prototypes, Coded Prototypes; Prototyping tools in practice)
- Phase 4 of interaction design: 'evaluate' (analytic vs empirical methods in practicse; evaluation of users experience with standardized questionnaires; formative vs. summative evaluation; usability tests, A/B studies; Continuous processes for quality control resp. UX evaluation)
- Post WIMP interaction: Interaction Design beyond PC and Smartphone

Qualification-goals/Competencies:

- The students are able to use systematically and theoretically founded methods for the design of user interfaces of interactive systems.
- The students are able to use their knowledge in Software Ergonomics, Media Design and Media Informatics in a realistic Interaction Design project
- They are capable of categorizing existing systems and develop concepts for improving them.
- They are capable of using systematic and theoretical approaches to design user interfaces of interactive systems.
- They are capable of planning and designing human-computer interfaces with high user experience.

Grading through:

- portfolio exam - the concrete examination elements and their weights will be published in the course
- written exam

Requires:

- Software Ergonomics (CS2200-KP04, CS2200)
- Introduction to Media Informatics (CS1600-KP04, CS1600)

Responsible for this module:

- Prof. Dr. rer. nat. Hans-Christian Jetter

Teacher:

- Institute for Multimedia and Interactive Systems
- Prof. Dr. rer. nat. Hans-Christian Jetter
- MitarbeiterInnen des Instituts

Literature:

- M. Herczeg: Interaktionsdesign - Oldenbourg-Verlag, 2006
- H. Sharp, J. Preece, Y. Rogers: Interaction Design: Beyond Human-Computer Interaction - Wiley, 2019
- R. Hartson, P. Pyla: The UX Book: Agile UX Design for a Quality User Experience. - Morgan Kaufman, 2019

Language:

- offered only in German

Notes:

Admission requirements for taking the module
- None (the competences of the modules mentioned under Requires are needed for this module, but are not a formal prerequisite).

Admission requirements for participation in module examination(s):
- Preliminary examinations may be required and will be announced at the beginning of the semester.

Module Exam(s):
- CS2600-L1 Interaction Design and User Experience, written exam, 90min, 50% of the module grade
- CS2600-L1 Interaction Design and User Experience, portfolio exam, 50% of the module grade during the semester

Replaces CS2600-KP08 Interaction Design