



UNIVERSITÄT ZU LÜBECK

Module Guide for the Study Path

# **Bachelor Media Informatics 2014**



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

**Duration:**

1 Semester

**Turnus of offer:**

each winter semester

**Credit points:**

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)
- Lab course Java (lecture, 2 SWS)
- Lab course Java (exercise, 2 SWS)
- Java project (programming project, 2 SWS)

**Workload:**

- 150 Hours private studies
- 90 Hours in-classroom work
- 30 Hours work on project
- 30 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 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

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

**Duration:**

1 Semester

**Turnus of offer:**

each winter semester

**Credit points:**

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
- Multimedia 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

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

1 Semester

**Turnus of offer:**

each winter semester

**Credit points:**

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:**

1 Semester

**Turnus of offer:**

each winter semester

**Credit points:**

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 scientifically 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)

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**Responsible for this module:**

- [Prof. Dr. rer. nat. Jürgen Prestin](#)

**Teacher:**

- [Institute for Mathematics](#)
- [Prof. Dr. rer. nat. Jürgen Prestin](#)
- [PD Dr. rer. nat. Jörn Schnieder](#)

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**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

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**Language:**

- offered only in German

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**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

**CS1001-KP08, CS1001 - Algorithms and Data Structures (AuD)**
**Duration:**

1 Semester

**Turnus of offer:**

each summer semester

**Credit points:**

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, 3rd semester at the earliest
- 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. Esfandiar Mohammadi](#)

**Teacher:**

- [Institute for IT Security](#)
- [Prof. Dr. rer. nat. Esfandiar Mohammadi](#)

**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.

**CS1200-KP06, CS1200SJ14 - Fundamentals of Computer Engineering 1 (TG11)**
**Duration:**

1 Semester

**Turnus of offer:**

each summer semester

**Credit points:**

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
- Bachelor Biophysics 2024 (optional subject), computer science, 6th 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.
- 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

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**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

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**Language:**

- offered only in German

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**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.

<b>CS2200-KP04, CS2200 - Software Ergonomics (SoftErgo)</b>		
<b>Duration:</b> 1 Semester	<b>Turnus of offer:</b> each summer semester	<b>Credit points:</b> 4
<b>Course of study, specific field and term:</b> <ul style="list-style-type: none"> <li>• Bachelor IT-Security 2016 (optional subject), specific, Arbitrary semester</li> <li>• Bachelor Media Informatics 2020 (compulsory), media informatics, 2nd semester</li> <li>• Bachelor Psychology 2016 (optional subject), computer science, Arbitrary semester</li> <li>• Bachelor Psychology 2013 (optional subject), computer science, Arbitrary semester</li> <li>• Bachelor Media Informatics 2014 (compulsory), media informatics, 2nd semester</li> <li>• Bachelor Medical Informatics 2011 (optional subject), software engineering, 4th to 6th semester</li> <li>• Bachelor Computer Science 2012 (compulsory), foundations of computer science, 2nd semester</li> </ul>		
<b>Classes and lectures:</b> <ul style="list-style-type: none"> <li>• Software Ergonomics (lecture, 2 SWS)</li> <li>• Software Ergonomics (exercise, 1 SWS)</li> </ul>		<b>Workload:</b> <ul style="list-style-type: none"> <li>• 55 Hours private studies</li> <li>• 45 Hours in-classroom work</li> <li>• 20 Hours exam preparation</li> </ul>
<b>Contents of teaching:</b> <ul style="list-style-type: none"> <li>• Motivation and introduction</li> <li>• Models of HCI</li> <li>• Modes of input &amp; input devices</li> <li>• Modes of output &amp; output devices</li> <li>• Time behavior of interactive systems</li> <li>• Graphical control elements</li> <li>• Usability and usability processes</li> <li>• Digital work</li> </ul>		
<b>Qualification-goals/Competencies:</b> <ul style="list-style-type: none"> <li>• The students know the basic theories, models and criteria for user- and application-centered interactive multimedia systems.</li> <li>• They are able to transfer this knowledge into development processes and to evaluate interactive systems systematically.</li> <li>• They can describe work systems as well as applications in education and entertainment in a user- and task-centered way.</li> </ul>		
<b>Grading through:</b> <ul style="list-style-type: none"> <li>• portfolio exam - the concrete examination elements and their weights will be published in the course</li> </ul>		
<b>Responsible for this module:</b> <ul style="list-style-type: none"> <li>• <a href="#">Prof. Dr. rer. nat. Hans-Christian Jetter</a></li> </ul>		
<b>Teacher:</b> <ul style="list-style-type: none"> <li>• <a href="#">Institute for Multimedia and Interactive Systems</a></li> <li>• <a href="#">Prof. Dr. rer. nat. Hans-Christian Jetter</a></li> <li>• MitarbeiterInnen des Instituts</li> </ul>		
<b>Literature:</b> <ul style="list-style-type: none"> <li>• M. Herczeg: Software-Ergonomie - 4. Auflage, München: Oldenbourg-Verlag, 2018</li> <li>• <a href="#">Jetter, H.: D 3 Mensch-Computer-Interaktion, Usability und User Experience - In R. Kuhlen, D. Lewandowski, W. Semar &amp; C. Womser-Hacker (Ed.), Grundlagen der Informationswissenschaft (pp. 525-534). Berlin, Boston: De Gruyter Saur.</a></li> </ul>		
<b>Language:</b> <ul style="list-style-type: none"> <li>• offered only in German</li> </ul>		
<b>Notes:</b>		



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, oral exam, 50% of the grade
- CS2200-L1 Software-Ergonomie, portfolio exam, 50% of the grade during the semester

**PY1710-KP04, PY1710 - Work Psychology (ArbPsy)**
**Duration:**

1 Semester

**Turnus of offer:**

not available anymore

**Credit points:**

4

**Course of study, specific field and term:**

- Bachelor Media Informatics 2014 (compulsory), interdisciplinary competence, 2nd semester
- Bachelor Psychology 2013 (optional subject), psychology, Arbitrary semester
- Bachelor Psychology 2016 (optional subject), psychology, 2nd or 4th semester
- Master Entrepreneurship in Digital Technologies 2014 (optional subject), interdisciplinary competence, Arbitrary semester

**Classes and lectures:**

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

**Workload:**

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

**Contents of teaching:**

- History of work psychology
- Sociotechnical systems and work systems
- Models of work behavior
- Work analysis and evaluation
- Effects of work
- Designing work environments and tasks
- Human-machine-systems within work systems
- Training and skill development
- Work motivation and satisfaction with work

**Qualification-goals/Competencies:**

- The students can denote components and influential factors in work systems that include human-machine-interaction and can explain them with recourse to models especially for computer workstations and other applications of digital media in work systems.
- They are able to use psychological concepts and methods and can read and understand psychological scientific studies on applications of digital and interactive media in the context of work.
- They can cooperate effectively with psychologists and ergonomists in interdisciplinary teams.

**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](#)

**Literature:**

- F. W. Nerdinger, G. Blickle & N. Schaper: Arbeits- und Organisationspsychologie (3. Auflage) - Berlin, Heidelberg: Springer, 2014
- K. Sonntag, E. Frieling & R. Stegmaier: Lehrbuch Arbeitspsychologie (3. Auflage) - Bern: Hans Huber, 2012

**Language:**

- offered only in German

**Notes:**

Preliminary examinations 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.

The module will be offered for the last time in the summer semester 2020.

**PY1801-KP08 - Empirical methodology and statistics (EmpStat)**
**Duration:**

1 Semester

**Turnus of offer:**

each summer semester

**Credit points:**

8

**Course of study, specific field and term:**

- Bachelor Media Informatics 2014 (compulsory), psychology, 2nd semester

**Classes and lectures:**

- Statistics I (lecture, 2 SWS)
- Evaluation and Research Methodology (lecture, 2 SWS)
- Research Methodology (exercise, 2 SWS)

**Workload:**

- 150 Hours private studies and exercises
- 90 Hours in-classroom work

**Contents of teaching:**

- DESCRIPTIVE STATISTICS:
  - measures of central tendency and dispersion
  - data visualization and interpretation
  - descriptive univariate analyses of data with different levels of measurement
  - descriptive analysis of bivariate distributions
  - statistical measures and effect sizes
- INFERENCE STATISTICS
  - introduction to probability
  - from population to sample and vice versa
  - analysis of relationships in frequency data
  - principles of statistical hypotheses testing: significance test
  - statistical techniques to explore relationships between variables
  - statistical techniques to compare groups (parametric statistics) Evaluation und Research Methodology
- EVALUATION AND RESEARCH METHODS
  - basic understanding of science
  - theories and literature
  - understanding empirical studies
  - operationalization and data collection methods
  - designs and research plans
  - sampling
  - planning, procedure, organization
  - ethics
  - data entry and cleaning
  - data analysis
  - interpretation and discussion of results

**Qualification-goals/Competencies:**

- Students understand and can critically evaluate the basic concepts of quantitative data analysis with psychological data
- They can apply this knowledge to statistical tasks
- They have a basic understanding of how to use statistics software like SPSS or R
- They are able to discuss statistical results on their own
- They have a basic understanding of evaluation and research methods

**Grading through:**

- written exam

**Responsible for this module:**

- [Prof. Dr. rer. nat. Thomas Franke](#)

**Teacher:**

- [Department of Psychology](#)
- [Institute for Multimedia and Interactive Systems](#)
- [Dr. rer. nat. Daniel Wessel](#)
- [Prof. Dr. rer. nat. Jonas Obleser](#)



**Literature:**

- Eid, M., Gollwitzer, M. & Schmitt, M.: Statistik und Forschungsmethoden. - Beltz. 1. Auflage, 2010
- Wirtz, M., Nachtigall, C: Deskriptive Statistik. Statistische Methoden für Psychologen Teil 1 - Beltz Juventa. 6. Auflage, 2012
- Motulsky, H.: Intuitive Biostatistics - Oxford University Press. 3. Auflage, 2014

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**Language:**

- offered only in German

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

**Duration:**

1 Semester

**Turnus of offer:**

each winter semester

**Credit points:**

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
- Bachelor Biophysics 2024 (optional subject), computer science, 5th 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.

**CS2000-KP08, CS2000 - Theoretical Computer Science (TI)**
**Duration:**

1 Semester

**Turnus of offer:**

each winter semester

**Credit points:**

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

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**Literature:**

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

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**Language:**

- offered only in German

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**Notes:**

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

**CS2300-KP06, CS2300SJ14 - Software Engineering (SWEng14)**

<b>Duration:</b> 1 Semester	<b>Turnus of offer:</b> each winter semester	<b>Credit points:</b> 6	<b>Max. group size:</b> 12
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**Course of study, specific field and term:**

- Bachelor Biophysics 2024 (optional subject), computer science, 5th semester
- 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 assurance.
- They are able to model software systems on different levels of abstraction.
- 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
- Prof. Dr. Diedrich Wolter

**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.

<b>CS2601-KP08, CS2601SJ14 - Media Production and Media Programming (MedienProd)</b>		
<b>Duration:</b> 1 Semester	<b>Turnus of offer:</b> each winter semester	<b>Credit points:</b> 8
<b>Course of study, specific field and term:</b> <ul style="list-style-type: none"> <li>Bachelor Media Informatics 2014 (compulsory), media informatics, 3rd semester</li> </ul>		
<b>Classes and lectures:</b> <ul style="list-style-type: none"> <li>Media Production and Media Programming (lecture, 3 SWS)</li> <li>Media Production and Media Programming (exercise, 3 SWS)</li> </ul>		<b>Workload:</b> <ul style="list-style-type: none"> <li>120 Hours private studies</li> <li>90 Hours in-classroom work</li> <li>30 Hours exam preparation</li> </ul>
<b>Contents of teaching:</b> <ul style="list-style-type: none"> <li>Introduction and Overview</li> <li>Media production: Graphics and Images</li> <li>Media production: Movies and Animations</li> <li>Media production: Audio</li> <li>Media production: 3D-Modelling</li> <li>Media production: Hypermedia</li> <li>Media production: Content-Management-Systems</li> <li>Media programming: Models and architectures</li> <li>Media programming: Interfaces</li> <li>Media programming: Languages and libraries</li> <li>Media programming: Web programming</li> <li>Media programming: Programming for mobile devices</li> <li>Summary and Outlook</li> </ul>		
<b>Qualification-goals/Competencies:</b> <ul style="list-style-type: none"> <li>Students can evaluate technical production methods and tools for programming and production of interactive multimedia computer applications.</li> <li>Students can develop and prototype problem-oriented concepts for interactive multimedia computer applications.</li> </ul>		
<b>Grading through:</b> <ul style="list-style-type: none"> <li>written exam</li> </ul>		
<b>Requires:</b> <ul style="list-style-type: none"> <li>Software Ergonomics (CS2200-KP04, CS2200)</li> </ul>		
<b>Responsible for this module:</b> <ul style="list-style-type: none"> <li><a href="#">Prof. Dr. rer. nat. Michael Herczeg</a></li> </ul>		
<b>Teacher:</b> <ul style="list-style-type: none"> <li><a href="#">Institute for Multimedia and Interactive Systems</a></li> <li><a href="#">Prof. Dr. rer. nat. Michael Herczeg</a></li> <li><a href="#">Prof. Dr.-Ing. Nicole Jochems</a></li> <li>MitarbeiterInnen des Instituts</li> </ul>		
<b>Literature:</b> <ul style="list-style-type: none"> <li>M. Herczeg: Interaktionsdesign - München: Oldenbourg-Verlag, 2006</li> <li>M. Herczeg: Software-Ergonomie: Grundlagen der Mensch-Computer-Kommunikation - 3. Auflage, München: Oldenbourg-Verlag, 2009</li> </ul>		
<b>Language:</b> <ul style="list-style-type: none"> <li>offered only in German</li> </ul>		

<b>PY2210-KP04, PY2210 - Perception and Cognition in HCI (KogPsy)</b>		
<b>Duration:</b> 1 Semester	<b>Turnus of offer:</b> each winter semester	<b>Credit points:</b> 4
<b>Course of study, specific field and term:</b> <ul style="list-style-type: none"> <li>• Bachelor Media Informatics 2020 (compulsory), psychology, 1st semester</li> <li>• Master Entrepreneurship in Digital Technologies 2020 (optional subject), interdisciplinary competence, Arbitrary semester</li> <li>• Bachelor Media Informatics 2014 (compulsory), psychology, 3rd semester</li> </ul>		
<b>Classes and lectures:</b> <ul style="list-style-type: none"> <li>• Psychology of Perception and Cognition (lecture, 2 SWS)</li> <li>• Psychology of Perception and Cognition (seminar, 1 SWS)</li> </ul>		<b>Workload:</b> <ul style="list-style-type: none"> <li>• 75 Hours private studies and exercises</li> <li>• 45 Hours in-classroom work</li> </ul>
<b>Contents of teaching:</b> <ul style="list-style-type: none"> <li>• History of cognitive psychology</li> <li>• Attention</li> <li>• Visual perception</li> <li>• Hearing</li> <li>• Skin senses, haptic and tactile perception</li> <li>• Psychophysics</li> <li>• Expertise, learning, memory, and knowledge</li> <li>• Reasoning and problem solving</li> <li>• Judgment, decision making</li> </ul>		
<b>Qualification-goals/Competencies:</b> <ul style="list-style-type: none"> <li>• The students can understand, classify, and use cognitive psychological scientific contributions.</li> <li>• 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.</li> <li>• They know how to evaluate technological systems and interactive media with methods from cognitive psychology.</li> </ul>		
<b>Grading through:</b> <ul style="list-style-type: none"> <li>• portfolio exam</li> </ul>		
<b>Responsible for this module:</b> <ul style="list-style-type: none"> <li>• <a href="#">Prof. Dr. rer. nat. Thomas Franke</a></li> </ul>		
<b>Teacher:</b> <ul style="list-style-type: none"> <li>• <a href="#">Institute for Multimedia and Interactive Systems</a></li> <li>• <a href="#">Prof. Dr. rer. nat. Thomas Franke</a></li> <li>• MitarbeiterInnen des Instituts</li> </ul>		
<b>Literature:</b> <ul style="list-style-type: none"> <li>• J.R. Anderson: Kognitive Psychologie (7. Auflage) - Heidelberg: Spektrum, 2013</li> <li>• E. B. Goldstein: Wahrnehmungspsychologie (9. Auflage) - Heidelberg: Spektrum, 2014</li> </ul>		
<b>Language:</b> <ul style="list-style-type: none"> <li>• offered only in German</li> </ul>		
<b>Notes:</b>		



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

<b>CS2150-KP08, CS2150SJ14 - Operating Systems and Networks (BSNetze14)</b>		
<b>Duration:</b> 1 Semester	<b>Turnus of offer:</b> each summer semester	<b>Credit points:</b> 8
<b>Course of study, specific field and term:</b>		
<ul style="list-style-type: none"> <li>• Bachelor Media Informatics 2020 (compulsory), computer science, 4th semester</li> <li>• Bachelor Computer Science 2019 (compulsory), foundations of computer science, 4th semester</li> <li>• Bachelor Robotics and Autonomous Systems 2020 (compulsory), computer science, 4th semester</li> <li>• Bachelor Medical Informatics 2019 (compulsory), computer science, 4th semester</li> <li>• Bachelor Computer Science 2016 (compulsory), foundations of computer science, 4th semester</li> <li>• Bachelor Robotics and Autonomous Systems 2016 (compulsory), computer science, 4th semester</li> <li>• Bachelor IT-Security 2016 (compulsory), computer science, 4th semester</li> <li>• Bachelor Media Informatics 2014 (compulsory), foundations of computer science, 4th semester</li> <li>• Bachelor Medical Informatics 2014 (compulsory), computer science, 4th semester</li> <li>• Bachelor Computer Science 2014 (compulsory), foundations of computer science, 4th semester</li> </ul>		
<b>Classes and lectures:</b>		<b>Workload:</b>
<ul style="list-style-type: none"> <li>• Operating Systems and Networks (lecture, 4 SWS)</li> <li>• Operating Systems and Networks (exercise, 2 SWS)</li> </ul>		<ul style="list-style-type: none"> <li>• 130 Hours private studies</li> <li>• 90 Hours in-classroom work</li> <li>• 20 Hours exam preparation</li> </ul>
<b>Contents of teaching:</b>		
<ul style="list-style-type: none"> <li>• Tasks and Structure</li> <li>• Historical Overview of Computer and Operating Systems</li> <li>• Coding of Symbols and Numbers</li> <li>• Foundations of Operating Systems</li> <li>• Processes, Inter-Process Communication and Process Management</li> <li>• Storage Management</li> <li>• Input / Output</li> <li>• Files and File Systems</li> <li>• Examples (UNIX, Windows, mobile OS)</li> <li>• Computer Networks and the Internet</li> <li>• Application Layer</li> <li>• Transport Layer</li> <li>• Network Layer</li> <li>• Link and Physical Layer</li> </ul>		
<b>Qualification-goals/Competencies:</b>		
<ul style="list-style-type: none"> <li>• Students know about the main concepts of operating systems.</li> <li>• Students are able to judge, which OS concepts can be appropriately applied to novel computing architectures.</li> <li>• Students are able to apply the most important strategies and algorithms for operating systems.</li> <li>• At the end of the course, students know the most important concepts of computer networks</li> <li>• Students know the importance of the different layers of the OSI and Internet protocol suite along with the most important protocols and services of each layer</li> <li>• The students are able to decide which network technologies to use to meet the requirements of any given application scenario</li> <li>• The students know how the Internet works and are able to program small applications</li> <li>• Students can apply the most important methods and algorithms from the field of networks</li> </ul>		
<b>Grading through:</b>		
<ul style="list-style-type: none"> <li>• written exam</li> </ul>		
<b>Responsible for this module:</b>		
<ul style="list-style-type: none"> <li>• <a href="#">Prof. Dr. Stefan Fischer</a></li> </ul>		
<b>Teacher:</b>		
<ul style="list-style-type: none"> <li>• <a href="#">Institute of Telematics</a></li> <li>• <a href="#">Prof. Dr. Stefan Fischer</a></li> </ul>		



- [Dr. rer. nat. Florian-Lennert Lau](#)

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**Literature:**

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

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**Language:**

- offered only in German

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**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.

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

<b>Duration:</b>	<b>Turnus of offer:</b>	<b>Credit points:</b>	<b>Max. group size:</b>
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 implementation 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 to standards 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

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**Language:**

- offered only in German

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**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.

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

1 Semester

**Turnus of offer:**

each summer semester

**Credit points:**

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 practice; 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 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
- 

**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:**

- 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
- Michael Richter, Markus Flückiger: Usability und UX kompakt - Produkte für Menschen, 2015
- Saul Greenberg, Sheelagh Carpendale, Nicolai Marquardt, Bill Buxton: Sketching User Experiences - The Workbook, 2012

**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, oral exam, 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

**CS2700-KP04, CS2700 - Databases (DB)**
**Duration:**

1 Semester

**Turnus of offer:**

each winter semester

**Credit points:**

4

**Course of study, specific field and term:**

- Bachelor Biophysics 2024 (optional subject), computer science, 6th semester
- Bachelor MES 2020 (optional subject), computer science / electrical engineering, 3rd semester at the earliest
- 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. Sven Groppe](#)

**Teacher:**

- [Institute of Information Systems](#)
- [Prof. Dr. Sven Groppe](#)

**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.

**PY2904-KP04, PY2904 - Media Psychology (MedienPsy)**

<b>Duration:</b> 1 Semester	<b>Turnus of offer:</b> each summer semester	<b>Credit points:</b> 4
<b>Course of study, specific field and term:</b>		
<ul style="list-style-type: none"> <li>• Bachelor Psychology 2013 (optional subject), psychology, Arbitrary semester</li> <li>• Bachelor Media Informatics 2020 (compulsory), psychology, 4th semester</li> <li>• Bachelor Psychology 2016 (optional subject), psychology, Arbitrary semester</li> <li>• Bachelor Biophysics 2016 (optional subject), no specific field, 6th semester</li> <li>• Bachelor Psychology 2020 (optional subject), psychology, Arbitrary semester</li> <li>• Bachelor Media Informatics 2014 (compulsory), psychology, 4th semester</li> <li>• Bachelor Psychology 2027 (optional subject), psychology, Arbitrary semester</li> </ul>		
<b>Classes and lectures:</b>		<b>Workload:</b>
<ul style="list-style-type: none"> <li>• Media Psychology (lecture, 2 SWS)</li> <li>• Media Psychology (seminar, 1 SWS)</li> </ul>		<ul style="list-style-type: none"> <li>• 75 Hours private studies and exercises</li> <li>• 45 Hours in-classroom work</li> </ul>
<b>Contents of teaching:</b>		
<ul style="list-style-type: none"> <li>• Media selection, media use, media reception</li> <li>• Media effects</li> <li>• Media competency</li> <li>• Persuasive technology, gamification</li> <li>• Advertising, social networks</li> <li>• Public Relations</li> <li>• Human-computer interaction, companion technologies</li> </ul>		
<b>Qualification-goals/Competencies:</b>		
<ul style="list-style-type: none"> <li>• The students can explicate theories and findings of media psychology using digital media as examples.</li> <li>• 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.</li> <li>• They are able to analyse and to evaluate digital media with methods from media psychology.</li> </ul>		
<b>Grading through:</b>		
<ul style="list-style-type: none"> <li>• portfolio exam - the concrete examination elements and their weights will be published in the course</li> </ul>		
<b>Responsible for this module:</b>		
<ul style="list-style-type: none"> <li>• <a href="#">Prof. Dr. rer. nat. Thomas Franke</a></li> </ul>		
<b>Teacher:</b>		
<ul style="list-style-type: none"> <li>• <a href="#">Institute for Multimedia and Interactive Systems</a></li> <li>• <a href="#">Prof. Dr. rer. nat. Thomas Franke</a></li> <li>• MitarbeiterInnen des Instituts</li> </ul>		
<b>Literature:</b>		
<ul style="list-style-type: none"> <li>• B. Batinic &amp; M. Appel (Hrsg.): Medienpsychologie - Heidelberg: Springer, 2008</li> <li>• S. Trepte &amp; L. Reinecke: Medienpsychologie - Stuttgart: Kohlhammer, 2013</li> <li>• :</li> </ul>		
<b>Language:</b>		
<ul style="list-style-type: none"> <li>• offered only in German</li> </ul>		
<b>Notes:</b>		



Prerequisites for attending the module:

- None

Prerequisites for the exam:

- Successful completion of homework assignments during the semester.

Exam(s):

- PY2904-L1 Medienpsychologie, Portfolioprfung, semesterbegleitend, 100% der Modulnote

**CS1002-KP04, CS1002 - Introduction to Logics (Logik)**
**Duration:**

1 Semester

**Turnus of offer:**

each summer semester

**Credit points:**

4

**Course of study, specific field and term:**

- Bachelor MES 2014 (optional subject), computer science / electrical engineering, 3rd semester at the earliest
- 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
- Bachelor Biophysics 2024 (optional subject), computer science, 6th 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
- Formalization and coding of problems
- Validating correctness and satisfiability of formalizations
- Syntax and semantics of propositional logic
- Syntax and semantics of predicate logic
- Proof calculus

**Qualification-goals/Competencies:**

- Students are able to explain the concepts of syntax and semantics for the examples of propositional 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 able 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

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**Language:**

- offered only in German

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**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.

**CS1202-KP06, CS1202 - Fundamentals of Computer Engineering 2 (TG12)**

**Duration:**

1 Semester

**Turnus of offer:**

each winter semester

**Credit points:**

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

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**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

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**Language:**

- offered only in German

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**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

**CS2450-KP02, CS2450 - Tools for scientific practice (Werkzeuge)**
**Duration:**

1 Semester

**Turnus of offer:**

each winter semester

**Credit points:**

2

**Course of study, specific field and term:**

- Bachelor Interdisciplinary Courses for health sciences (optional subject), interdisciplinary competence, Arbitrary semester
- Bachelor Computer Science 2019 (compulsory), interdisciplinary competence, 3rd semester
- Bachelor Medical Informatics 2014 (optional subject), interdisciplinary competence, Arbitrary semester
- Bachelor Medical Informatics 2019 (optional subject), interdisciplinary competence, Arbitrary semester
- Bachelor Computer Science 2016 (compulsory), interdisciplinary competence, 3rd semester
- Bachelor Interdisciplinary Courses (optional subject), Interdisciplinary modules, Arbitrary semester
- Bachelor Media Informatics 2014 (optional subject), interdisciplinary competence, 5th or 6th semester
- Bachelor Computer Science 2014 (compulsory), interdisciplinary competence, 3rd semester

**Classes and lectures:**

- Tools for scientific practice (seminar-style lectures, 2 SWS)

**Workload:**

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

**Contents of teaching:**

- Programming language Python
- Markup languages (LaTeX, Markdown)
- User Interfaces and Integrated Development Environments (Jupyter Notebook)
- Software for version control (git)
- digital libraries search (DBLP, ACM, IEEE) Scientific Computing (NumPy, SciPy)
- Data processing and visualization (Pandas, matplotlib, NLTK)
- Machine Learning (scikit-learn)
- DeepLearning (Tensorflow, PyTorch)

**Qualification-goals/Competencies:**

- The students know diverse technical tools for scientific work.
- They can apply important technical tools from the Python Ecosystem.
- They can handle version control and markup languages.
- They are able to select appropriate tools.

**Grading through:**

- exercises and project assignments

**Is requisite for:**

- Bachelor Thesis Computer Science (CS3990-KP15, CS3990)
- Bachelor Project Computer Science (CS3701-KP05, CS3701SJ14)
- Bachelor Seminar Informatics (CS3702-KP04, CS3702)

**Responsible for this module:**

- Studiengangsleitung Informatik

**Teacher:**

- [Institute of Computer Engineering](#)
- Alle prüfungsberechtigten Dozentinnen/Dozenten des Studienganges

**Language:**

- German and English skills required

**Notes:**

Prerequisites for attending the module:  
- None

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

**Duration:**

1 Semester

**Turnus of offer:**

each summer semester

**Credit points:**

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 subject), 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

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**Language:**

- German and English skills required

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**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:**

1 Semester

**Turnus of offer:**

each winter semester

**Credit points:**

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 subject), 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:**

- Programming Languages and Type Systems (lecture, 2 SWS)
- Programming 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 syntactic 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.
- They 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, CS1000S14)

**Responsible for this module:**

- [Prof. Dr. Martin Leucker](#)

**Teacher:**



- [Institute of Software Technology and Programming Languages](#)
- [Dr. Annette Stümpel](#)
- [Prof. Dr. Martin Leucker](#)

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**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

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**Language:**

- German and English skills required

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**Notes:**

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

**CS3100-KP08, CS3100SJ14 - Signal Processing (SignalV14)**
**Duration:**

1 Semester

**Turnus of offer:**

each winter semester

**Credit points:**

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-actively 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

**CS3130-KP08 - Nonstandard Databases and Data Mining (NDBDM)**
**Duration:**

1 Semester

**Turnus of offer:**

not available anymore

**Credit points:**

8

**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, 5th semester
- Bachelor Medical Informatics 2019 (optional subject), computer science, 4th to 6th semester
- Bachelor Media Informatics 2014 (optional subject), computer science, 5th or 6th semester
- Bachelor IT-Security 2016 (optional subject), computer science, Arbitrary 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

**Classes and lectures:**

- Nonstandard Databases and Data Mining (lecture, 4 SWS)
- Nonstandard Databases and Data Mining (exercise, 2 SWS)

**Workload:**

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

**Contents of teaching:**

- Semi-structured data models (JSON, XML) and full text queries
- Information Retrieval
- Multidimensional index structures
- Clustering
- Embedding techniques
- first-n, top-k, and skyline queries
- Probabilistic databases, query response, query transformation, safe plan query, top-k queries (Monte Carlo simulation, Luby-Karp method, multi-simulation), open-world acceptance
- Probabilistic modeling, Bayesian networks, query response algorithms, learning methods for models
- Temporal databases and the relational model
- Probabilistic Temporal Databases
- SQL: new developments (e.g. JSON structures and arrays), time series (e.g. TimescaleDB)
- Stream databases, principles of window-oriented incremental processing
- Approximation techniques for stream data processing, stream mining
- Probabilistic spatiotemporal databases and stream data processing systems: queries and index structures, spatiotemporal data mining, probabilistic skylines
- From NoSQL to NewSQL databases, graph data in SQL, CAP theorem, CALM theorem, blockchain databases

**Qualification-goals/Competencies:**

- Knowledge: Students can name the main features of standard databases and, in addition, can explain which nonstandard database models emerge if certain features are dropped. Students can describe the main ideas behind nonstandard databases presented in the course by explaining the main features of respective query languages (syntax and semantics) as well as the most important implementation techniques used for their practical realization.
- Skills: Students can apply query languages for nonstandard data models introduced in the course to retrieve desired structures from sample datasets for satisfying human information needs. Students will be enabled to represent data in the relational data model using encoding techniques presented in the course such that they can demonstrate how new formalisms relate to or can be implemented in SQL (SQL-2011). In case an SQL transformation cannot be found, students can explain and apply dedicated algorithms for query answering. Students can demonstrate how index structures help answering queries fast by showing how index structures are built, updated, and exploited for query answering. The participants of the course can derive query answers by evaluating queries step by step and by deriving optimized query execution plans.
- Social skills: Students work in teams to handle assignments, and they are encouraged to present their solution to other students in small presentations (in lab classes). In addition, self-dependence is fostered by giving pointers to query evaluation engines for various formalism presented in the lecture such that students get familiar with data models and query languages by self-controlled work.

**Grading through:**

- written exam

**Requires:**

- Databases (CS2700-KP04, CS2700)

**Responsible for this module:**

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

**Teacher:**

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

**Literature:**

- S. Abiteboul, P. Buneman, D. Suciu: Data on the Web - From Relations to Semistructured Data and XML - Morgan-Kaufmann, 1999
- Ch. Aggarwal: Data Mining - The Textbook - Springer, 2015
- S. Chakravarthy, Q. Jiang: Stream Data Processing - A Quality of Service Perspective - Springer, 2009
- J. Leskovec, A. Rajaraman: Mining of Massive Datasets - Cambridge University Press, 2012
- P. Revesz: Introduction to Databases: From Biological to Spatio-Temporal - Springer 2010
- P. Rigaux, M. Scholl, A. Voisard: Spatial Databases With Applications to GIS - Morgan-Kaufmann, 2001
- D. Suciu, D. Olteanu, Chr. Re, Chr. Koch: Probabilistic Databases - Morgan & Claypool, 2011

**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 assignments as specified at the beginning of the semester.

Module Exam(s):

- CS3130-L1: Non-Standard Databases and Data Mining, written exam, 90min, 100% of module grade.

Former name of the module: Algorithmic Data Analysis

**CS3202-KP04, CS3202 - Nonstandard Database Systems (NDB)**

**Duration:**

1 Semester

**Turnus of offer:**

not available anymore

**Credit points:**

4

**Course of study, specific field and term:**

- 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, 5th or 6th semester
- Bachelor Medical Informatics 2011 (optional subject), Applied computer science, 4th to 6th semester
- Master Computer Science 2012 (optional subject), specialization field media informatics, 2nd or 3rd semester
- Master CLS 2010 (optional subject), computer science, Arbitrary semester
- Bachelor CLS 2010 (optional subject), computer science, 6th semester
- Master Computer Science 2012 (optional subject), advanced curriculum distributed information systems, 2nd or 3rd semester
- Bachelor Computer Science 2012 (optional subject), central topics of computer science, 5th or 6th semester

**Classes and lectures:**

- Nonstandard Database Systems (lecture, 2 SWS)
- Nonstandard Database Systems (exercise, 1 SWS)

**Workload:**

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

**Contents of teaching:**

- introduction
- semistructured databases
- Temporal and spatial databases (temporally restricted validity, multidimensional index structures)
- Sequence Databases
- Databases for data streams (window concept)
- Databases for incomplete information (e.g., constraint databases)
- Probabilistic databases
- Databases with answer ranking (top-k queries)

**Qualification-goals/Competencies:**

- Knowledge: Students can name the main features of standard databases and, in addition, can explain which non-standard database models emerge if features are dropped. They can describe the main ideas behind non-standard databases presented in the course by explaining the main features of respective query languages (syntax and semantics) as well as the most important implementation techniques used for their practical realization.
- Skills: Students can apply query languages for non-standard data models introduced in the course to retrieve desired structures from sample datasets in order to satisfy information needs specified textually in natural language. Students are able to represent data in the relational data model using encoding techniques presented in the course such that they can demonstrate how new formalisms relate to or can be implemented in SQL (in particular, SQL-99). In case an SQL transformation cannot be found, students can explain and apply dedicated algorithms for query answering. Students can demonstrate how index structures help answering queries fast by showing how index structures are built, updated, and exploited for query answering. The participants of the course can derive query answers by evaluating queries step by step and by deriving optimized query execution plans.
- Social skills: Students work in teams to handle assignments, and they are encouraged to present their solution to other students in small presentations (in lab classes). In addition, self-dependence is fostered by giving pointers to query evaluation engines for various formalism presented in the lecture such that students get familiar with data models and query languages by self-controlled work.

**Grading through:**

- Written or oral exam as announced by the examiner

**Requires:**

- Databases (CS2700-KP04, CS2700)

**Responsible for this module:**

- [Prof. Dr. rer. nat. habil. Ralf Möller](#)

**Teacher:**

- [Institute of Information Systems](#)



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

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**Literature:**

- S. Abiteboul, P. Buneman, D. Suciu: Data on the Web - From Relations to Semistructured Data and XML - Morgan Kaufmann, 1999
- J. Chomicki, G. Saake (Eds.): Logics for Databases and Information Systems - Springer, 1998
- P. Rigaux, M. Scholl, A. Voisard: Spatial Databases With Applications to GIS - Morgan Kaufmann, 2001
- P. Revesz: Introduction to Constraint Databases - Springer, 2002
- P. Revesz: Introduction to Databases- From Biological to Spatio-Temporal - Springer 2010
- S. Ceri, A. Bozzon, M. Brambilla, E. Della Valle, P. Fraternali, S. Quarteroni: Web Information Retrieval - Springer, 2013
- S. Chakravarthy, Q. Jiang: Stream Data Processing A Quality of Service Perspective - Springer, 2009
- D. Suciu, D. Olteanu, Chr. Re, Chr. Koch: Probabilistic Databases - Morgan & Claypool, 2011

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**Language:**

- offered only in German

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

<b>Duration:</b>	<b>Turnus of offer:</b>	<b>Credit points:</b>
1 Semester	each summer semester	4
<b>Course of study, specific field and term:</b>		
<ul style="list-style-type: none"> <li>• Bachelor Biophysics 2024 (optional subject), computer science, 6th semester</li> <li>• Bachelor Robotics and Autonomous Systems 2020 (compulsory), Robotics and Autonomous Systems, 6th semester</li> <li>• Bachelor Computer Science 2019 (optional subject), major subject informatics, Arbitrary semester</li> <li>• Bachelor MES 2020 (optional subject), computer science / electrical engineering, 3rd semester at the earliest</li> <li>• Bachelor Media Informatics 2020 (optional subject), computer science, 5th or 6th semester</li> <li>• Bachelor Medical Informatics 2019 (optional subject), computer science, 4th to 6th semester</li> <li>• Bachelor MES 2014 (optional subject), computer science / electrical engineering, 3rd semester at the earliest</li> <li>• Bachelor Computer Science 2016 (optional subject), major subject informatics, Arbitrary semester</li> <li>• Bachelor Computer Science 2016 (compulsory), Canonical Specialization Web and Data Science, 6th semester</li> <li>• Bachelor Robotics and Autonomous Systems 2016 (compulsory), Robotics and Autonomous Systems, 6th semester</li> <li>• Bachelor IT-Security 2016 (optional subject), computer science, Arbitrary semester</li> <li>• Bachelor Biophysics 2016 (optional subject), computer science, 6th semester</li> <li>• Bachelor Medical Informatics 2014 (optional subject), computer science, 5th or 6th semester</li> <li>• Bachelor Media Informatics 2014 (optional subject), computer science, 5th or 6th semester</li> <li>• Bachelor Computer Science 2014 (optional subject), central topics of computer science, 6th semester</li> <li>• Bachelor Computer Science 2014 (compulsory), specialization field robotics and automation, 6th semester</li> <li>• Bachelor Medical Informatics 2011 (optional subject), Applied computer science, 4th to 6th semester</li> <li>• Bachelor CLS 2010 (optional subject), computer science, 6th semester</li> <li>• Bachelor MES 2011 (optional subject), medical engineering science, 6th semester</li> <li>• Bachelor Computer Science 2012 (compulsory), specialization field robotics and automation, 4th semester</li> <li>• Bachelor Computer Science 2012 (optional subject), central topics of computer science, 5th or 6th semester</li> </ul>		
<b>Classes and lectures:</b>	<b>Workload:</b>	
<ul style="list-style-type: none"> <li>• Artificial Intelligence (lecture, 2 SWS)</li> <li>• Artificial Intelligence (exercise, 2 SWS)</li> </ul>	<ul style="list-style-type: none"> <li>• 55 Hours private studies</li> <li>• 45 Hours in-classroom work</li> <li>• 20 Hours exam preparation</li> </ul>	
<b>Contents of teaching:</b>		
<ul style="list-style-type: none"> <li>• Part 1: Search strategies As 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, adversarial search as well as heuristic search. The concept of agents will be presented.</li> <li>• Part 2: Learning and reasoning Revision 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.</li> <li>• Part 3: Applications of artificial intelligence Typical applications in the fields of robotics, machine vision, and industrial image and data processing are identified. Ethical issues and risks of the development of artificial intelligence are discussed.</li> </ul>		
<b>Qualification-goals/Competencies:</b>		
<ul style="list-style-type: none"> <li>• The students are able to handle scope-oriented tutorials with a mathematical background in a team, and timely.</li> <li>• They have developed an understanding for the benefits and disadvantages of the different search and problem solving techniques.</li> <li>• The students are in a position to choose and apply independently appropriate algorithms for search and learning issues.</li> <li>• They have gained an insight into the complex development of systems with artificial intelligence and the distinction of its various forms.</li> <li>• The students have an understanding of the risks and possible technological consequences of the development of systems with strong AI.</li> </ul>		
<b>Grading through:</b>		
<ul style="list-style-type: none"> <li>• portfolio exam</li> </ul>		
<b>Requires:</b>		
<ul style="list-style-type: none"> <li>• Analysis 2 (MA2500-KP04, MA2500)</li> <li>• Algorithms and Data Structures (CS1001-KP08, CS1001)</li> </ul>		

**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, Portfolio examination, 100% of the module grade

Note: The portfolio examination consists of: 70 points in the form of a written examination at the end of the semester, 15 points in the form of semester-accompanying programming tasks (group and individual performance), 15 points in the form of semester-accompanying e-tests (individual performance)

<b>CS3230-KP04 - Design thinking in practice (DeThPr)</b>		
<b>Duration:</b> 1 Semester	<b>Turnus of offer:</b> irregularly in the winter semester	<b>Credit points:</b> 4
<b>Course of study, specific field and term:</b> <ul style="list-style-type: none"> <li>• Bachelor Media Informatics 2020 (optional subject), media informatics, 5th or 6th semester</li> <li>• Bachelor Media Informatics 2014 (optional subject), media informatics, 5th or 6th semester</li> </ul>		
<b>Classes and lectures:</b> <ul style="list-style-type: none"> <li>• Design Thinking in Practice (block practical course, 3 SWS)</li> </ul>	<b>Workload:</b> <ul style="list-style-type: none"> <li>• 45 Hours in-classroom work</li> <li>• 35 Hours private studies</li> <li>• 20 Hours written report</li> <li>• 20 Hours oral presentation (including preparation)</li> </ul>	
<b>Contents of teaching:</b> <ul style="list-style-type: none"> <li>• Basics of Design Thinking and Google Venture Sprints</li> <li>• Application of problem analysis and problem definition techniques</li> <li>• Application of techniques for generating ideas and solving problems</li> <li>• Application of decision making techniques</li> <li>• Development of a (digital) prototype</li> <li>• User validation of the prototype in the usability lab</li> <li>• Iteration of the prototype and retrospective</li> </ul>		
<b>Qualification-goals/Competencies:</b> <ul style="list-style-type: none"> <li>• 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.</li> <li>• The students are able to divide the methods of Design Thinking and Google Venture Sprints into meaningful subtasks.</li> <li>• 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).</li> </ul>		
<b>Grading through:</b> <ul style="list-style-type: none"> <li>• presentation</li> <li>• project work</li> <li>• documentation</li> </ul>		
<b>Responsible for this module:</b> <ul style="list-style-type: none"> <li>• <a href="#">Prof. Dr.-Ing. Nicole Jochems</a></li> </ul> <b>Teacher:</b> <ul style="list-style-type: none"> <li>• <a href="#">Institute for Multimedia and Interactive Systems</a></li> </ul>		
<b>Literature:</b> <ul style="list-style-type: none"> <li>• Jake Knapp: Sprint: How to Solve Big Problems and Test New Ideas in Just Five Days</li> <li>• Jeanne Liedtka and Tim Ogilvie: Designing for Growth: A Design Thinking Toolkit for Managers</li> </ul>		
<b>Language:</b> <ul style="list-style-type: none"> <li>• German, except in case of only English-speaking participants</li> </ul>		
<b>Notes:</b> <p>Prerequisites for attending the module: - None</p> <p>Prerequisites for the exam: - Successful completion of assignments during the semester</p> <p>Exam(s): - CS3230-L1 Design-Thinking in der Praxis, mündliche Prüfung, 100% der Modulnote</p>		



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

1 Semester

**Turnus of offer:**

each summer semester

**Credit points:**

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

Prerequisites for attending the exam:

- None

Exam(s):

- CS3240-L1 Neue Webtechnologien und Einsatz in der Praxis, Praktische Prüfungen, semesterbegleitend, B-Schein

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

**Duration:**

1 Semester

**Turnus of offer:**

each winter semester

**Credit points:**

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

<b>CS5610-KP04, CS5610 - Computer-Supported Teaching and Learning (CGLehrLern)</b>		
<b>Duration:</b>	<b>Turnus of offer:</b>	<b>Credit points:</b>
1 Semester	every summer semester	4
<b>Course of study, specific field and term:</b>		
<ul style="list-style-type: none"> <li>• Bachelor Media Informatics 2020 (optional subject), media informatics, 5th or 6th semester</li> <li>• Bachelor Media Informatics 2014 (optional subject), computer science, 5th or 6th semester</li> <li>• Master Computer Science 2012 (optional subject), specialization field media informatics, 2nd and 3rd semester</li> </ul>		
<b>Classes and lectures:</b>		<b>Workload:</b>
<ul style="list-style-type: none"> <li>• Computer-Supported Teaching and Learning (lecture, 2 SWS)</li> <li>• Computer-Supported Teaching and Learning (exercise, 1 SWS)</li> </ul>		<ul style="list-style-type: none"> <li>• 75 Hours private studies</li> <li>• 45 Hours in-classroom work</li> </ul>
<b>Contents of teaching:</b>		
<ul style="list-style-type: none"> <li>• Introduction to the course</li> <li>• Introduction to the field of application and research</li> <li>• Pedagogical foundations</li> <li>• Overview Digital teaching-learning scenarios</li> <li>• Digital transformation within the university context</li> <li>• Learning spaces and learning environments</li> <li>• Classification of educational technologies</li> <li>• Standards for teaching and learning technologies</li> <li>• Development processes</li> <li>• Learning Analytics</li> <li>• Gamification</li> <li>• Legal framework</li> </ul>		
<b>Qualification-goals/Competencies:</b>		
<ul style="list-style-type: none"> <li>• Students are able to summarize fundamentals, principles and applications of computer-based teaching and learning systems.</li> <li>• They are able to analyze trends and developments in the field and to assess them with regard to their use in concrete application contexts.</li> <li>• They have the ability to familiarize themselves with an existing open source system and to develop it further independently along the applicable specifications.</li> </ul>		
<b>Grading through:</b>		
<ul style="list-style-type: none"> <li>• portfolio exam - the concrete examination elements and their weights will be published in the course</li> </ul>		
<b>Responsible for this module:</b>		
<ul style="list-style-type: none"> <li>• <a href="#">Prof. Dr.-Ing. Nicole Jochems</a></li> </ul>		
<b>Teacher:</b>		
<ul style="list-style-type: none"> <li>• <a href="#">Institute for Multimedia and Interactive Systems</a></li> <li>• <a href="#">Prof. Dr.-Ing. Nicole Jochems</a></li> <li>• MitarbeiterInnen des Instituts</li> </ul>		
<b>Literature:</b>		
<ul style="list-style-type: none"> <li>• H. Kritzenberger: Multimediale und Interaktive Lernräume - München: Oldenbourg, 2005</li> <li>• J. Haake, G. Schwabe &amp; M. Wessner: CSCL-Kompendium 2.0 - München: Oldenbourg, 2012</li> <li>• S. Schön, M. Ebner: Lehrbuch für Lernen und Lehren mit Technologien - Berlin, epubli 2. Auflage, 2013</li> </ul>		
<b>Language:</b>		
<ul style="list-style-type: none"> <li>• offered only in German</li> </ul>		
<b>Notes:</b>		



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)		
<b>Duration:</b> 1 Semester	<b>Turnus of offer:</b> Currently not available	<b>Credit points:</b> 4
<b>Course of study, specific field and term:</b> <ul style="list-style-type: none"> <li>• Bachelor Media Informatics 2020 (optional subject), media informatics, 5th or 6th semester</li> <li>• Bachelor IT-Security 2016 (optional subject), computer science, Arbitrary semester</li> <li>• Bachelor Media Informatics 2014 (optional subject), media informatics, 5th or 6th semester</li> <li>• Master Computer Science 2012 (optional subject), specialization field media informatics, 2nd or 3rd semester</li> </ul>		
<b>Classes and lectures:</b> <ul style="list-style-type: none"> <li>• Computer-Supported Cooperative Work (CSCW) in Safety-Critical Contexts (lecture, 2 SWS)</li> <li>• Computer-Supported Cooperative Work (CSCW) in Safety-Critical Contexts (exercise, 1 SWS)</li> </ul>		<b>Workload:</b> <ul style="list-style-type: none"> <li>• 55 Hours private studies</li> <li>• 45 Hours in-classroom work</li> <li>• 20 Hours exam preparation</li> </ul>
<b>Contents of teaching:</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Socio-technical systems</li> <li>• Designing groupware</li> <li>• Classifying groupware</li> <li>• Supporting awareness</li> <li>• Supporting communication</li> <li>• Supporting coordination</li> <li>• Supporting teams</li> <li>• Supporting communities</li> <li>• Technical integration</li> <li>• User interfaces for groupware</li> </ul>		
<b>Qualification-goals/Competencies:</b> <ul style="list-style-type: none"> <li>• The students know the basics, principles and applications of computer-supported cooperative work (CSCW) and how to apply them.</li> <li>• They can describe representative platforms and systems for CSCW.</li> <li>• They are able to analyze, design, implement and evaluate CSCW systems in an application- and user-oriented way.</li> </ul>		
<b>Grading through:</b> <ul style="list-style-type: none"> <li>• Written or oral exam as announced by the examiner</li> </ul>		
<b>Responsible for this module:</b> <ul style="list-style-type: none"> <li>• N.N.</li> </ul>		
<b>Teacher:</b> <ul style="list-style-type: none"> <li>• <a href="#">Institute for Multimedia and Interactive Systems</a></li> </ul>		
<b>Literature:</b> <ul style="list-style-type: none"> <li>• T. Gross &amp; M. Koch: Computer-Supported Cooperative Work - München: Oldenbourg-Verlag, 2007</li> <li>• D. Coleman: Groupware - Collaborative Strategies for Corporate LANs and Intranets - San Francisco: Prentice-Hall 1997</li> <li>• G. Schwabe et al.(Hrsg.): CSCW-Kompodium - Berlin: Springer 2001</li> <li>• F. Lehner, S. Dustdar (Hrsg.): Telekooperation in Unternehmen - Wiesbaden: Deutscher Universitäts-Verlag 1997</li> <li>• M. Beaudouin-Lafon (Hrsg.): Computer-Supported Cooperative Work - New York: Wiley 1998</li> </ul>		
<b>Language:</b> <ul style="list-style-type: none"> <li>• offered only in German</li> </ul>		
<b>Notes:</b>		



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:**

1 Semester

**Turnus of offer:**

every summer semester

**Credit points:**

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 and Synthesizer
- Digital Soundsynthesis, Virtual Studio Technology (theory and practice)
- analog 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



PY3210-KP04 - Gamification (Gamific)		
<b>Duration:</b> 1 Semester	<b>Turnus of offer:</b> irregularly	<b>Credit points:</b> 4 (Typ B)
<b>Course of study, specific field and term:</b> <ul style="list-style-type: none"> <li>• Bachelor Media Informatics 2020 (optional subject), psychology, 5th or 6th semester</li> <li>• Bachelor Media Informatics 2014 (optional subject), psychology, 5th or 6th semester</li> </ul>		
<b>Classes and lectures:</b> <ul style="list-style-type: none"> <li>• Gamification (lecture, 1 SWS)</li> <li>• Gamification (seminar, 1 SWS)</li> </ul>		<b>Workload:</b> <ul style="list-style-type: none"> <li>• 60 Hours in-classroom work</li> <li>• 20 Hours written report</li> <li>• 20 Hours private studies</li> <li>• 20 Hours Multimedia contribution</li> </ul>
<b>Contents of teaching:</b> <ul style="list-style-type: none"> <li>•</li> <li>•</li> <li>•</li> <li>•</li> <li>•</li> <li>•</li> <li>•</li> </ul>		
<b>Qualification-goals/Competencies:</b> <ul style="list-style-type: none"> <li>•</li> <li>•</li> <li>•</li> <li>•</li> </ul>		
<b>Grading through:</b> <ul style="list-style-type: none"> <li>• see Notes</li> <li>• project work</li> <li>• successful addressing of the project goals</li> </ul>		
<b>Responsible for this module:</b> <ul style="list-style-type: none"> <li>• Prof. Dr. rer. pol. Moreen Heine</li> </ul> <b>Teacher:</b> <ul style="list-style-type: none"> <li>• Institute for Multimedia and Interactive Systems</li> <li>• Dr. rer. nat. Daniel Wessel</li> </ul>		
<b>Literature:</b> <ul style="list-style-type: none"> <li>• :</li> </ul>		
<b>Language:</b> <ul style="list-style-type: none"> <li>• German and English skills required</li> </ul>		

**RO5300-KP06 - Humanoid Robotics (HumRob)**
**Duration:**

1 Semester

**Turnus of offer:**

each summer semester

**Credit points:**

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:**

- Development of humanoid robots: The special features of the kinematics of humanoid robots based on the human model are considered. Challenges and strategies for the design of humanoid robots are discussed. Mechatronic concepts for humanoid robot development are presented using examples.
- Control of humanoid walking robots: Basic concepts for the planning and control of walking movements are introduced. The characteristics of human locomotion are considered. Based on this, the motion planning and control of robotic walking is presented.
- Gripping with humanoid robot hands: Grip planning and grip synthesis with humanoid robot hands is presented. Basic characteristics of human grasping are considered. Analytical methods for planning and evaluating grasps are discussed and modern approaches for learning grasps are introduced.
- Modeling and planning: Basic concepts of modeling and planning tasks are discussed. The description of a goal-oriented action using modular actions is shown. Optimization methods for automated action planning are presented.

**Qualification-goals/Competencies:**

- Students acquire the ability to independently solve application-oriented exercises from robotics, with a focus on (humanoid) robots with a mathematical background
- You have a basic understanding of the kinematic properties of humanoid robots
- They know the requirements for the design of humanoid robots and understand mechatronic concepts for the development of human-inspired robot kinematics.
- They understand the complexity of controlling humanoid robots, especially with regard to bipedal walking and gripping with five-fingered hands, including the dynamic processes
- You have gained an insight into learning methods for planning the action sequences of humanoid robots, including the dynamic processes
- You have experience in programming humanoid robots

**Grading through:**

- Oral examination

**Responsible for this module:**

- [Prof. Dr.-Ing. Julia Starke](#)

**Teacher:**

- [Institute for Robotics and Cognitive Systems](#)
- [Prof. Dr.-Ing. Julia Starke](#)

**Literature:**

- Murray, Li and Sastry: A mathematical introduction to robotic manipulation - CRC Press 1994

**Language:**



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**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, oral exam, 100% of the module grade

**CS3201-KP04, CS3201 - Usability Engineering (UsabUXEng)**

<b>Duration:</b> 1 Semester	<b>Turnus of offer:</b> each winter semester	<b>Credit points:</b> 4
<b>Course of study, specific field and term:</b>		
<ul style="list-style-type: none"> <li>• Bachelor Media Informatics 2020 (compulsory), media informatics, 5th semester</li> <li>• Bachelor Computer Science 2019 (optional subject), major subject informatics, Arbitrary semester</li> <li>• Bachelor Computer Science 2019 (compulsory), Canonical Specialization SSE, 5th semester</li> <li>• Bachelor Robotics and Autonomous Systems 2020 (optional subject), computer science, 5th or 6th semester</li> <li>• Bachelor Computer Science 2016 (optional subject), major subject informatics, Arbitrary semester</li> <li>• Bachelor Computer Science 2016 (compulsory), Canonical Specialization SSE, 5th semester</li> <li>• Bachelor Robotics and Autonomous Systems 2016 (optional subject), computer science, 5th or 6th semester</li> <li>• Bachelor IT-Security 2016 (optional subject), computer science, Arbitrary semester</li> <li>• Bachelor Media Informatics 2014 (compulsory), media informatics, 5th semester</li> <li>• Bachelor Computer Science 2014 (optional subject), central topics of computer science, 5th semester</li> <li>• Bachelor Medical Informatics 2011 (optional subject), software engineering, 4th to 6th semester</li> <li>• Bachelor Computer Science 2012 (compulsory), specialization field media informatics, 6th semester</li> <li>• Bachelor Computer Science 2012 (optional subject), central topics of computer science, 6th semester</li> </ul>		
<b>Classes and lectures:</b>	<b>Workload:</b>	
<ul style="list-style-type: none"> <li>• Usability Engineering (lecture, 2 SWS)</li> <li>• Usability-Engineering (exercise, 1 SWS)</li> </ul>	<ul style="list-style-type: none"> <li>• 55 Hours private studies</li> <li>• 45 Hours in-classroom work</li> <li>• 20 Hours exam preparation</li> </ul>	
<b>Contents of teaching:</b>		
<ul style="list-style-type: none"> <li>• Introduction and motivation</li> <li>• Software- und Usability-Engineering</li> <li>• Usability and UX target criteria for interactive systems</li> <li>• Cost-benefit analysis</li> <li>• Design and conception methods for user experience</li> <li>• Organizational and context analysis</li> <li>• User analyses</li> <li>• Task analyses</li> <li>• Modeling and design of interactive systems</li> <li>• Evaluation of interactive systems: planning, implementation and evaluation</li> <li>• Statistical methods of usability and UX evaluation</li> <li>• Interdisciplinary teams and social processes</li> <li>• Embedding usability and UX in business processes</li> </ul>		
<b>Qualification-goals/Competencies:</b>		
<ul style="list-style-type: none"> <li>• Students can explain and implement the basic human-centered development processes for multimedia interactive systems.</li> <li>• You can adapt and apply the basic processes for development projects to suit the problem.</li> <li>• They can apply usability and user experience engineering methods in a targeted manner and evaluate, reflect on and communicate their results.</li> <li>• They can justify the influence of formal and informal requirements as well as complex social structures and behaviors on human-centered development processes.</li> <li>• The exercise trains team skills, structured work, time management and presentation skills.</li> </ul>		
<b>Grading through:</b>		
<ul style="list-style-type: none"> <li>• written exam</li> </ul>		
<b>Requires:</b>		
<ul style="list-style-type: none"> <li>• Software Ergonomics (CS2200-KP04, CS2200)</li> </ul>		
<b>Responsible for this module:</b>		
<ul style="list-style-type: none"> <li>• <a href="#">Prof. Dr. phil. André Calero Valdez</a></li> </ul>		
<b>Teacher:</b>		

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

**Literature:**

- Deborah J. Mayhew: The Usability Engineering Lifecycle - Morgan Kaufmann Publ., 1999
- Jeff Sauro, James R. Lewis: Quantifying the User Experience - Morgan Kaufmann Publ., 2016
- 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

<b>CS3210-KP08, CS3210 - Bachelor Project Media Informatics (BProDesign)</b>		
<b>Duration:</b> 1 Semester	<b>Turnus of offer:</b> each winter semester	<b>Credit points:</b> 8
<b>Course of study, specific field and term:</b> <ul style="list-style-type: none"> <li>• Bachelor Media Informatics 2020 (compulsory), media informatics, 5th semester</li> <li>• Bachelor Media Informatics 2014 (compulsory), media informatics, 5th semester</li> </ul>		
<b>Classes and lectures:</b> <ul style="list-style-type: none"> <li>• Bachelor Project Media Informatics (project work, 6 SWS)</li> </ul>	<b>Workload:</b> <ul style="list-style-type: none"> <li>• 150 Hours group work</li> <li>• 30 Hours oral presentation (including preparation)</li> <li>• 30 Hours written report</li> <li>• 20 Hours work on project</li> <li>• 10 Hours in-classroom work</li> </ul>	
<b>Contents of teaching:</b> <ul style="list-style-type: none"> <li>• 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</li> <li>• Practice of text-, image-, video-, audio- and 3D-animation processing as well as corresponding tools and programming languages</li> <li>• Documentation and presentation of project work</li> <li>• Scientific presentation of the project work and presentation of an</li> </ul>		
<b>Qualification-goals/Competencies:</b> <ul style="list-style-type: none"> <li>• The students are able to accomplish a complete development process for the production of an interactive multimedia systems in practice.</li> <li>• They are able to assess and apply media- and interaction-related methods and tools.</li> <li>• They have the methodological competence to analyze complex tasks, divide them into sub-tasks and implement them based on division of labor.</li> <li>• They possess the communication skills to write down and present their results in an appropriate way.</li> </ul>		
<b>Grading through:</b> <ul style="list-style-type: none"> <li>• presentation</li> <li>• project work</li> <li>• internship report</li> <li>• Elevator Pitch</li> <li>• B-Certificate (not graded)</li> </ul>		
<b>Responsible for this module:</b> <ul style="list-style-type: none"> <li>• <a href="#">Prof. Dr.-Ing. Nicole Jochems</a></li> </ul>		
<b>Teacher:</b> <ul style="list-style-type: none"> <li>• <a href="#">Institute for Multimedia and Interactive Systems</a></li> <li>• <a href="#">Prof. Dr.-Ing. Nicole Jochems</a></li> <li>• MitarbeiterInnen des Instituts</li> </ul>		
<b>Literature:</b> <ul style="list-style-type: none"> <li>• M. Burhardt: Einführung in das Projektmanagement - Publicis Publ. 2013</li> <li>• M. B. Rosson &amp; J. M. Carroll: Usability engineering. Scenario-based development of human-computer interaction - Morgan Kaufmann series in interactive technologies, 1st ed. San Francisco: Academic Press, 2002</li> </ul>		
<b>Language:</b> <ul style="list-style-type: none"> <li>• offered only in German</li> </ul>		
<b>Notes:</b>		



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)		
<b>Duration:</b> 1 Semester	<b>Turnus of offer:</b> each winter semester	<b>Credit points:</b> 3 (Typ B)
<b>Course of study, specific field and term:</b> <ul style="list-style-type: none"> <li>• Bachelor Media Informatics 2020 (compulsory), media informatics, 5th semester</li> <li>• Bachelor Media Informatics 2014 (compulsory), interdisciplinary competence, 5th semester</li> </ul>		
<b>Classes and lectures:</b> <ul style="list-style-type: none"> <li>• CS3220-V: Scientific Working (lecture, 1 SWS)</li> <li>• CS3220-S: Scientific Working (seminar, 1 SWS)</li> </ul>		<b>Workload:</b> <ul style="list-style-type: none"> <li>• 55 Hours private studies</li> <li>• 30 Hours in-classroom work</li> </ul>
<b>Contents of teaching:</b> <ul style="list-style-type: none"> <li>• Scientific work and research</li> <li>• Developing ideas</li> <li>• Process-oriented work</li> <li>• Research and review</li> <li>• Written work</li> <li>• Evaluation and empiricism</li> <li>• Presentation and speech</li> </ul>		
<b>Qualification-goals/Competencies:</b> <ul style="list-style-type: none"> <li>• The students can obtain a solid grounding a scientific topic, from literature research till evaluation.</li> <li>• They are able to present the results in a written documentation and in a talk in an understandable way.</li> <li>• The can present and discuss a scientific topic.</li> </ul>		
<b>Grading through:</b> <ul style="list-style-type: none"> <li>• continuous, successful participation in course</li> </ul>		
<b>Is requisite for:</b> <ul style="list-style-type: none"> <li>• Bachelor Thesis Media Informatics (CS3992, CS3992-KP15)</li> </ul>		
<b>Responsible for this module:</b> <ul style="list-style-type: none"> <li>• <a href="#">Prof. Dr.-Ing. Nicole Jochems</a></li> </ul>		
<b>Teacher:</b> <ul style="list-style-type: none"> <li>• <a href="#">Institute for Multimedia and Interactive Systems</a></li> <li>• <a href="#">Dr. rer. nat. Daniel Wessel</a></li> <li>• MitarbeiterInnen des Instituts</li> </ul>		
<b>Language:</b> <ul style="list-style-type: none"> <li>• offered only in German</li> </ul>		
<b>Notes:</b> <p>Prerequisites for attending the module: - None</p> <p>Prerequisites for the exam: - None</p>		

<b>CS3280-KP04, CS3280 - Bachelor Seminar Media Informatics (BSemMedien)</b>		
<b>Duration:</b> 1 Semester	<b>Turnus of offer:</b> each winter semester	<b>Credit points:</b> 4 (Typ B)
<b>Course of study, specific field and term:</b> <ul style="list-style-type: none"> <li>• Bachelor Media Informatics 2020 (compulsory), media informatics, 5th semester</li> <li>• Bachelor Media Informatics 2014 (compulsory), interdisciplinary competence, 5th semester</li> </ul>		
<b>Classes and lectures:</b> <ul style="list-style-type: none"> <li>• Bachelor Seminar (seminar, 2 SWS)</li> </ul>		<b>Workload:</b> <ul style="list-style-type: none"> <li>• 60 Hours work on an individual topic with written and oral presentation</li> <li>• 30 Hours private studies</li> <li>• 30 Hours in-classroom work</li> </ul>
<b>Contents of teaching:</b> <ul style="list-style-type: none"> <li>• Familiarization in a scientific topic</li> <li>• Working on a scientific topic and its answers for problems</li> <li>• Presentation and discussion of the topic</li> </ul>		
<b>Qualification-goals/Competencies:</b> <ul style="list-style-type: none"> <li>• The students can obtain a solid grounding a scientific topic.</li> <li>• They are able to present the results in a written documentation and in a talk in an understandable way.</li> <li>• They can present and discuss a scientific topic.</li> </ul>		
<b>Grading through:</b> <ul style="list-style-type: none"> <li>• presentation</li> <li>• term paper</li> </ul>		
<b>Responsible for this module:</b> <ul style="list-style-type: none"> <li>• <a href="#">Prof. Dr. rer. pol. Moreen Heine</a></li> </ul> <b>Teacher:</b> <ul style="list-style-type: none"> <li>• <a href="#">Institute for Multimedia and Interactive Systems</a></li> <li>• <a href="#">Prof. Dr. rer. pol. Moreen Heine</a></li> <li>• <a href="#">Dr. rer. nat. Daniel Wessel</a></li> </ul>		
<b>Literature:</b> <ul style="list-style-type: none"> <li>• Topic and literature are chosen individually.:</li> </ul>		
<b>Language:</b> <ul style="list-style-type: none"> <li>• German and English skills required</li> </ul>		
<b>Notes:</b> <p>Prerequisites for attending the module: - None</p> <p>Prerequisites for the exam: - None</p> <p>Exam(s): - CS3280-L1 Bachelor-Seminar Medieninformatik, Seminarvortrag, 50% der Modulnote - CS3280-L1 Bachelor-Seminar Medieninformatik, Hausarbeit, 50% der Modulnote</p>		

**CS3205-KP04, CS3205 - Computer Graphics (CompGrafik)**
**Duration:**

1 Semester

**Turnus of offer:**

each summer semester

**Credit points:**

4

**Course of study, specific field and term:**

- Bachelor Computer Science 2019 (optional subject), major subject informatics, Arbitrary semester
- Bachelor MES 2020 (optional subject), computer science / electrical engineering, 3rd semester at the earliest
- 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

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**Literature:**

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

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**Language:**

- offered only in German

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**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

**CS3992, CS3992-KP15 - Bachelor Thesis Media Informatics (BScMedien)**
**Duration:**

1 Semester

**Turnus of offer:**

each semester

**Credit points:**

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)