Technische Hochschule
Brandenburg
University of
Applied Sciences
Fachbereich
Informatik und Medien

# Module Reference of Bachelor Program Applied Computer Science

09/2023

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| Module Name: | Mathematics I |
| Study Semester: | 1st semester |
| Module Coordinator: | Prof. Dr. Rolf Socher |
| Main Lecturer: | Prof. Dr. Rolf Socher |
| Teaching Language: | German |
| Level within Curriculum: | B.Sc. Informatik, B.Sc. Applied Computer Science, B.Sc. Medizininformatik<br>1st semester, mandatory module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | |
| Learning Outcome / Skills: | The students loose their timitidy of mathematics.<br>They learn about the importance of Mathematics für computer science.<br>They are able to apply mathematical tools in concrete computer science applications.<br>They are familiar with mathematical thinking (abstraction, precision, logical reasoning).<br>They are proficient in using the language of mathematical formulae.<br>They are able to express concepts in different representations (graphical, formulae,…) and to translate between different representations.<br>They are familiar with abstract concepts such as equvalence classes, injective/surjective/bijective functions and mappings, inverse functions, and limits.<br>They are able to solve the following problems:<br>• Modelling using sets<br>• Modelling using functions<br>• Compute limits of sequences and geometric series<br>They are proficient in using the rules of |

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| | differentiation. |
| Course Content: | Sets and set operations, power set, cartesian product, binomial coefficients<br>Relations (Equivalence relations and classes)<br>Functions (injective, surjective, bijective functions, inverse function, trigonometric functions and their inverses)<br>Prime numbers, divisibility and modular arithmetic (congruence relation, ISBN check sum)<br>Computing in $Z_m$, extended euklidean algorithm<br>sequences, series and convergence<br>basics of differential calculus |
| Mode of Assessment: | Written exam<br>Additional sssessments during the semester may be included in the final grading. |
| Teaching Media: | Blackboard and chalk, online course |
| Literature: | Hagerty R.: Diskrete Mathematik für Informatiker, Bonn: Addison-Wesley, 2004<br>Schubert M.: Mathematik für Informatiker. Wiesbaden: Vieweg und Teubner Verlag 2009<br>Socher R.: Mathematik für Informatiker. München: Hanser 2011<br>Teschl S. und Teschl G.: Mathematik für Informatiker, Band 1, Diskrete Mathematik und Lineare Algebra. 3. Aufl. Berlin, Heidelberg: Springer 2008 |

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| Module Name: | Algorithms and Data Structures |
| Study Semester: | 1st semester |
| Module Coordinator: | Prof. Dr. Reiner Creutzburg |
| Main Lecturer(s): | Prof. Dr. Reiner Creutzburg |
| Teaching Language: | German<br>English for Applied Computer Science |
| Level within Curriculum: | B.Sc. Applied Computer Science, 1st sem., mandatory module<br>B.Sc. Informatik, 1st sem., mandatory module<br>B.Sc. Medizininformatik, 1st sem., mandatory module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | |
| Learning Outcome / Skills: | The students know standard algorithms for typical problems from:<br>searching, sorting, string matching, recursion,<br>trees and graphs.<br>They are able to assess and evaluate the performance of algorithms.<br>The know the data structures list, array, chained list, stack, queue, tree, graph.<br>The students learn the importance of mathematics for computer science by means of concrete applications.<br>They learn the necessary mathematical tools in concrete problems of basic computer science and are able to apply them. |
| Course Content: | algorithms<br>complexity analysis, asymptotic analysis,<br>complexity classes<br>data structures |

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| | elementary data structures<br>trees and graphs<br>searching and sorting<br>string matching<br>recursion<br>graph algorithms<br>case studies |
| Mode of Assessment: | written exam<br>additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Classical lecture with mixed media (slides, internet sources, animations), exercises |
| Literature: | Cormen T.H., Leiserson C.E., Rivest R.L., Stein C.: Introduction to Algorithms, Third Edition., MIT Press, McGraw-Hill, 2009<br>Sedgewick R.: Algorithmen. (2. Aufl.), Addison Wesley 2003<br>Aho, A. V., Ulman, J. D.: Data Structures and Algorithms 1983 |

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| Module Name: | Computer Science and Logic |
| Study Semester: | 1st semester |
| Module Coordinator: | Prof. Dr. Michael Syrjakow |
| Main Lecturer(s): | Prof. Dr. Jochen Heinsohn, Prof. Dr. Michael Syrjakow |
| Teaching Language: | German; English for Applied Computer Science |
| Level within Curriculum: | B.Sc. Informatik, B.Sc. Medizininformatik,<br>B.Sc. Applied Computer Science:<br>1st sem. |
| Teaching Methods: | Lecture: 3 hours weekly per semester<br>Exercise: 1 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | |
| Learning Outcome / Skills: | Students will learn about the relationships between important branches of informatics and media; applied logic plays a key role in computer science.<br>They will be able to recognize the importance of the fundamentals of computer science and their relevance to the curriculum.<br>They will also be able to code and to represent numbers as well as relevant information in computers and recognize the importance of algorithms, programming and software development.<br>Students will develop skills, such as logical thinking and creative working methods and will be familiar with the role of applied logic in the modern spectrum of computer science and media. |
| Course Content: | • **Introduction to computer science**<br>a) informatics and branches thereof<br>b) information and its representation, data, types and structures of data, number systems and number depiction<br>c) major components and basic architecture of computer systems |

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| | d) algorithms, programming languages and software development (overview only)<br>• **Applied logic**<br>a) propositional logic: formulas, syntax and semantics, Boolean functions, semantic equivalency, simplifying formulas, DNF and KNF, resolution procedure, horn formulas, logical reasoning<br>b) predicate logic: definition of a formula, formulating sentences in predicate logic, syntax and semantics, simplifying predicate logic formulas, unification and resolution<br>c) other logics (overview only) |
| Mode of Assessment: | Written exam.<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with mixed media (blackboard and mostly interactively filled slides), exercises in small groups |
| Literature: | Brookshear G., Brylow D.: Computer Science: An Overview, Pearson, 12. Auflage, 2014.<br>Herold H., Lurz B., Wohlrab J., Hopf M.: Grundlagen der Informatik, Pearson Studium, 3. Auflage, 2017.<br>Ernst H., Schmidt J., Beneken G.: Grundkurs Informatik: Grundlagen und Konzepte für die erfolgreiche IT-Praxis - Eine umfassende, praxisorientierte Einführung, Springer Vieweg, 6. Auflage 2016.<br>Rechenberg P.: Was ist Informatik? Eine allgemeinverständliche Einführung, 3. Auflage 2000.<br>Schneider U., Werner D.: Taschenbuch der Informatik, Carl Hanser Verlag, 7. Auflage 2012.<br>Lee, S.-F.: Logic: A Complete Introduction, Teach Yourself, 2017.<br>Schöning U.: Logik für Informatiker, Spektrum Akademischer Verlag, 5. Auflage 2000.<br>Siefkes D.: Formalisieren und Beweisen: Logik für Informatiker, Vieweg+Teubner Verlag, 2. Auflage 2013.<br>Winter R.: Grundlagen der formalen Logik, Verlag Harri Deutsch, 2. Auflage 2001. |

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| Module Name: | Programming I |
| Study Semester: | 1st Semester |
| Module Coordinator: | Prof. Dr. Gabriele Schmidt |
| Main Lecturer(s): | Prof. Dr. Gabriele Schmidt, Prof. Dr. Sven Buchholz |
| Teaching Language: | German |
| Level within Curriculum: | B.Sc. Informatik, B.Sc. Medizininformatik,<br>B.Sc. Applied Computer Science:<br>1st semester |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | |
| Learning Outcome / Skills: | Students are able to apply principle concepts of programming using higher programming languages.<br>Students are able to select the appropriate basic concepts for a given task and develop them as a Java program.<br>Students acquire knowledge, understanding, and first method and application skills for programming. |
| Course Content: | Basic concepts of higher-level programming languages (basic data types, operations, control structures, complex data types, arrays and classes, attributes, methods and objects)<br>Concept of the algorithm and its properties<br>Principles and guidelines for structured programming<br>Practical exercises using the example of Java |
| Mode of Assessment: | Written exam.<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with mixed media (blackboard and mostly interactively filled slides), computer based exercises |
| Literature: | Ullenboom C.: Java ist auch eine Insel, Galileo Computing, auch als E-Buch: |

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| | http://openbook.galileocomputing.de/javainsel/<br>Krüger G., Hansen H.: Handbuch der Java-Programmierung, Addison-Wesley, auch als E-Buch: http://www.javabuch.de<br>Lorig D.: Java-Programmierung für Anfänger: Programmieren lernen ohne Vorkenntnisse, CreateSpace Independent Publishing Platform<br>Sierra K., Bates B.: (Übersetzung L. Schulten, E. Buchholz), Java von Kopf bis Fuß, O Reilly<br>Darwin I. F. (Übersetzung L. Schulten, G.W. Selke, D.Reder, W. Gabriel), Java Kochbuch, O Reilly |

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| Module Name: | Computer Engineering and Media Technology |
| Study Semester: | 1st semester |
| Module Coordinator: | Prof. Dr.-Ing. Gerald Kell |
| Main Lecturer(s): | Prof. Eberhard Hasche, Prof. Dr.-Ing. Gerald Kell |
| Teaching Language: | German |
| Level within Curriculum: | B.Sc. Informatik, 1st sem., mandatory module<br>B.Sc. Applied Computer Science, 1st sem., mandatory module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | Propädeutikum is recommended |
| Learning Outcome / Skills: | The students are familiar with simple switching elements in electrical circuits, basic rules of switch logic and gate functions as well as the structure, formats and special features of digital media (like color, 3D, film/video and audio) and can apply them in standard applications.<br><br>They are able to edit and implement digital media and are familiar with Boolean equations, truth tables and logic plans.<br><br>They can develop combinatorial circuits and estimate and evaluate the performance of algorithms. |
| Course Content: | Electrical circuits and switching elements, logic gates and logic levels, CMOS technology, coders and decoders, multiplexers, arithmetic circuits, PROMs<br>Colour, colour spaces and colour models. Introduction to 3D (modeling, sculpting, texturing, shading and rendering). Destructive and non-destructive audio editing. Basics of film and video workflows. |

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| Mode of Assessment: | Written exam<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with mixed media (mostly interactively filled slides), computer lab exercises |
| Literature: | Siemers C.: Das Taschenbuch Digitaltechnik, ISBN 3-446-40903-3, Hanser Verlag 2007<br>Hering E., Steinhart H.: Taschenbuch der Mechatronik, 2005<br>Hasche E, Ingwer P, Game of Colors: Moderne Bewegtbildproduktion – Theorie und Praxis für Film, Video und Fernsehen, Springer 2016, ISBN 978-3-662-43889-3 |

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| Module Name: | Project-oriented Studies |
| Study Semester: | 1st semester |
| Module Coordinator: | Prof. Dr. Michael Syrjakow |
| Main Lecturer(s): | All professors and academic employees of the department of computer science and media |
| Teaching Language: | German; English for Applied Computer Science |
| Level within Curriculum: | B.Sc. Informatik, B.Sc. Medizininformatik,<br>B.Sc. Applied Computer Science:<br>1st sem., mandatory module |
| Teaching Methods: | flexibly organized compact lectures (altogether approx. 5 days during the semester) including contact hours, self-study (working groups), Web-based support as necessary, 2 SWS |
| Workload: | 60 hrs = 30 hrs contact hrs and 30 hrs directed self-study |
| Credit Points: | 2 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | None |
| Learning Outcome / Skills: | Students know how to use facilities at the University of Applied Sciences, such as the library, laboratories, and examination offices.<br>They have acquired social competencies and general learning skills through group work on topics of computer science (B.Sc. Informatik, B.Sc. Applied Computer Science) and medical informatics (B.Sc. Medizininformatik)<br>Students are able to apply methods and techniques of project management and they can use presentation techniques. Beyond that, they know how to solve problems cooperatively.<br>They have got an overview of the broad range of courses offered at the department of computer science and media and they are in an excellent starting position for successful studies. |
| Course Content: | First part (2 days at the beginning of the semester): visit of the library, introduction into self-organization and cooperative work, presentation of the IT-infrastructure and the learning platform Moodle, choice of a topic for the second part (group work). |

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| | Second Part: self-organized (guided) group work (8-9 weeks), participation at the workshops: "presentation techniques" and "course organization", developing of presentations and guided exercises on the results of group work; final presentation of group work (3 days mid-semester). |
| Mode of Assessment: | Full participation at the first part<br>Second part: successfully completed group work including presentation and documentation of the results<br>without grading |
| Teaching Media: | Self-organized guided group work, laboratory exercises, Web-based support. |
| Literature: | Depends on the project topics. For example:<br>Hillebrecht S.: Gruppenarbeiten vorbereiten und moderieren, Springer Gabler, 2016.<br>Hüttmann A.: Erfolgreich studieren mit Soft Skills, Springer Gabler, 2015.<br>Renz K.-C.: Das 1 x 1 der Präsentation: Für Schule, Studium und Beruf, Springer Gabler, 2. Auflage 2016.<br>Stöhler C.: Projektmanagement für Durchstarter - Die Toolbox für die Projektarbeit im Studium, Claudia Stöhler Verlag, 2013. |

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| Module Name: | English |
| Study Semester: | 1st semester |
| Module Coordinator: | Dr. Annett Kitsche |
| Main Lecturer(s): | BA Christoph Reinecke |
| Teaching Language: | English |
| Level within Curriculum: | B.Sc. Informatik, 1st sem., mandatory module<br>B.Sc. Applied Computer Science, 1st sem., mandatory module |
| Teaching Methods: | Exercises: 2 hours weekly per semester |
| Workload: | 60 hrs = 30 contact hrs and 30 hrs directed self-study |
| Credit Points: | 2 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | English language level B2 |
| Learning Outcome / Skills: | Students will extend their specialist vocabulary in computing and will be able to utilise it in communicative situations. In addition, they will develop listening and speaking skills relevant to their studies and profession that will enable them to take part in English language lectures and discussions. Their ability to read and process English-language specialist literature will be enhanced; the main focus in developing written language skills will be on forms important for professional situations. In this process, soft skills and intercultural competence will also grow. |
| Course Content: | Forms of interactive oral and written language on presenting, describing, discussing and evaluating situations, processes and procedures in IT and daily life influenced by IT.<br>Engaging with authentic texts (reading and listening) in the original language Accompanying English-language lectures (lecture preview and review) |
| Mode of Assessment: | combination of:<br>• CV, application and handout in English<br>• presentation und discussion<br>• written exam |
| Teaching Media: | Seminar-type learning environment with varying language exercises using the language laboratories and relevant teaching materials, integrating self- |

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| | study, online learning and independent Internet research. |
| Literature: | Current material from English language IT and computer magazines and online sources, e.g. MOOCS<br>Books: English for IT (Oxford); IT Matters (Cornelsen); |

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| Module Name: | Mathematics II |
| Study Semester: | 2nd semester |
| Module Coordinator: | Prof. Dr. Rolf Socher |
| Main Lecturer(s): | Prof. Dr. Rolf Socher, Prof. Dr. Roland Uhl |
| Teaching Language: | German<br>English for Applied Computer Science |
| Level within Curriculum: | B.Sc. Informatik, B.Sc. Medizininformatik, B.Sc. Applied Computer Science<br>2nd semester, mandatory module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | Mathematics I |
| Learning Outcome / Skills: | They learn about the importance of linear algebra für computer science.<br>They are able to apply mathematical tools in concrete computer science applications.<br>They are familiar with mathematical thinking (abstraction, precision, logical reasoning).<br>They are proficient in using the language of mathematical formulae.<br>They are able to express concepts in different representations (graphical, formulae,…) and to translate between different representations.<br>They are familiar with abstract concepts such as vector spaces, linear independence, bases of vector spaces, and linear mappings.<br>They are experienced in applying the Gauß-Algorithm for solving linear equational systems and for computing the inverse of a square matrix.<br>They are able to solve the following problems:<br>• Transformation between different representations of lines and planes in space<br>• Determining intersections of lines and planes |

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| | in space<br>• Checking sets of vectors on linear independence<br>• Determining the matrix of a linear mapping |
| Course Content: | matrices, vectors, matrix operations and simple applications<br>Linear equational systems and the Gauß-Algorithm<br>Error correcting Codes<br>Analytic geometry in the plane and in the space: vectors, angles, lines and planes, lineare and affine transformations<br>Vector spaces, subspaces, bases, and dimension<br>Lineare mappinmgs and matrices |
| Mode of Assessment: | Written exam<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Blackboard and chalk, online course |
| Literature: | Jänich K.: Lineare Algebra. 11. Aufl. Berlin: Springer Verlag 2008<br>Schubert M.: Mathematik für Informatiker. Wiesbaden: Vieweg und Teubner Verlag 2009<br>Socher R.: Mathematik für Informatiker. München: Hanser 2011<br>Teschl S. und Teschl G.: Mathematik für Informatiker, Band 1, Diskrete Mathematik und Lineare Algebra. 3. Aufl. Berlin, Heidelberg: Springer 2008 |

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| Module Name: | Formal Languages / Automata Theory |
| Study Semester: | 2nd semester |
| Module Coordinator: | Prof. Dr. Matthias Homeister |
| Main Lecturer(s): | Prof. Dr. Rolf Socher<br>Prof. Dr. Matthias Homeister |
| Teaching Language: | German<br>English for Applied Computer Science |
| Level within Curriculum: | B.Sc. Informatik, 2nd sem., mandatory module<br>B.Sc. Applied Computer Science, 2nd sem., mandatory module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise class: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | Mathematics I<br>Programming I |
| Learning Outcome / Skills: | The students are familiar with the main ideas and techniques of theoretical computer science (abstraction, rigour and logical reasoning).<br><br>They are able to formulate issues in different representations (e.g. graph and table representations of automata) and transform them from one representation into the other.<br><br>They are able to construct, analyse and apply deterministic and nondeterministic finite automata.<br><br>They are able to construct, analyse and apply regular expressions<br><br>They are able to apply transformations on and between automata (minimization, NFA into DFA, regular expression into NFA) and to prove whether a language is regular or not. |

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| | They are able to construct, analyse and apply context-free grammars. They can convert CFGs into Chomsky normal form and understand the CYK-algorithm. They can determine whether a language is context-free or not.<br><br>They understand the relationship between automata and grammars, they know context-sensitive grammars and are able to classify formal languages with respect to the Chomsky hierarchy.<br><br>They understand the role of formal languages, automata and grammars in the context of compiler construction. |
| Course Content: | Regular languages: deterministic and nondeterministic finite automata, transformations (minimal DFAs, NFA into DFA, regular expression into NFA), regular expressions, lexical analysis, pumping lemma.<br>Context-free languages: Grammars, derivations, context-free grammars, Chomsky normal form, CYK-algorithm, derivation trees and ambiguity, syntactical analysis, pumping lemma.<br>Chomsky hierarchy: context-sensitive grammars, Type-0 grammars, connections between the different classes of languages and the associated computing models. |
| Mode of Assessment: | - Written exam<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with mixed media, exercises |
| Literature: | Sipser: Introduction to the Theory of Computation, Cengage Learning, 3rd edition, 2013<br>Socher: Theoretische Grundlagen der Informatik. 3. Aufl. München: Hanser Verlag 2008<br>Wagenknecht, Hielscher: Formale Sprachen, abstrakte Automaten und Compiler. 2. Auflage, Wiesbaden, Springer-Vieweg, 2015<br>Vossen G., Witt K.-U.: Grundkurs theoretische Informatik. 6. Auflage, Wiesbaden, Springer-Vieweg, 2016.<br>Böckenhauer, Hromkovic.: Formale Sprachen. Wiesbaden, Springer-Vieweg, 2012. |

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| Module Name: | Operating Systems / Web Computing |
| Study Semester: | 2nd semester |
| Module Coordinator: | Prof. Dr. Michael Syrjakow |
| Main Lecturer(s): | Prof. Dr. Michael Syrjakow, Prof. Dr. Thomas Preuß |
| Teaching Language: | German<br>English for Applied Computer Science |
| Level within Curriculum: | B.Sc. Informatik, B.Sc. Medizininformatik,<br>B.Sc. Applied Computer Science, 2nd sem., mandatory module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | fundamental programming skills, fundamental skills in HTML |
| Learning Outcome / Skills: | The students know the fundamental concepts of distributed systems and the structure of Web applications, including the underlying architectures, protocols and technologies.<br>They are familiar with the basic concepts and structures of operating systems. They also have an in-depth knowledge of multitasking/ multiprogramming, scheduling algorithms, classic and virtual main memory management and attendant algorithms, inter-process communication using signals, pipes, semaphores, and message passing.<br>The students are able to use command-line interfaces in a UNIX system (UNIX commands), to develop and implement simple web applications, to create shell scripts and use them to automate UNIX system (servers) work processes.<br>They know basics of Python programming and can use Python to develop dynamic Web applications. |
| Course Content: | - Client/Server architectures (2-, 3-, multi- |

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| | level)<br>- P2P-fundamentals<br>- Fundamentals of cloud computing<br>- Overview of TCP/IP, Internet name administration, IP addresses<br>- Connection-orientated and connectionless communication<br>- HTTP, FTP, SMTP as examples of application protocols<br>- Stateless protocols and session management<br>- Development of dynamic Web-based applications with Python<br>- XML and XPath<br>- Operating system tasks and resources<br>- Preemptive multitasking in multi-user operating systems<br>- Processes and threads, including creation and inter-process communication<br>- Basic problems of process synchronization, race-conditions, deadlocks, …<br>- Process synchronization with lock-variables, semaphores, monitors<br>- Basics of main memory administration<br>- Virtual main memory administration, page assigning algorithms and page replacement algorithms, for example FiFo, LRU, OPT, second chance, working sets, including performance considerations. |
| Mode of Assessment: | Written exam<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with mixed media (blackboard and mostly interactively filled slides), exercises in small groups, computer based exercises |
| Literature: | Badach A., Hoffmann E.: Technik der IP-Netze: Internet-Kommunikation in Theorie und Einsatz, Carl Hanser Verlag, 3. Auflage, 2015.<br>Bengel G.: Grundkurs Verteilte Systeme: Grundlagen und Praxis des Client-Server und Distributed Computing, 4. Auflage, 2014.<br>Ernesti J., Kaiser P.: Python 3: Das umfassende Handbuch: Sprachgrundlagen, |

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| | Objektorientierung, Modularisierung, Rheinwerk Computing, 4. Auflage, 2015.<br>Meinel C., Sack H.: Internetworking: Technische Grundlagen und Anwendungen, Springer, 2012.<br>Tannenbaum A.S., Steen M. van: Verteilte Systeme: Prinzipien und Paradigmen, Pearson, 2. Auflage, 2007.<br>Tannenbaum A.S.: Moderne Betriebssysteme, Pearson, 4. aktualisierte Auflage, 2016.<br>Wolf J.: HTML5 und CSS3: Das umfassende Handbuch zum Lernen und Nachschlagen, Rheinwerk Computing, 2. Auflage, 2016. |

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| Module Name: | Programming II |
| Study Semester: | 2nd semester |
| Module Coordinator: | Prof. Dr. Gabriele Schmidt |
| Main Lecturer(s): | Prof. Dr. Gabriele Schmidt, Prof. Dr. Sven Buchholz |
| Teaching Language: | German<br>English for Applied Computer Science |
| Level within Curriculum: | B.Sc. Informatik, B.Sc. Medizininformatik,<br>B.Sc. Applied Computer Science:<br>2nd semester, mandatory module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | Programming I,<br>Algorithms and Data Structures |
| Learning Outcome / Skills: | Students know and understand the concepts of object orientation and object-oriented programming using the Java programming language as an example.<br>Students understand the design guidelines in class diagrams and can read them and convert them into programs.<br>Students are able to program in a good programming style.<br>Through the practical exercises the students develop first application, analysis, problem-solving and method competences in object-oriented programming. |
| Course Content: | Complete introduction to object orientation: classes, attributes, management methods and business methods, objects, inheritance, abstract classes and interfaces, polymorphism<br>Good programming and design style: principle of structuring, encapsulation, secret principle, abstract data type<br>Error Handling with Exception Handling<br>Abstract concepts like generic data types, inner |

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| | classes<br>Use of classes of a library / programming interface using the Java API as an example |
| Mode of Assessment: | Written exam.<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with mixed media (blackboard and mostly interactively filled slides), computer based exercises |
| Literature: | Ullenboom C.: Java ist auch eine Insel, Galileo Computing, auch als E-Buch: http://openbook.galileocomputing.de/javainsel/<br>Krüger G., Hansen H.: Handbuch der Java-Programmierung, Addison-Wesley, auch als E-Buch: http://www.javabuch.de<br>Lorig D.: Java-Programmierung für Anfänger: Programmieren lernen ohne Vorkenntnisse, CreateSpace Independent Publishing Platform<br>Sierra K., Bates B.: (Übersetzung L. Schulten, E. Buchholz), Java von Kopf bis Fuß, O Reilly<br>Darwin I. F. (Übersetzung L. Schulten, G.W. Selke, D.Reder, W. Gabriel), Java Kochbuch, O Reilly |

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| Module Name: | Computer Systems Organisation |
| Study Semester: | 2nd Semester |
| Modul Coordinator: | Prof. Dr. Karl-Heinz Jänicke |
| Main Lecturer(s): | Prof. Dr. Karl-Heinz Jänicke, Prof. Dr. Gerald Kell |
| Teaching Language: | German |
| Level within Curriculum: | B.Sc. Applied Computer Science, 2nd sem., mandatory module<br>B.Sc. Informatik, 2nd sem., mandatory module |
| Teaching Methods: | Lectures: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 h = 60 contact hrs and 90 hrs self-directed study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | |
| Learning Outcome / Skills: | Students get to know the basics of the architecture and organisation of computer systems.<br>They will be familiar with the components of the x86 processor programming models and will be able to program short algorithms using simple processor machine commands.<br>They will understand elementary internal computer processes and recognise the connection between computer architecture, computer organisation and computer performance.<br>They will grasp the notion of computer as a functioning unit comprising function blocks working sequentially and they will be able to demonstrate the fundamental functions of these blocks using simple state machines. |
| Course Content: | Components of a computer and their elementary realisation (processor, controller, register file and further memory elements), Von-Neumann computing concept and Harvard architecture, dealing with machine commands, utilising pipeline procedures.<br>Programming model of simple x86 processors: command set, register set, operands, addressing and segmenting memory, types of addresses, command notation, … |

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| | Programming examples in machine languages: Illustration of high language elements on the machine level, simple mathematics exercises, sub-routine technology, stacks and stack organisation, stack utilisation, interrupt technology, organisation of input and output distribution<br>Structure and functions of finite state machines, the development of transmission functions of elementary logic and arithmetic, structure of a controller |
| Mode of Assessment: | - Written exam<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with mixed media (mostly blackboard, slides, beamer), Exercises on blackboard and on computer |
| Literature: | Müller Th. u.a.: Technische Informatik I: Grundlagen der Informatik und Assemblerprogrammierung, vdf Verlag, Zürich, 2000<br>Beierstein Th., Hagenbruch, O.: Taschenbuch Mikroprozessortechnik, Fachbuchverlag Leipzig, 2001<br>Siemers Ch.: Prozessorbau, Hanser Verlag München, 1999<br>Märtin Chr.: Rechnerarchitekturen, Fachbuchverlag Leipzig, 2001<br>Further in-course materials on inter alia assembler programming<br>Further literature and course material from journals and the internet shall be recommended during the course. |

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| Module title: | Media Design |
| Semester level: | 2nd semester |
| Module coordinator: | Prof. Alexander Urban |
| Lecturer/s: | Prof. Alexander Urban |
| Language of instruction: | German |
| Level within curriculum: | B.Sc. Informatik, 2nd semester, mandatory module<br>B.Sc. Applied Computer Science, 2nd semester, mandatory module |
| Teaching strategy / weekly hours: | Lectures: 2 hours weekly<br>Laboratory exercises: 2 hours weekly |
| Study hours: | 150 hrs. = 60 contact hrs. and 90 hrs. directed self-study |
| Credit points: | 5 |
| Prerequisites according to study regulations: | |
| Recommended prerequisites: | |
| Learning outcomes / skills: | The students know the basics of designing the visual media (typography / type design, color / light, composition / shape / layout, space / time and movement).<br>Based on these competences, the students are able to use pictorial means for the design of print and screen media purposefully and aesthetically.<br>To do this, students master the functions of relevant software solutions for creative image and graphics editing.<br>The students know the basics of the theory of perception. |
| Course content: | 1. Typography and type design (history and theory)<br>2. Colour (physics of colours, colour psychology, colour theory)<br>3. Colour management (colour spaces, device profiles, colour correction)<br>4. Form, composition (art history, design |

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| | theory)<br>5. Picture design (picture retouching, creative image manipulation)<br>6. Graphical user interfaces (GUI, interface design)<br>7. Analytical vision and visual features<br>8. Experiencing space and time<br>9. Fundamentals of Semiotics |
| Mode of assessment: | Documentary work with oral conversation<br>Additional assessments during the semester may be included in the final grading. |
| Types of media: | Lectures (digital presentation slides), computer exercises |
| Indicative reading: | Böhringer J., et al.: Kompendium der Mediengestaltung für Digital- und Printmedien, Berlin 2000<br>Braun G.: Grundlagen der Visuellen Kommunikation, München 1993<br>Stankowski A., Duschek K.: Visuelle Kommunikation, Berlin 1994<br>Lewandowsky P., et al.: Visuelles Gestalten mit dem Computer, Reinbek bei Hamburg 2002<br>Neutzling U.: Typo und Layout im Web, Reinbek bei Hamburg 2002<br>Turtschi R.: Mediendesign, Sulgen 1998<br>Itten J.: Kunst der Farbe, Ravensburg 1987<br>Skopec D.: Layout digital, Reinbek bei Hamburg, 2004<br>Götz V.: Typo digital, Reinbek bei Hamburg, 2004 |

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| Module Name: | Mathematics III |
| Study Semester: | 3rd Semester |
| Module Coordinator: | Prof. Dr. Rolf Socher |
| Main Lecturer: | Prof. Dr. Roland Uhl |
| Teaching Language: | German |
| Level within Curriculum: | B.Sc. Informatik, B.Sc. Applied Computer Science<br>3rd Semester, mandatory |
| Teaching Methods: | Lecture: 1 hours weekly per semester<br>Exercise: 1 hours weekly per semester |
| Workload: | 60 hrs = 30 contact hrs and 30 hrs directed self-study |
| Credit Points: | 2 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | Mathematics I |
| Learning Outcome / Skills: | The students are vfamiliar with the basic notions of probability theory.<br>They are able to compute total probabilities and to apply Bayes´ formula.<br>They are able to compute mean values, variance and standard deviation of random variables.<br>They are familiar with the following probability distributions and know ho wand when to apply them: Binomial, hypergeometric, Poisson, Gauß. |
| Course Content: | Kolmogoroff´s axioms, Laplace experiments, stochasticv independence, conditional probability, Bayesian formula, random variables, expectation value, variance and standard deviation, probability distributions (Binomial, hypergeometric, Poisson, Gauß) |
| Mode of Assessment: | Written exam<br>Additional sssessments during the semester may be included in the final grading. |
| Teaching Media: | Blackboard and chalk |
| Literature: | Stingl P.: Mathematik für Fachhochschulen. Technik und Informatik, 7. Aufl. München: Hanser 2003<br>Papula L.: Mathematik für Ingenieure und Naturwissenschaftler, Band 3, 5. Aufl. Wiesbaden: |

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| | Vieweg und Teubner 2008<br>Teschl S., Teschl G.: Mathematik für Informatiker, Band 2, Analysis und Stochastik. 2. Aufl. Berlin, Heidelberg: Springer 2007 |

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| Modulbezeichnung: | Databases |
| Study Semester: | 3rd semester |
| Module Coordinator: | Prof. Dr. Susanne Busse |
| Main Lecturer(s): | Prof. Dr. Susanne Busse |
| Teaching Language: | German |
| Level within Curriculum: | B.Sc. Informatik, 3rd sem., mandatory module<br>B.Sc. Applied Computer Science, 3rd sem., mandatory module<br>B.Sc. Medizininformatik, 3rd sem., mandatory module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | |
| Learning Outcome / Skills: | The students have an understanding of database systems. They know the differences between data models and are able to select suitable database system types for practical problems.<br>The students are able to design and implement relational databases with normalized schemas using SQL. They can query relational databases and are able to analyze their structure.<br>The students know variants of accessing relational databases from application programs with advantages and disadvantages, respectively. |
| Course Content: | • concepts of database systems<br>• data models<br>• design of (relational) databases<br>  ○ database design process<br>  ○ entity-relationship model and its extensions |

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| | ○ relational data model<br>○ normalization<br>• data definition and manipulation using SQL<br>• relational database languages / SQL<br>• accessing databases from programming languages<br>• concept of transactions, ACID |
| Mode of Assessment: | Written exam<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with mixed media (mostly interactively filled slides), computer lab exercises |
| Literature: | Kemper A., Eickler A.: Datenbanksysteme – Eine Einführung, 10. Aufl., Oldenbourg, 2015<br>Elmasri R., Navathe S.B.: Fundamentals of Database Systems, 6. ed., Addison-Wesley, 2010<br>Heuer A., Saake G.: Datenbanken – Konzepte und Sprachen, 5. Aufl., mitp Verlag, 2013<br>Schuber M.: Datenbanken Theorie, Entwurf und Programmierung relationaler Datenbanken, 2. Aufl., B.G. Teubner, 2007 |

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| Modulbezeichnung: | Operating Systems/Computer Networks |
| Study Semester: | 3rd semester |
| Module Coordinator: | Prof. Dr.-Ing. Martin Schafföner |
| Main Lecturer(s): | Prof. Dr.-Ing. Martin Schafföner |
| Teaching Language: | Deutsch<br>English for Applied Computer Science |
| Level within Curriculum: | B.Sc. Informatik, 3rd sem., mandatory module<br>B.Sc. Applied Computer Science, 3rd sem., mandatory module<br>B.Sc. Medizininformatik, 3rd sem., mandatory module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | Operating Systems/Webcomputing |
| Learning Outcome / Skills: | Students have basic knowledge of programming with operating system APIs. They are able to design adequate programs under correctness and performance constraints.<br>Students know basic concepts and technologies of modern computer networks. They understand selected protocols in detail and can evaluate different technologie alternatives.<br>Based on application requirements, students are able to design a suitable network. They are able to correctly design and implement simple distributed applications using sockets, threads, semaphores etc. |
| Course Content: | • Input/output, device management<br>• Persistent storage, clocks, terminals<br>• Filesystems: requirements, design, implementation<br>• Main memory management, especially virtual memory management and page |

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| | swapping<br>• Concurrency with threads<br>• Operating system APIs for files, directories, sockets, shared memory, pipes, message queues, etc.<br>• Overview of typical problems, solution patterns and properties of network communication: error handling, flow control, access control, congestion control, addressing, routing and forwarding<br>• Detailed analysis of selected protocols with an emphasis on: TCP, IPv4 und IPv6, Ethernet, WiFi<br>• Fundamental design methodologies for computer networks; overview of network components like switches, routers, proxies, firewalls and wireless technologies |
| Mode of Assessment: | - written exam<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with mixed media (mostly interactively filled slides), computer lab exercises |
| Literature: | Glatz E.: Betriebssysteme: Grundlagen, Konzepte, Systemprogrammierung, dpunkt Verlag, 2. aktual. Aufl. 2010<br>A.S. Tanenbaum, H. Bos: Modern Operating Systems, Pearson, 4. Aufl. 2015<br>A.S. Tanenbaum. D.J. Wetherall: Computer Networks, Pearson, 5. Aufl. 2011<br>J.F. Kurose, K.W. Ross: Computer Networking: A Top-Down Approach, Pearson, 6. Aufl. 2013 |

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| Module Name: | Programming III |
| Study Semester: | 3rd semester |
| Module Coordinator: | Prof. Dr. Harald Loose |
| Main Lecturer(s): | Prof. Dr. Harald Loose |
| Teaching Language: | German |
| Level within Curriculum: | B.Sc. Informatik, B.Sc. Applied Computer Science, B.Sc. Medizininformatik, 3rd sem., mandatory module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise/Laboratory: 2 hours weekly per semester<br>Home work |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | Modules Programming I and II |
| Recommended Prerequisites: | Mastering concepts of procedural and object oriented programming<br>Basics of informatics, algorithms and data structures.<br>Know how to program using JAVA |
| Learning Outcome / Skills: | Students know and understand the concepts of procedural and object oriented programming (in the scope of the programming languages C and C++).<br>They master the syntax of both languages.<br>They are able to write their own programs in C and C++, to read and modify other programs.<br>They master the techniques, project organization, editing, debugging and search of bugs. They are able to apply them in integrated develop environment the Visual Studio. |
| Course Content: | Application of algorithms and data structures<br>Overview about commons and differences between JAVA, C and C++<br>Concepts of procedural and object oriented programming in theory and practice, in particular pointer, overloading functions, standard parameters, exception handling and function templates as well as multiple inheritance, bindings, operator overloading and class templates;<br>Practice using the integrated develop environment the Visual Studio<br>Regular programming assessments during the exercises. |
| Mode of Assessment: | - Written Examination (120 min.)<br>Additional assessments during the semester may be included in the final grading. |

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| Teaching Media: | Lecture with mixed media (mostly interactively filled slides), computer lab exercises |
| Literature: | Kernighan B.W., Ritchie D.M. Programmieren in C. Carl Hanser Verlag 1990<br>Stroustrup B. Die C++-Programmiersprache: Aktuell zu C++11, Carl Hanser Verlag 2015<br>Stroustrup B. Einführung in die Programmierung mit C++, Pearson Studium, 2010<br>Isernhagen R.: Softwaretechnik in C und C++. Carl Hanser Verlag 2000<br>Kirch U., Prinz P.: C++ - Lernen und professionell anwenden (mitp Professional), mitp Verlag 2015 |
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| Module Name: | Fundamentals of Security |
| Study Semester: | 3rd semester |
| Module Coordinator: | Prof. Dr. Claus Vielhauer |
| Main Lecturer(s): | Prof. Dr. Claus Vielhauer |
| Teaching Language: | German<br>optionally English for Applied Computer Science |
| Level within Curriculum: | B.Sc. Informatik, 3rd sem., mandatory module<br>B.Sc. Applied Computer Science, 3rd sem., mandatory module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | |
| Learning Outcome / Skills: | After successful completion of the module, students can describe the essential objectives and concepts of IT security (for example, security aspects, risk concept, attacker scenarios).<br>They can point out, differentiate, evaluate and relate technical protection objectives and methods to the security aspects. Essential legal frameworks that are relevant to IT security can be identifiedand their mode of action described.<br>Students are able to analyse vulnerabilities in IT systems, as well as in IT-related operational processes and to plan basic protection concepts on the basis of the treated protection methods.<br>In addition, they recognize today's and future areas of conflict between social and technical aspects of IT security, e.g. Personality protection in the Internet. |
| Course Content: | - Introduction, Terminology, Basic Data Security Aspects and Security Requirements, Vulnerabilities and known Attacks<br>- Privacy and non-technical Data Security, Social Engineering |

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| | - Security Management and Policies: Introduction to Security Management and Security Standards such as ISO 27001<br>- Practical IT Security: BSI IT Basic Protection, Procedure for Planning and Implementation of Security Concepts<br>- Network Security: Solution Approach Firewall<br>- Applied Cryptography: Historical Techniques, Basic Techniques and Symmetric Cryptosystems<br>- Applied Asymmetric Cryptosystems and Cryptographic Hash Functions, Asymmetric Encryption & Digital Signatures<br>- Key Management, Certificates, Legal Aspects of the Digital Signature<br>- Anonymity with Mixes, Steganography and User Authentication |
| Mode of Assessment: | - Written examination<br>- Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with mixed media (mostly interactively filled slides), computer lab exercises, elaboration and presentation of a projects in small groups. |
| Literature: | Bishop M.: Computer Security, Addison-Wesley, Boston, U.S.A, ISBN 0-201-44099-7, 2002<br>Bishop M.: Introduction to Computer Security, Addison Wesley, ISBN-10: 03212474422004<br>Pfleger C.P.,et al.: Security in Computing, Prentice Hall, 4th edition, ISBN-10: 0132390779, 2006<br>Eckert C.: IT-Sicherheit. Konzepte - Verfahren - Protokolle, 9. Auflage, De Gruyter Oldenbourg, ISBN-10: 348677848X 2014<br>Tanenbaum A. S.: Computernetzwerke, Pearson Studium, 5. Auflage, ISBN-10: 3868941371, 2012<br>Vielhauer C.: Biometric User Authentication for IT Security: From Funda-mentals to Handwriting, Springer, New York, U.S.A., 978-0-387-26194-2, 2016<br>Schmeh, K.: Kryptografie: Verfahren, Protokolle, Infrastrukturen (iX-Edition), 6. Auflage, dpunkt.verlag GmbH, 3864903564, 2016 |

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| Module Name: | Alternative Programming Paradigms |
| Study Semester: | 3rd semester |
| Module Coordinator: | Prof. Dr. Jochen Heinsohn |
| Main Lecturer(s): | Prof. Dr. Jochen Heinsohn |
| Teaching Language: | German or English |
| Level within Curriculum: | B.Sc. Informatik, B.Sc. Medizininformatik,<br>B.Sc. Applied Computer Science:<br>3rd sem., core elective module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | Computer Science and Logic, 1st sem. |
| Learning Outcome / Skills: | Students are introduced to the relationships between various programming paradigms and generations of programming languages. Thus, they are able to judge their characteristics, advantages, disadvantages with regard to computer science and media applications.<br>Using two “alternative” languages (for example, Lisp/Scheme and Prolog), students will gain the ability to program applications beyond the mainstream programming paradigms/languages, such as Java, Python or C. Students will have a command of the fundamental concepts of both these languages and can deepen their existing knowledge independently. |
| Course Content: | • Reasons for existence of alternative programming paradigms, generations of programming languages and their characteristics<br>• Introduction to descriptive programming using SWI Prolog with programming exercises and homework<br>• www.swi-prolog.org<br>• Prolog application examples<br>• Introduction to functional programming using |

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| | Scheme with programming exercises and homework<br>• www.DrRacket.org<br>• Lisp and Scheme application examples |
| Mode of Assessment: | Written exam.<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with mixed media (mostly interactively filled slides), computer lab exercises in small groups |
| Literature: | Chapter „Programmiersprachen" in Schneider/Werner: Taschenbuch der Informatik, Fachbuchverlag Leipzig, 7th edition, 2012 (good basic introduction)<br>Lecture notes as well as numerous further books on the subject available in the library<br>All slides of the course are available in moodle<br>www.DrScheme.org<br>www.swi-prolog.org |

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| Module title: | Computer Animation |
| Semester level: | 3rd semester |
| Module coordinator: | Prof. Stefan Kim |
| Lecturer/s: | Prof. Stefan Kim |
| Language of instruction: | German |
| Level within curriculum: | BA in Computer Science, 3rd semester, core elective module<br>BA in Applied Computer Science, 3rd semester, core elective module |
| Teaching strategy / weekly hours: | Lectures: 2 hours weekly<br>Laboratory course: 2 hours weekly |
| Study hours: | 150 hrs. = 60 contact hrs. and 90 hrs. directed study |
| Credit points: | 5 |
| Prerequisites according to study regulations: | |
| Recommended prerequisites: | Successful participation in the module media design |
| Learning outcomes / skills: | After attending the module students are able to produce short computer-animated movies.<br>They know basic techniques of 2D and especially 3D animation.<br>They understand the workflow from the creative-aesthetic conception of computer-generated image sequences to the storyboard, the realization steps and even the output in different formats.<br>Students can use common software to create computer animations in fields such as advertising, TV, film, interactive formats, information visualization. |
| Course content: | Fundamentals of animation, time, motion, space<br>Modeling 1 - basic geometric objects<br>Modeling 2 – spline-based modeling<br>Modeling 3 - polygons, subdivision surfaces<br>Texturing 1 - shading, texture mapping<br>Texturing 2 - prozedural shaders, UV-Mapping<br>Lighting 1 - lighting design in film and photography<br>Lighting 2 - CG lighting, light-animation<br>Animation 1 - keyframes, interpolations, loops<br>Animation 2 - prozedural animations, dynamics |

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| | Animation 3 – particle animation, VFX<br>Rendering 1 - Raytracing, Global Illumination<br>Rendering 2 - HDRI, PBR, NPR<br>Compositing 1 – alpha channels, AOVs<br>Compositing 2 – motion tracking |
| Mode of assessment: | - Documentary work with oral conversation<br>Semester-related work can be included in the assessment. |
| Types of media: | Lectures (digital presentation slides), computer exercises |
| Indicative reading: | Birn, Jeremy: Lighting & Rendering, Rodenburg Verlag, 3. Auflage, 2015<br>Asanger A.: Cinema 4D – ab Version 17: Das umfassende Handbuch, Rheinwerk Design, 2015<br>Flückiger B.: Visual Effects: Filmbilder aus dem Computer, Schüren Verlag, 2008<br>Jackel, Neunreither, Wagner: Methoden der Computeranimation, Springer, 2006<br>Pluralsight – Online Learning Platform |

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| Module Name: | Data Processing with MATLAB™ |
| Study Semester: | 3rd semester |
| Module Coordinator: | Prof. Dr. Thomas Schrader |
| Main Lecturer(s): | Prof. Dr. Thomas Schrader<br>Dr. Katja Orlowski |
| Teaching Language: | German |
| Level within Curriculum: | B.Sc. Informatik, third sem., core elective module<br>B.Sc. Applied Computer Science, third sem., core elective module<br>B.Sc. Medical Informatics, third sem., core elective module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites, according to Study and Exam Regulations: | |
| Recommended Prerequisites: | First programming experience<br>Knowledge of matrices and complex numbers<br>(Basic knowledge in medicine and medical informatics) |
| Learning Outcome / Skills: | Understanding<br>The students understand the different forms of data (text, numbers, tables, images, sound). They can explain the special properties of each data form. They can explain the components of the data lifecycle.<br>Analyzing<br>The students can analyze and describe the relationship between data, information, and knowledge. They can import data from different sources using MATLAB™. They can conduct simple analyses.<br>Assessing<br>The students can assess medical data regarding the quality and content-related information. They can identify relevant information within a given dataset. |

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| | Applying<br>The students apply the fundamental principles of the ETL-process (Extract, Transform, Load). They can conduct analyses independently.<br>Implementing<br>The students can implement simple ETL-processes in MATLAB™. |
| Course Content: | Introduction to MATLAB™<br>Introduction to the IDE of MATLAB™<br>Data structures in the form of matrices<br>Implementing functions<br>Structuring the source code<br>Introduction to GUI development<br>Data types, especially medical data<br>measured data, sensor data, text data<br>matrices, tables, lists, structs<br>ETL-process<br>Extract – get Data from Excel, CSV, text files, and images<br>Transform – data adjustment, criteria of data quality<br>Load – load data for further analyses<br>Explorative data processing and analysis<br>Usage and applying different types of plots<br>Creating of informative aggregations |
| Mode of Assessment: | - written examinations<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with mixed media (mostly interactively filled slides), computer lab exercises |
| Literature: | Schweizer W.: MATLAB kompakt, Oldenbourg 2013.<br>Werner M.: Digitale Signalverarbeitung mit MATLAB, Springer Verlag 2012<br>Gonzales R.C., Woods R.E., Eddins S.L.: Digital Image Processing using MATLAB, Pearson 2004<br>Hoffmann J., Quint F.: Signalverarbeitung mit MATLAB und Simulink, Oldenbourg, 2007 |

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| Module title: | Foley and Sounddesign |
| Studiensemester: | 5th semester |
| Module coordinator: | Prof. Alexander Urban |
| Lecturer/s: | Prof. Alexander Urban, Prof. Stefan Kim |
| Language of instruction: | German and English |
| Level within curriculum: | B.Sc. Informatik, 5th semester, core elective module<br>B.Sc. Applied Computer Science, 3rd semester, core elective module |
| Teaching strategy / weekly hours: | Lecture: 4 hours weekly, Laboratory course: 4 hours weekly |
| Study hours: | 150 hrs. = 60 contact hrs. and 90 hrs. directed study |
| Credit points: | 5 |
| Prerequisites according to study regulations: | |
| Recommended prerequisites: | Fundamentals of Audio/Video |
| Learning outcomes / skills: | This module teaches the basics of recording and producing sounds of all kinds. The field of audio application extends beyond conventional media such as film, radio and television to digital media. The production of atmospheric background noises, recordings of complete music ensembles or the underlaying of sound to a computer game play an equally important role.<br><br>Basically, students should be able to record audio of any kind and produce sounds of any genre. The understanding of the signal-technical connections and the operation of the usual tools are expected as further key competences. |
| Course content: | 1. Foley<br>2. Recording Studio Technology<br>3. Audio and Video Postproduction<br>4. Creating own Sounds<br>5. Processing Sound Material<br>6. Application of Sound Effects<br>7. Editing Audio |
| Mode of assessment: | Documentary work with oral conversation<br>Additional assessments during the semester may be |

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| | included in the final grading.. |
| Types of media: | Film, Foto, Audio, Text |
| Indicative reading: | Steve Wright: Digital Compositing for Film and Video, Waltham 2010<br>Syd Field: Das Handbuch zum Drehbuch, Frankfurt am Main 1997<br>Harald Schleicher/Alexander Urban (Hg.): Filme machen, Frankfurt am Main 2005<br>James Monaco: Film verstehen, Reinbek 2000<br>Jay Rose: Audio Postproduction for Digital Video, San Francisco 2002<br>Curtis Roads: The Computer Music Tutorial, Cambridge, Mass. 1996<br>Ric Viers: Sound Effects Bible: How to Create and Record Hollywood Style Sound Effects, 2008<br>Andy Farnell: Designing Sound, 2008<br>Vanessa Theme Ament: The Foley Grail: The Art of Performing Sound for Film, Games, and Animation, 2009<br>www.electronic-musician.com, www.mixonline.com, www.filmsound.org |

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| Module title: | Fundamentals of Audio/Video |
| Semester level: | 3rd semester |
| Module coordinator: | Prof. Alexander Urban |
| Lecturer/s: | Prof. Alexander Urban |
| Language of instruction: | German |
| Level within curriculum: | B.Sc. Informatik, 3rd semester, core elective module<br>B.Sc. Applied Computer Science, 3rd semester, core elective module |
| Teaching strategy / weekly hours: | Lectures: 2 hours weekly<br>Laboratory course: 2 hours weekly |
| Study hours: | 150 hrs. = 60 contact hrs. and 90 hrs. directed study |
| Credit points: | 5 |
| Prerequisites according to study regulations: | |
| Recommended prerequisites: | Successful participation in the modules “Media Design” and „Computer Engineering and Media Technology“ |
| Learning outcomes / skills: | The students know the basics of designing time-based media (film / video and audio).<br>They understand the basic principles of shooting and can apply them to their own projects.<br>The students master the basic principles of working in the recording studio and can apply these in their own projects.<br>They master simple video and audio recordings in the studio and the set.<br>The students can design post-production workflows and know how to use individual technologies.<br>They know the aesthetic fundamentals of combining picture and sound and are able to connect different types of media. The students arre able to use the relevant software programs (eg Da Vinci Resolve, Cinema 4D, Logic Express and ProTools HD). |
| Course content: | 1. Film History |

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| | 2. Film and Semiotics<br>3. Film Design and Dramaturgy<br>4. Introduction to Film Recording Techniques<br>5. History of Sound in the Movies<br>6. Introduction to Audio Studio Technology<br>7. Principles of Monophonic Audio Recordings in the studio<br>8. Principles of Stereophonic Audio Recordings on site<br>9. Audio and Video Postproduction<br>10. Basics of the Aesthetics of Image and Sound |
| Mode of assessment: | Documentary work with oral discussion<br>Additional assessments during the semester may be included in the final grading.. |
| Types of media: | Lectures (digital presentation slides), computer exercises |
| Indicative reading: | Aristoteles: Poetik, Ditzingen 1994<br>Syd Field: Das Handbuch zum Drehbuch, Frankfurt am Main 1997<br>Eberhard Hasche, Patrick Ingwer: Game of Colors: Moderne Bewegtbildproduktion, Berlin 2016<br>Harald Schleicher/Alexander Urban (Hg.): Filme machen, Frankfurt am Main 2005<br>James Monaco: Film verstehen, Reinbek 2009<br>Jay Rose: Audio Postproduction for Digital Video, San Francisco 2008<br>Curtis Roads: The Computer Music Tutorial, Cambridge, Mass. 1996<br>Steve Wright: Digital Compositing for Film and Video, Waltham 2010 |

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| Module Name: | Cloud Computing: Fundamentals |
| Study Semester: | 3rd semester |
| Module Coordinator: | Prof. Dr. Thomas Preuss |
| Main Lecturer(s): | Prof. Dr. Thomas Preuss |
| Teaching Language: | German or English |
| Level within Curriculum: | B.Sc. Informatik, B.Sc. Applied Computer Science, B.Sc. Medizininformatik: 3rd semester (core elective module) |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | Programming 1 and 2, Operating Systems & Web computing |
| Learning Outcome / Skills: | Students know and understand the specifics and basic concepts of distributed and cloud-based systems.<br>They are able to assess and evaluate the necessity, the advantages but also the problems when using these systems.<br>Students will be able to use the basic technologies to develop distributed applications in the cloud.<br>During the practical exercises, students will design and implement a distributed application in the cloud step-by-step using selected technologies, thus acquiring problem-solving and methodological. |
| Course Content: | ● Motivation and problems in the use of distributed and cloud-based systems.<br>● Cloud Service Models (IaaS, PaaS, SaaS)<br>● Cloud Delivery Models (Public, private, community, hybrid, multi)<br>● Cloud-Technologies<br>○ Data Center<br>○ Virtualization<br>● Cloud-Services (compute, storage, IAM, |

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| | load balancer, database)<br>• Classifikation of Communication Models<br>• Error Semantics<br>• Scaling & Availablity<br>• C/S and P2 Architectures<br>• Web Services (REST & SOAP)<br>• Middleware (RPC, MOM) |
| Mode of Assessment: | Written or oral exams (Announced at the beginning of the teaching period).<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with mixed media (blackboard and mostly interactively slides), exercises in small groups, computer based exercises |
| Literature: | A. S. Tanenbaum, M. van Steen: Verteilte Systeme, Pearson, 2003.<br>T. Erl; Z. Mahmood; R. Puttini: Cloud Computing: Concepts, Technology & Architecture, Pearson 2013.<br>M. J. Kavis: Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, & IaaS), Wiley, 2014.<br>A. Homer et. al.:Cloud Design Patterns, Microsoft patterns & practices, 2014.<br>J. Dunkel, A. Eberhart, S. Fischer, C. Kleiner, A. Koschel: Systemarchitekturen für verteilte Anwendungen, Hanser-Verlag, 2007. |

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| Module Name: | Human-Computer Interaction |
| Study Semester: | 3rd semester |
| Module Coordinator: | Prof. Dr. Martin Christof Kindsmüller |
| Main Lecturer(s): | Prof. Dr. Martin Christof Kindsmüller |
| Teaching Language: | German or English |
| Level within Curriculum: | B.Sc. Informatik, 3th sem., core elective module<br>B.Sc. Applied Computer Science, 3rd sem., core elective module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | |
| Learning Outcome / Skills: | Students have an overview over the area of Human-Computer Interaction in its complexity. They can apply this knowledge to evaluate existing systems on different HCI dimensions (like e.g. usability) and to (re-)design new or existing systems on these dimensions.<br>They understand the specific ways of thinking and the concepts and methods of neighboring disciplines like psychology, design, and ergonomics. They can apply these principles self-dependently for simple issues and are able to collaborate interdisciplinary for complex issues. |
| Course Content: | History of Human-Computer Interaction<br>Psychological basics (perception. learning, memory, thinking, problem solving, gestalt principles)<br>Norms and laws (ISO-9241, Work design, VDU workplace regulation, accessibility, ...)<br>Analysis techniques (interviews, questionnaires, observation methods, ...)<br>Design of interactive systems (visions, storyboards, wireframes, prototyping, ...)<br>UI design (system paradigms, design principles, UI |

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| | design patterns, ...)<br>Usability engineering (evaluation, usability tests, reporting, ...)<br>Intuitive use, user experience, social computing |
| Mode of Assessment: | - Semester project with discussion<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with mixed media (mostly interactively filled slides), (group) assignments with and without computers |
| Literature: | Benyon, D. (2010). Designing Interactive Systems: A Comprehensive Guide to HCI and Interaction Design. Harlow: Addison Wesley.<br>Butz, A. & Kröger, A. (2017). Mensch-Maschine-Interaktion. München: De Gruyter – Oldenbourg.<br>Norman, D. A. (2013). The Design of Everyday Things. New York, NY: Basic Books.<br>Preim, B. & Dachselt, R. (2010/2015). Interaktive Systeme, Band 1 & 2. Berlin: Springer.<br>Raskin, J. (2000). The Humane Interface. Boston, MA: Addison-Wesley.<br>Ritter, F. E., Baxter, G. D., & Churchill, E. F. (2014). Foundations for Designing User-Centered Systems. London: Springer London.<br>Sharp, H., Rogers, Y., & Preece, J. (2011). Interaction Design: Beyond Human-Computer Interaction (3rd. ed.). Chichester: Wiley.<br>Shneiderman, B. & Plaisant, C. (2009). Designing the User Interface: Strategies for Effective Human Computer Interaction. Boston, MA: Addison-Wesley. |

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| Module Name: | Introduction to MATLAB |
| Study Semester: | 3rd semester |
| Module Coordinator: | Prof. Dr. Harald Loose |
| Main Lecturer(s): | Prof. Dr. Harald Loose, Prof. Dr. Thomas Schrader |
| Teaching Language: | German |
| Level within Curriculum: | B.Sc. Informatik, B.Sc. Applied Computer Science, B.Sc. Medizininformatik, 3rd sem., core elective module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise/Laboratory: 2 hours weekly per semester, 20 participants<br>Home work |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | Programming I<br>Programming II<br>Knowledge about Matrices and complex numbers |
| Learning Outcome / Skills: | Students are able to solve problems of different domains, especially in the field of biosignal and medical image processing, using MATLAB<br>They are able to develop their own scripts and functions.<br>They master fundamental elements of procedural programming as well as the main functions of data acquisition, data visualization and file handling.<br>Students know basic functions of signal statistics and signal processing.<br>They are able to apply the Fourier transformation and to interpret spectrums.<br>They master the handling of self-developed graphics (App figure). |
| Course Content: | Introduction to MATLAB™, Exercise/Laboratory using MATLAB™,<br>The development environment and embedded tools/apps,<br>Developing und publishing of scripts,<br>Procedural programming in MATLAB (data types, operations, instructions, matrices, structures, cells, strings, functions),<br>Scripts and their structure, |

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| | Figure-App, Development, configuration, post processing<br>Examples in signal and image processing. |
| Mode of Assessment: | - Written Examination, Semester project with discussion<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with mixed media (mostly interactively filled slides), computer lab exercises |
| Literature: | Schweizer W.: MATLAB kompakt, Oldenbourg 2013.<br>Werner M.: Digitale Signalverarbeitung mit MATLAB, Springer Verlag 2012<br>Gonzales R.C., Woods R.E., Eddins S.L.: Digital Image Processing using MATLAB, Pearson 2004<br>Hoffmann J., Quint F.: Signalverarbeitung mit MATLAB und Simulink, Oldenbourg, 2007 |

**An English module description is currently not available**

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| Modulbezeichnung: | Mikrocomputertechnik |
| Studiensemester: | 3. Semester |
| Modulverantwortliche(r): | Prof. Dr. Gerald Kell |
| Dozent(in): | Prof. Dr. Gerald Kell, Prof. Dr. Karl-Heinz Jänicke |
| Sprache: | Deutsch, Englisch |
| Zuordnung zum Curriculum | Ba Informatik, 3. Sem., Wahlpflichtmodul<br>Ba Applied Computer Science, 3. Sem., Wahlpflichtmodul |
| Lehrform/SWS: | Vorlesung: 2 SWS<br>Übung: 2 SWS |
| Arbeitsaufwand: | 150 h = 60 h Präsenz- und 90 h Eigenstudium |
| Kreditpunkte: | 5 |
| Voraussetzungen nach Prüfungsordnung | |
| Empfohlene Voraussetzungen: | Grundkenntnisse in Digitaltechnik, Rechnerorganisation und Informationstechnik |
| Angestrebte Lernergebnisse: | Die Studierenden kennen alle wesentlichen Bestandteile eines Mikrocomputers sowie deren Funktionen und überblicken deren Zusammenspiel.<br>Sie besitzen die wichtigsten Kenntnisse und Fertigkeiten, um die Konfiguration eines Mikrocomputers bei dessen Programmierung optimal zu berücksichtigen und können auf dem Niveau von Standardanwendungen Konfigurationen eines Mikrocomputers selbst entwickeln.<br>Sie sind in der Lage, ausgewählte Konfigurationen von Mikrocomputern selbständig zu evaluieren. |
| Inhalt: | Strukturen von Steuer- und Rechenwerken und ihre technischen Eigenschaften, Registersätze, serielle und parallele Rechenwerke, Architektur und Adressierung von Halbleiterspeichern, Bussysteme und Busarbitrierung, Hardwarekonzepte für die Interrupt- und Trap-Behandlung, Massenspeicher, Computerschnittstellen und Peripheriebausteine |
| Studien-/Prüfungsleistungen: | - Klausur<br>Semesterbegleitende Leistungen können in die Bewertung einbezogen werden. |
| Medienformen: | Lehrmaterialien, Aufgaben und Vorlesungsmanuskripte in elektronischer Form, Laborpraktika und Übungen am Computer |

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| Literatur: | Beierlein T., Hagenbruch O.: Taschenbuch Mikroprozessortechnik, Fachbuchverlag Leipzig<br>Schiffmann W., Schmitz R.: Technische Inf. 2: Grundlagen der Computertechnik, Springer-Verlag<br>Dembowski K.: Computerschnittstellen und Bussysteme, Hüthig Verlag<br>Bähring H.: Mikrorechner - Systeme, Springer-Verlag 2005<br>Wüst K.: Mikroprozessortechnik, ISBN 3-528-03932-9, Vieweg Verlag 2004 |

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| Module Name: | Optimization Algorithms |
| Study Semester: | 3rd / 5th semester |
| Module Coordinator: | Prof. Dr. Ulrich Baum |
| Main Lecturer(s): | Prof. Dr. Ulrich Baum |
| Teaching Language: | German / English |
| Level within Curriculum: | B.Sc. Informatik, 3rd or 5th sem., core elective module<br>B.Sc. Applied Computer Science, 3rd sem., core elective module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | Algorithms and Data Structures<br>Mathematics II |
| Learning Outcome / Skills: | Students are familiar with fundamental problems of discrete and linear optimization as well as corresponding solution algorithms.<br>They are able to model real-world scenarios as instances of generic optimization problems, then select and apply suitable algorithms for solving these.<br>Students understand the practical strengths and limitations of algorithmic optimization. They are familiar with strategies for approximate solution of hard optimization problems. |
| Course Content: | • Linear optimization<br>  ○ Simplex algorithm<br>  ○ Integer linear programming<br>  ○ Transport and assignment problems<br>• Optimization on graphs<br>  ○ Minimum spanning trees<br>  ○ Shortest paths in graphs<br>  ○ Maximum flow in networks<br>  ○ Traveling Salesman Problem |

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| | • Heuristics and approximation methods<br>• Optimization in game theory |
| Mode of Assessment: | - Written or oral examination (will be announced at the beginning of the lecture period)<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture, exercises (paper-based and computer lab) |
| Literature: | T. Cormen, C. Leiserson et al.: Algorithmen – eine Einführung, 3. Aufl., Oldenbourg, 2010.<br>W. Domschke, A. Drexl et al.: Einführung in Operations Research, 9. Aufl., Springer, 2015.<br>R. Sedgewick, K. Wayne: Algorithmen, 4. Aufl., Pearson, 2014.<br>B. Werners, Grundlagen des Operations Research, 3. Aufl., Springer, 2013.<br>S. Winter, Grundzüge der Spieltheorie, 2. Aufl., Springer, 2019. |

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| Module Name: | Lab Placement |
| Study Semester: | 4th semester |
| Module Coordinator: | Dean of Studies at the Department of Computer Science and Media |
| Main Lecturer(s): | All teaching staff at the Department of Computer Science and Media |
| Teaching Language: | German; English for Applied Computer Science |
| Level within Curriculum | B.Sc. Applied Computer Science and B.Sc. Informatik, 4th sem., Mandatory Module |
| Teaching Methods: | Laboratory courses: 4hrs/week |
| Workload: | 150hrs = 60 contact hrs and 90hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations | Pass grades in Programming I and II. |
| Recommended Prerequisites: | |
| Learning Outcome / Skills: | The students can make practical use of the knowledge acquired in the first 3 semesters.<br>Students show this during different experiments, in which the combination of their knowledge in various courses is required.<br>Students can prepare for and carry out experiments. They can deduce conclusions from what they observed during the experiments. |
| Course Content: | Experiments in fields like Computer science, practical and technical Computer Science, e.g.<br>• Porting of a relational database<br>• Image compression<br>• Audio and Video<br>• Knights game (Yucky Chocolate)<br>• Computer systems organisation<br>• Digital technology<br>• Computer animation<br>• Colours and colour resemblance in image processing<br>• Responsive Websites<br>• Story-telling with digital and analog media |

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| | • Biometrical user authentication and Hashing<br>• K-Means in Java<br>• Runtime and memory profiling of Java applications |
| Mode of Assessment: | Protocols of experiments and oral discussion (no grades) |
| Teaching Media: | Various lab experiments |
| Literature: | Handouts from teachers (with further references) |

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| Module Name: | Software Engineering |
| Study Semester: | 4th semester |
| Module Coordinator: | Prof. Dr. Gabriele Schmidt |
| Main Lecturer(s): | Prof. Dr. Gabriele Schmidt |
| Teaching Language: | German |
| Level within Curriculum: | B.Sc. Informatik, B.Sc. Medizininformatik,<br>B.Sc. Applied Computer Science:<br>4th semester, mandatory module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | Programming I-III |
| Learning Outcome / Skills: | Students know the tasks of software engineering and of the software development process and can name methods of requirements engineering.<br>Students can apply object-oriented modeling in both analysis and design to develop solutions to a given problem. Supporting, they know and can apply design patterns and layered architecture.<br>In teamwork, students model and implement a larger software task. In doing so, they apply team skills and application, analysis, problem-solving and method competencies in software engineering. |
| Course Content: | Explanation of the term software engineering<br>Introduction to management models of the software development process<br>Introduction to Requirements Engineering<br>Object-oriented modeling with UML<br>Object Oriented Analysis (OOA)<br>Object-oriented design / design (OOD)<br>Design patterns<br>Introduction to the software architecture (layer architecture) |

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| Mode of Assessment: | Written exam.<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with mixed media (blackboard and mostly interactively filled slides), computer based exercises in small groups |
| Literature: | Balzert H.: Lehrbuch der Objektmodellierung, Spektrum Akademischer Verlag<br>Balzert H.: Lehrbuch der Software-Technik 2 Software-Management, Software-Qualitätssicherung, Unternehmensmodellierung, Spektrum Akademischer Verlag<br>Fowler M.: UML konzentriert Addison-Wesley<br>Gamma E., Helm R., Johnson R., Vlissides J.: Design Patterns. Addison Wesley<br>Larman G.: Appling UML and Patterns, Person Education<br>Rupp C., Hahn J., Queins S., Jeckle M., Zengler B.: UML 2 glasklar, Hanser Fachbuch |

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| Module Name: | Applied Cryptography |
| Study Semester: | 4th semester |
| Module Coordinator: | Prof. Dr. Ulrich Baum |
| Main Lecturer(s): | Prof. Dr. Ulrich Baum |
| Teaching Language: | German |
| Level within Curriculum: | B.Sc. Informatik, 4th sem., core elective module<br>B.Sc. Applied Computer Science, 4th sem., core elective module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | Fundamentals of Security |
| Learning Outcome / Skills: | Students are familiar with the basic terms, objectives, and some methods of modern cryptography.<br>They understand design and operation, security assumptions and possible aplications of some current cryptographic algorithms.<br>Students are able to analyze security requirements of a given application scenario and compare different cryptographic algorithms for use in that scenario.<br>They are able to select suitable cryptographic algorithms and tools for an application and apply them correctly. |
| Course Content: | • Basic definitions, objectives of cryptography<br>• Symmetric cryptosystems: design and operation of AES, modes of operation<br>• Cryptographic hash functions<br>• Message integrity<br>• Key exchange, e.g. Diffie-Hellman<br>• Asymmetric cryptosystems: design and operation of RSA<br>• Digital signatures and certificates |

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| | • Key management, Web of Trust<br>• Secure data transmission protocols (e.g. TLS, SSH)<br>• File and email encryption<br>• Storage media encryption |
| Mode of Assessment: | - Oral or written exam (will be decided at the beginning of the semester)<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture, computer lab exercises |
| Literature: | Claudia Eckert: IT-Sicherheit: Konzepte – Verfahren – Protokolle, 10. Aufl., De Gruyter, 2018.<br>Christof Paar, Jan Pelzl: Kryptografie verständlich, Springer, 2016.<br>Klaus Schmeh: Kryptografie: Verfahren – Protokolle – Infrastrukturen, 6. Aufl., dpunkt, 2016.<br>Jörg Schwenk: Sicherheit und Kryptographie im Internet, 4. Aufl., Springer, 2014.<br>Dietmar Wätjen, Kryptographie, 3. Aufl., Springer, 2018. |

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| Module Name: | Basics of immersive Worlds |
| Study Semester: | 4th Semester |
| Module Coordinator: | Prof. Stefan Kim |
| Main Lecturer(s): | Prof. Stefan Kim |
| Teaching Language: | German |
| Level within Curriculum: | B.Sc. Informatik, 4th sem., core elective module<br>B.Sc. Applied Computer Science, 4th sem., core elective module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | |
| Learning Outcome / Skills: | Students understand the specific requirements of immersive media.<br>They know the differences between VR, AR and MR as well as the respective application potentials in industry and art.<br>The students are able to conceive, design and technically implement their own applications of immersive worlds. |
| Course Content: | - Definition of terms - Immersion, VR / AR / MR<br>- Sensory modalities<br>- History of immersive worlds<br>- Application areas<br>- Technical workflow for developing immersive media (Modeling, Shading, Rendering, Compiation)<br>- Tracking methods<br>- Hardware and APIs (Unity XR, OpenVR, AR Foundation, ARKit, ARCore, AR.js)<br>- Interaction and scripting<br>- Interactive Storytelling in immersive Worlds |
| Mode of Assessment: | - Documentary work with oral conversation |

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| | Semester-related work can be included in the assessment. |
| Teaching Media: | Lectures (digital presentation slides), computer lab exercises |
| Literature: | Linowes, Jonathan: Unity Virtual Reality Projects, Packt Publishing, 2020<br>Glover, Jesse and Linowes, Jonathan: Complete Virtual Reality and Augmented Reality Development with Unity, Packt Publishing, 2019<br>Hauser, Dominik: Build Location-Based Projects for iOS, Pragmatic Bookshelf, 2020<br>Lim, Greg: Beginning iOS 14 & Swift App Development, 2020 |

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| Module Name: | Biometrics in Security |
| Study Semester: | 4th semester |
| Module Coordinator: | Prof. Dr. Claus Vielhauer |
| Main Lecturer(s): | Prof. Dr. Claus Vielhauer |
| Teaching Language: | German |
| Level within Curriculum: | B.Sc. Informatik, 4th sem., core elective module<br>B.Sc. Applied Computer Science, 4th sem., core elective module<br>B.Sc. Medizininformatik, 4th sem., core elective module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | Fundamentals of Security |
| Learning Outcome / Skills: | After students have completed the module successfully, they can describe and distinguish the essential termini and concepts from biometrics (e.g. Authentication, Enrollment, Biometric Classification, Error Classes, Modality Terms, uni- versus multimodal Biometrics etc.).<br>They are able to name and to discuss critically problems related to the natural variability of biometric data. Further, they can outline selected methods of feature extraction and classification.<br>Graduates have the capability to develop biometric systems based on a process model composed of feature extraction and classification. They can categorise and analyse specific methods related to the general aspects Universality, Uniqueness, Permanence, Collectability, Performance, Acceptability and Circumvention.<br>They can indicate and specify requirements for experimental evaluation of biometrics systems, as well as develop application related test plans. Further, students are able to reflect the relevant |

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| | standards from biometrics with regards to their application areas. |
| Course Content: | - Introduction, Overview, Terminology and Definitions<br>- Mathematical and Technical Fundamentals<br>- Error Rates, Recognition Accuracy and Forgery Resistance<br>- Applications, Concepts and Properties of selected Biometric Modalities (unimodal):<br>- Behavioral-based Methods: Speech, Handwriting, Gait Recognition, Keystroke Dynamics, Lip Movement, Audio-Visual Speaker Recognition<br>- Physiological Methods: Iris, Face, Hand, Ear, Retina<br>- Multimodal Biometric Fusion from Multifactoral to Multibiometric Methods: Multimodal, Multialgorithmic, Multisensorial, Multipresentation<br>- Evaluation and Benchmarking of Biometric Systems<br>- Standardization in Biometrics |
| Mode of Assessment: | - Written examination<br>- Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with mixed media (mostly interactively filled slides), computer lab exercises, elaboration and presentation of a projects in small groups. |
| Literature: | Behrens M.: Biometrische Identifikation, Vieweg+Teubner Verlag, ISBN: 978-3-322-90844-5 3528057866, 2001 (in German)]<br><br>Vielhauer C.: Biometric User Authentication for IT Security: From Fundamentals to Handwriting, ISBN 0-387-26194-X, 2006 [Viel2006]<br><br>Zhang D.D.: Automated Biometrics, ISBN 0-7923-7856-3, 2000 [Zhang2000]<br><br>Jain A.K., Ross A.A., Nandakumar K.: Introduction to Biometrics, Springer, ISBN-10:0387773258 , 2011 |

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| | Jain A.K., Flynn P., Ross A.A.: Handbook of Biometrics, Springer, ISBN-10: 1441943757 (softcover reprint 2010), 2008<br><br>Bundesamt für Sicherheit in der Informaationstechnik: Einführung in die technischen Grundlagen der biometrische Authentisierung https://www.bsi.bund.de/DE/Themen/DigitaleGesellschaft/Biometrie/TechnischeGrundlagen/technischegrundlagen_node.html, requested March 2017 |

**An English module description is currently not available**

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| Modulbezeichnung: | Rechnerarchitektur |
| Studiensemester: | 4. Semester |
| Modulverantwortliche(r): | Prof. Dr. Gerald Kell |
| Dozent(in): | Prof. Dr. Gerald Kell |
| Sprache: | Deutsch |
| Zuordnung zum Curriculum | Ba Informatik, 4. Sem., Wahlpflichtmodul<br>Ba Applied Computer Science, 4. Sem., Wahlpflichtmodul |
| Lehrform/SWS: | Vorlesung: 2 SWS<br>Übungen: 2 SWS |
| Arbeitsaufwand: | 150 h = 60 h Präsenz- und 90 h Eigenstudium |
| Kreditpunkte: | 5 |
| Voraussetzungen nach Prüfungsordnung | |
| Empfohlene Voraussetzungen: | Grundkenntnisse in Digitaltechnik, Rechnerorganisation und Informationstechnik |
| Angestrebte Lernergebnisse: | Die Studierenden kennen Architektur- und Bauprinzipien von verschiedenen Rechnersystemen und können diese in eine Bewertungsmatrix einordnen.<br>Sie beherrschen die Grundlagen zur Anwendung von Parallelität und die damit zusammenhängenden strukturalen und funktionalen Grundregeln und sind dazu befähigt, räumliche und zeitliche Parallelität in Rechnern anzuwenden.<br>Sie beherrschen grafische Arbeitsmethoden und sind in der Lage, aktuelle und künftige Entwicklungslinien von Rechnersystemen einzuschätzen. |
| Inhalt: | Klassifikation von Rechnersystemen, Arten und Ebenen der Parallelität in Rechnersystemen, Systemzuverlässigkeit, Leistungsmessung und -bewertung, spezielle Formen der Halbleiter- und Massenspeicher, Speicher- und Nachrichtenbasierte Kopplung von Prozessoren, Grafische Arbeitsmethoden, Abschätzung der Leistungsfähigkeiten künftiger Technologien. |
| Studien-/Prüfungsleistungen: | - Klausur<br>Semesterbegleitende Leistungen können in die Bewertung einbezogen werden. |
| Medienformen: | Lehrmaterialien, Aufgaben und |

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| | Vorlesungsmanuskripte in elektronischer Form, Laborpraktika und Übungen am Computer |
| Literatur: | Märtin C.: Rechnerarchitekturen, Fachbuchverlag Leipzig 2001, ISBN 3-446-21475-5<br>Schürmann B.: Grundlagen der Rechnerkommunikation, Vieweg 2004, ISBN 3-528-15562-0;<br>Oberschelp W., Vossen G.: Rechneraufbau und Rechnerstrukturen, Oldenbourg 1998, ISBN 3-486-24288-1 |

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| Module Name: | C#- and .NET-Programming |
| Study Semester: | 4th semester |
| Module Coordinator: | Prof. Dr. Harald Loose |
| Main Lecturer(s): | Prof. Dr. Harald Loose |
| Teaching Language: | German (most of materials in English) |
| Level within Curriculum: | B.Sc. Informatik, B.Sc. Applied Computer Science, B.Sc. Medizininformatik, 4th sem., core elective module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise/Laboratory: 2 hours weekly per semester, 20 participants<br>Home work |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | Programming I-III |
| Learning Outcome / Skills: | Students are able to implement programs in at the beginning unknown languages and environments addressed to various target hardware.<br>They know C# und XAML and they are able to use them.<br>They understand the principles of event oriented programming for graphical user interfaces.<br>Students develop the ability to design, to implement, to test and to document relatively simple applications in team work. |
| Course Content: | Fundamental concepts and technologies of the development of Apps for current Windows-versions, Introduction to the programming language C# und XAML and the development environment.<br>Introduction to libraries and tools of App programming in the current version of the Visual Studio. |
| Mode of Assessment: | - Semester project with discussion (development of an app in teamwork)<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with mixed media (mostly interactively filled slides), computer lab exercises |
| Literature: | https://developer.microsoft.com/en-us/windows<br>Deitel, Deitel: Visual C# 2012 How to Program, Pearson 2013 |

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| | Geirhos M.: Professionell entwickeln mit C# 6 und Visual Studio 2015, Das Praxisbuch, Rheinwerk Computing, 2016.<br>Doberenz W., Gewinnus, T.: Visual C# 2015. Das Kochbuch, Hanser, 2015. |

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| Modulbezeichnung: | Database Programming |
| Study Semester: | 4th semester |
| Module Coordinator: | Prof. Dr. Susanne Busse |
| Main Lecturer(s): | Prof. Dr. Susanne Busse |
| Teaching Language: | German |
| Level within Curriculum: | B.Sc. Informatik, 4th sem., core elective module<br>B.Sc. Applied Computer Science, 4th sem., core elective module<br>B.Sc. Medizininformatik, 4th sem., core elective module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | Databases,<br>Fundamentals of Cloud Computing |
| Learning Outcome / Skills: | The students have a deep understanding of concepts and methods to assure integrity in relational databases (triggers, transactions, recovery). They are able to design and implement triggers in pre-selected database systems.<br>The students know variants of accessing relational databases from (mobile) application programs. They can implement database applications with Java, e.g. using object-relational mapping frameworks. They are able to determine a suitable transactional level for practical problems.<br>The students have an understanding of differences between relational and NoSQL databases, possibly running in a cloud. They are able to develop applications accessing pre-selected NoSQL systems.<br>The students know major performance aspects of relational databases. They are able to determine appropriate indexes and can tune database queries. |

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| Course Content: | • integrity vs. performance<br>• database design: integrity constraints and schema tuning<br>• triggers, stored procedures<br>• database applications with Java: JDBC, JPA<br>• database in mobile infrastructures, SQLite<br>• NoSQL databases, CAP<br>• document-oriented (JSON) NoSQL database applications<br>• transaction management, concurrency control<br>• index tuning |
| Mode of Assessment: | - Written Exam<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with mixed media (mostly interactively filled slides), computer lab exercises |
| Literature: | M. Kifer, A. Bernstein, P.M. Lewis: Database Systems, 2nd ed., Addison Wesley, 2006.<br>G. Saake, A. Heuer, K.-U. Sattler: Datenbanken: Implementierungstechniken, 3. Aufl., MITP-Verlag 2011.<br>G. Saake, K.-U. Sattler: Datenbanken & Java, 2. Aufl., dpunkt Verlag, 2003.<br>B. Müller, H. Wehr: Java Persistence API2 – Hibernate, EclipseLink, OpenJPA und Erweiterungen, Hanser Verlag, 2012.<br>P.J. Sadalage, M. Fowler: NoSQL Distilled, Addison-Wesley, 2013.<br>E. Redmond, J.R. Wilson: Seven Databases in Seven Weeks, Pragmatic Programmers, 2012.<br>D. Shasha, P. Bonnet: Database Tuning, Morgan Kaufmann, 2003. |

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| Module Name: | Data Visualization |
| Study Semester: | 4th semester |
| Module Coordinator: | Prof. Dr. Sven Buchholz |
| Main Lecturer(s): | Prof. Dr. Sven Buchholz |
| Teaching Language: | German or Englisch |
| Level within Curriculum: | B.Sc. Informatik, 4th sem., core elective module<br>B.Sc. Applied Computer Science, 4th sem., core elective module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | Comfortable with programming, willingness to learn some JavaScript |
| Learning Outcome / Skills: | The students know what data visualization aims for. They are familiar with typical visualization methods and also with statistical principles for describing data. They are competent with designing correct visualizations. The students know how to use JavaScript and associated libraries in order to create interactive data visualizations for the web. For specific selected domains of application overview knowledge is present.. |
| Course Content: | • History of Data Visualization<br>• Survey of methods and aims<br>• Ways of describing data statistically<br>• Static Visualization, Graph Visualization<br>• Interactive Visualization for the Web<br>• Selected fields of application |
| Mode of Assessment: | - Semester project with discussion<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with mixed media (mostly interactively filled slides), computer lab exercises |
| Literature: | Ware: Information Visualization, 2012. |

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| | Murray: Interactive Data Visualization for the Web, 2017.<br>Spence: Information Visualization, 2014.<br>Tufte: The Visual Display of Quantitative Information, 2007. |

**An English module description is currently not available**

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| Modulbezeichnung: | Digitale Kunst (Digital Art) |
| Studiensemester/Dauer der Module: | 4. Semester<br>In jedem Sommersemester |
| Modulverantwortliche(r): | Prof. Dr. Harald Loose |
| Dozent(in): | Prof. Dr. Harald Loose |
| Sprache: | Deutsch |
| Zuordnung zum Curriculum | Ba Informatik, Ba ACS, 4. Sem., Wahlpflichtmodul |
| Lehrform/SWS: | Vorlesung: 2 SWS<br>Übung: 2 SWS |
| Arbeitsaufwand: | 150 h = 60 h Präsenz- und 90 h Eigenstudium |
| Kreditpunkte: | 5 |
| Voraussetzungen nach Prüfungsordnung | |
| Empfohlene Voraussetzungen: | Kenntnisse und Erfahrungen in der Programmierung mit JAVA, C++, C#, Python oder MATLAB |
| Angestrebte Lernergebnisse: | Die Studierenden lernen Grundlagen der digitalen Signalen-, Text- und Bildverarbeitung kennen.<br>Sie wenden Algorithmen und Methoden der Informatik an, um verschiedenartige künstlerische Effekte auf Bildern oder in Texten oder in Audiodateien zu erzielen.<br>Sie lernen zu entwickelnde bzw. zu nutzende Algorithmen selbständig in einer Programmiersprache (MATLAB, PYTHON, JAVA, C++ oder C#) umzusetzen.<br>Sie vertiefen ihre Programmierkenntnisse und -erfahrungen. |
| Inhalt: | - Digitale Repäsentation von Signalen, Bildern und Texten,<br>- Traditionelle Technik der Bildverfremdung wie ASCII-Kunst, Pixel-Art, Collagen, Mosaike,<br>- Text- und Bildanalyse,<br>- Algorithmische Generierung von Ton, Bild und Text mit z.B. Fraktalen, Ton- und Bildgeneratoren,<br>- Grafische Darstellung mathematischer Gebilde,<br>- Optische Täuschungen<br>- Bekannte Galerien von E.J. Heller, H.W. Franke, |

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| | A. Kitaoka, H. Völz, B. Mandelbrot u.a. |
| Studien-/Prüfungsleistungen / Voraussetzungen für die Vergabe von Leistungspunkten | - Belegarbeit mit mündlichem Gespräch<br>Semesterbegleitende Leistungen können in die Bewertung einbezogen werden. |
| Medienformen: | Vorlesung mit gemischten Medien (überwiegend Beamer, Folien, Tafel), Übungen am Computer |
| Literatur: | Schweizer W.: MATLAB kompakt, Oldenbourg 2013.<br>Gonzales R.C., Woods R.E.,Eddins S.L.: Digital Image Processing using MATLAB, Pearson 2004 |

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| Module Name: | Digital Filming |
| Study Semester: | 4th semester |
| Module Coordinator: | Prof. Eberhard Hasche |
| Main Lecturer(s): | Prof. Eberhard Hasche |
| Teaching Language: | German or English |
| Level within Curriculum: | B.Sc. Informatik, 4th sem., core elective module<br>B.Sc. Applied Computer Science, 4th sem., core elective module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | Basics of Audio and Video |
| Learning Outcome / Skills: | The students know the parameters and properties of a digital camera and can use them specifically.<br>They are able to recreate a real scene in a 2.5D space.<br>Through practical exercises and computer simulations, the students develop an understanding of the most important modern camera movements.<br>They know the underlying processes and color space conversions using an HD camera and can aplly its parameters for a meaningful workflow.<br>Students master the most basic film editing technologies.<br>They will be able to perform basic digital compositions using basic technologies such as rotoscoping and keying and assemble them into a film. |
| Course Content: | |
| Mode of Assessment: | Semester project with discussion<br>Additional assessments during the semester may be included in the final grading. |

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| Teaching Media: | Lecture with mixed media (mostly interactively filled slides), computer lab exercises, practical exercises with camera equipment |
| Literature: | Hasche E und Ingwer P: Game of Colors - Moderne Bewegtbildproduktion, Springer-Vieweg, Berlin 2016,<br>Holmes P.: Hot Moves, Hollywood Camera Works, 2010, Video tutorials<br>Kamp W.: AV-Mediengestaltung Grundwissen, Verlag Europa-Lehrmittel, 2005<br>Wright S.:<br>**Di**gital Compositing for Film and Video: Production Workflows and Techniques, Focal Press., 2017<br>Poynton C. A.: A Technical Introduction to Digital Video, John Wiley & Sons, 1996<br>Reisz K., Millar G.: The Technique of Film Editing, Focal Press 1953 – 2002<br>The Foundry: Nuke Documentation |

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| Module Name: | Digital Signal and Image Processing |
| Study Semester: | 4th semester |
| Module Coordinator: | Prof. Dr. Harald Loose |
| Main Lecturer(s): | Prof. Dr. Harald Loose, Prof. Dr. Thomas Schrader |
| Teaching Language: | German (most of materials in English) |
| Level within Curriculum: | B.Sc. Informatik, B.Sc. Applied Computer Science, B.Sc. Medizininformatik, 4th sem., core elective module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise/Laboratory: 2 hours weekly per semester, 20 participants<br>Home work |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | Practical applicable knowledge in:<br>• Analysis and Numerical Mathematics<br>• Linear Algebra<br>• Object Oriented Programming<br>• Basics in MATLAB/Phyton |
| Learning Outcome / Skills: | Students know die differences between biological and technical sensors in the context of signal, audio and image acquisition.<br>Students know the steps of signal, audio and image processing.<br>They know standard algorithms to handle typical problems of filtering, feature detection and pattern recognition.<br>Students are able to solve problems of different domains, especially in the field of signal and image processing, using MATLAB. |
| Course Content: | • Repetition of basics in MATLAB, signal, audio and image processing<br>• Applications to biosignals annd audio (one dimensional signals) and to images and medicine ( two dimensional signals)<br>• Ear and Eye as signal processing systems, |

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| | phenomenon of perception<br>• Technical sensors of signal, audio and image acquisition.<br>• ADC and DAC, Saving of data |
| Mode of Assessment: | - Written Examination, Semester project with discussion<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with mixed media (mostly interactively filled slides), computer lab exercises |
| Literature: | Smith S. W.: The Scientist and Engineers Guide to Digital Signal Processing, 1997-1998, www.DSPGuide.com<br>Werner M.: Digitale Signalverarbeitung mit MATLAB, Vieweg Verlag 2003<br>Meffert B., Hochmuth O.: Werkzeuge der Signalverarbeitung, Pearson 2004<br>Gonzales R.C., Woods R.E.: Digital Image Processing, Pearson 2003<br>Gonzales R.C., Woods R.E.,Eddins S.L.: Digital Image Processing using MATLAB, Pearson 2004<br>Abmayr: Einführung in die digitale Bildverarbeitung<br>Haberäcker: Masterkurs Computergrafik und Bildverarbeitung Schweizer W.: MATLAB kompakt, Oldenbourg 2005<br>Hoffmann J., Quint F., Signalverarbeitung mit MATLAB und Simulink,Oldenbourg, 2007 |

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| Module Name: | Environment Creation |
| Study Semester: | 4th semester |
| Module Coordinator: | Prof. Dr. Reiner Creutzburg |
| Main Lecturer(s): | Prof. Eberhard Hasche, Prof. Dr. Reiner Creutzburg |
| Teaching Language: | English |
| Level within Curriculum: | B.Sc. Informatik, 4th sem., B.Sc. Applied Computer Science, 4th sem., core elective module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | No prerequisites |
| Recommended Prerequisites: | 3D workflkows |
| Learning Outcome / Skills: | The students develop an understanding for the processing of combined scan photogrammetry data by practice-related exercises on the computer.<br>They master the retoplogy technique and can create a pipeline safe low-resolution model from a high-resolution model.<br>They are able to create terrains from scratch or using real world geo data.<br>Students are able to create variations of assets with custom-made city and tree generators.<br>They are familiar with the most important randomization and scatter techniques for procedurally distributing assets across a terrain.<br>The students know different procedures for creating stone walls as a basis for architectural objects.<br>Students will be able to do basic work in Autodesk Maya, Sidefx Houdini and Pixologic ZBrush. |
| Course Content: | The main task in this course is to generate a game-ready asset.<br>A church is scanned with a combined lidar photogrammetry method, retopologized, a professional, readable UV map is created and finally<br>The cleaned hi-resolution geometry data is projected back onto the low-poly model. |

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| | Other topics are:<br>Terrain creation using real world geo data.<br>Asset population with randomizing and scattering techniques<br>City and tree generators in Houdini<br>Creating stone walls in Substance Designer, Maya-ZBrush and from modified scan data<br>Exploring high-end scan libraries (Megascan) |
| Mode of Assessment: | Semester project with discussion<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with mixed media (mostly interactively filled slides), computer lab exercises, practicle exercises with lidar scanner and dslr cameras |
| Literature: | https://www.sidefx.com/industries/games/<br>https://www.thegnomonworkshop.com/tutorials/houdini-terrain-techniques<br>https://www.youtube.com/watch?v=Busz8ttfhrs<br>https://www.thegnomonworkshop.com/tutorials/environment-production-workflow<br>https://www.thegnomonworkshop.com/tutorials/environment-creation-for-vr-using-photogrammetry<br>Ingwer, Hasche at all (2015) Practical Usefulness of Structure from Motion (SfM) Point Clouds Obtained from Different Consumer Cameras DOI: 10.1117/12.2074892 |

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| Module title: | Fundamentals of Interactive Media |
| Semester level: | 4th semester |
| Module coordinator: | Prof. Alexander Urban |
| Lecturer/s: | Prof. Eberhard Hasche, Prof. Stefan Kim, Prof. Alexander Urban |
| Language of instruction: | German |
| Level within curriculum: | BA in Computer Science, 4th semester, core elective module<br>BA in Applied Computer Science, 4th semester, core elective module |
| Teaching strategy / weekly hours: | Lectures: 2 hours weekly<br>Laboratory course: 2 hours weekly |
| Study hours: | 150 hrs. = 60 contact hrs. and 90 hrs. directed study |
| Credit points: | 5 |
| Prerequisites according to study regulations: | |
| Recommended prerequisites: | Successful participation in the modules Media Design and Fundamentals Digital Media |
| Learning outcomes / skills: | The students master the basics of designing interactive media (web applications, games, etc.). They can design the workflow for creating interactive media and develop the dramaturgy. The students are familiar with the special features of synchronous and asynchronous programming and can guide the users in terms of conceptual and aesthetic requirements. The students are familiar with the differences between online and offline applications and can prepare and integrate external media accordingly. They are able to use the relevant software programs (for example, Adobe Photoshop, Cinema 4D, Maya, Unity, Adobe Dreamweaver). |
| Course content: | 1. Screen Design<br>2. Interface Design<br>3. Introduction to Usability and Accessability<br>4. Dramaturgy of Interactive Media<br>5. User Guidance<br>6. Special Features of Synchronous and |

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| | Asynchronous Programming<br>7. Integration of External Media<br>8. Differences between Offline and Online Applications and Quality Assurance |
| Mode of assessment: | Documentary work with oral conversation<br>Additional assessments during the semester may be included in the final grading.. |
| Types of media: | Lectures (digital presentation slides), computer exercises |
| Indicative reading: | Joachim Böhringer et al.: Kompendium der Mediengestaltung für Digital- und Printmedien, Berlin 2014<br>Steve Krug: Don't make me think!, Bonn 2014<br>Jakob Nielsen: Erfolg des Einfachen, München 2000<br>Brenda Laurel: Computers as Theatre, Reading 2000<br>Helen Sharp, Yvonne Rogers, Jenny Preece: Interaction Design: Beyond Human-Computer Interaction, New York 2011<br>Carsten Seifert: Spiele entwickeln mit Unity 5 - 2D- und 3D-Games mit Unity und C# für Desktop, Web & Mobile, München 2017 |
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| Module Name: | Fundamemtals of Knowledge Processing |
| Study Semester: | 4th semester |
| Module Coordinator: | Prof. Dr. Jochen Heinsohn |
| Main Lecturer(s): | Prof. Dr. Jochen Heinsohn |
| Teaching Language: | German or English |
| Level within Curriculum: | 4th sem., core elective module for:<br>B.Sc. Informatik, B.Sc. Medizininformatik,<br>B.Sc. Applied Computer Science |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | |
| Learning Outcome / Skills: | Students will know the basics of information processing and artificial intelligence (AI) as well as their practical applications in computer science and media.<br>They will be able to apply, to construct and to implement relevant processes and algorithms, including estimating and judging their performance, also with respect to a simulation of human intelligence. |
| Course Content: | Introduction to AI, search algorithms (esp. heuristic and A*), rule-based knowledge representation (forward and backward chaining, conflict handling, metarules), logic-based knowledge representation, expert systems and tools, introduction to soft computing for modeling uncertainty and ambiguity, certainty factors, fuzzy logic, introduction to neural networks and machine learning |
| Mode of Assessment: | Written exam.<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with mixed media (mostly interactively filled slides), computer lab exercises in small groups |

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| Literature: | Slides of the course are available in moodle<br>Boersch I., Heinsohn J., Socher R.: Wissensverarbeitung - Eine Einführung in die KI, Spektrum, 2. Auflage, 2007<br>Spreckelsen, C., Spitzer, K.: Wissensbasen und Expertensysteme in der Medizin: KI-Ansätze zwischen klinischer Entscheidungsunterstützung und medizinischem Wissensmanagement, Vieweg+Teubner, 2008<br>Lämmel U., Cleve J.: Künstliche Intelligenz, 3. Auflage, Hanser Fachbuch, 2008<br>Beierle C., Kern-Isberner G.: Methoden wissensbasierter Systeme: Grundlagen, Algorithmen, Anwendungen. Springer 2014<br>Russell S., Norvig P.: Artificial Intelligence: A Modern Approach, (3rd Edition), 2009 |

| **Module Name:** | **International Media Camp** |
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| Study Semester: | 4. Semester |
| Module Coordinator: | Prof. Stefan Kim |
| Main Lecturer(s): | Prof. Stefan Kim, Prof. Julia Schnitzer, N.N. |
| Teaching Language: | Englisch |
| Level within Curriculum: | B.Sc. Applied Computer Science, 4th sem., core elective module, B.Sc. Informatik, 4th sem., core elective module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester<br>The course will be organized in block seminars and includes 1 intensive week in each of the two partner countries |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to study regulations: | |
| Recommended prerequisites: | English language skills, Portfolio with work from the field of digital media (number of participants may be limited) |
| Learning Outcome / Skills: | Students gain the ability to work together in a team on an intercultural basis. They have the conceptual and technical skills to realize a multimedia application. Against the background of the implementation of a media product, they gain an understanding of other living and learning cultures. They learn to organize themselves in internationally mixed small groups and to take responsibility for each other. They gain experience abroad and improve their language skills. |
| Course Content: | • Brainstorming techniques<br>• Conception of multimedia projects with a thematic focus on cultural characteristics of the participating partner countries<br>• Selection of suitable media, Prototyping<br>• Cross-media implementation technologies<br>• Project management<br>• Production of raw material - photo, video, audio, text, graphics in partner countries<br>• Data organization for collective collection, distribution, editing and versioning on a network-based platform<br>• Post-production, Compositing, Editing |

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| | • Documentation and presentation of the final project results |
| Mode of Assessment: | Semester project with discussion<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Mixed media seminar, online communication platforms, computer work |
| Literature: | Subject-related specialist literature and handouts from the teachers |

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| Module Name: | JEE Technologies and Applications |
| Study Semester: | 4th semester |
| Module Coordinator: | Prof. Dr. Martin Schafföner |
| Main Lecturer(s): | Prof. Dr. Martin Schafföner |
| Teaching Language: | German or English |
| Level within Curriculum: | B.Sc. Informatik, 4th sem., core elective module<br>B.Sc. Applied Computer Science, 4th sem., core elective module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | Programming I<br>Programming II<br>Fundamentals of Cloud Computing |
| Learning Outcome / Skills: | Students know the fundamental concepts for server-side Java development using the Java Enterprise Edition (JEE).<br>They understand the architecture of server-side JEE applications, besides technologies and frameworks used in the JEE ecosystem.<br>Students are able to apply current technologies of web-based applications in theory and practice.<br>They are capable of applying the module's topics in a larger project context and to develop near-production level application prototypes in small teams. |
| Course Content: | • Overview of current trends and topics in server-side application development<br>• Containers for server-side applications, e.g. Apache Tomcat, JBoss)<br>• Software architecture of server-side applications<br>• Concepts of development for large-scale applications, e.g. context & dependency injection for decoupled components |

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| | • Design and implementation of persistency layers<br>• MVC architecture of GUIs<br>• JSF, Expression Language & Tag Libraries |
| Mode of Assessment: | - Semester project with discussion<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with mixed media (mostly interactively filled slides), computer lab exercises |
| Literature: | Dr. Danny Coward: *Java EE 7: The Big Picture.* McGraw-Hill Osborne Media, 2014. ISBN 978-0071837347<br>J. Wetherbee et.al.: *Beginning EJB 3, Java EE, 7th Edition.* 2nd edition. Apress, 2013. ISBN 978-1430246923<br>Derek C. Ashmore: *The Java EE Architect's Handbook, Second Edition.* DVT Press, 2014. ISBN 978-0972954884<br>Arun Gupta: *Java EE 7 Essentials.* O'Reilly Media, 2013. ISBN 978-1449370176<br>Mike Keith, Merrick Schincariol: *Pro JPA 2.* 2nd edition. Apress, 2013. ISBN 978-1430249269 |

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| Module Name: | Machine Oriented Programming |
| Study Semester: | 4th semester |
| Module Coordinator: | Prof. Dr. Karl-Heinz Jänicke |
| Main Lecturer(s): | Prof. Dr. Karl-Heinz Jänicke, Prof. Dr. Gerald Kell |
| Teaching Language: | German |
| Level within Curriculum | B.Sc. Applied Computer Science, 4th sem., core elective module<br>B.Sc. Informatik, 4th sem., core elective module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 h = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | Computer Systems Organisation, Programming |
| Learning Outcome / Skills: | Students will be able to use assembler programming in modern micro-processor families.<br>They will understand internal computer processes and be able to manage algorithms for programming models of (primarily) PC processors as well as develop small sections of system software.<br>They will be able to apply high-level language programming suitable for hardware. |
| Course Content: | Using development tools, programming models of x86 processors and extensions, programming examples in machine languages, subroutine technology, macros and parameter hand-offs, managing local variables, recursive subroutines, re-entrant subroutines, interrupt handling, character string processing, extending the instruction set to support multimedia applications, CISC and RISC concept with examples, use of CISC and RISC concept in x86 processors, hardware-relevant and high-level language programming;<br>Overview and comparison of programming models of additional micro-processor and micro-controller families: power-PC, ARM, C166 |
| Mode of Assessment: | - Written exam<br>Additional assessments during the semester may be included in the final grading. |

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| Teaching Media: | Lecture with mixed media (mostly blackboard, slides, beamer), Exercises on blackboard and on computer |
| Literature: | Monadjemi P.: PC-Programmierung in Maschinensprache, Markt &Technik<br>Podschun T. E.: Das Assembler Buch I – Grundlagen, Einführung und Hochsprachoptimierung, Addison Wesley, 2003<br>Podschun T. E.: Die Assembler Referenz II – Kodierung, Dekodierung und Referenz, Addison Wesley, 2003<br>Duncan R.: Power Programming with Microsoft Macro Assembler, Microsoft Press<br>Pentium®Processor Family Developer's Manual - Volume 3: Architecture and Programming Manual<br>Intel Architecture Software Developer's Manual, Volume 3: System Programming Guide<br>Intel Architecture Software Developer's Manual, Volume 1: Basic Architecture<br>Intel MMX Technology Overview<br>Internet Streaming SIMD Extension (Intel Tech. Journal Q2 1999)<br>Further literature from journals and internet shall be recommended during the course. |

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| Module Name: | Mathematical Programming |
| Study Semester: | 4th Semester |
| Module Coordinator: | Prof. Dr. Rolf Socher |
| Main Lecturer: | Prof. Dr. Rolf Socher |
| Teaching Language: | German |
| Level within Curriculum: | Ba Computer Science, Ba Applied Computer Science, 4th Sem., facultative |
| Teaching Methods: | Lectures: 2 hours weekly<br>Laboratory course: 2 hours weekly |
| Workload: | 150 hrs. = 60 hrs. Contact and 90 h directed study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | Mathematics I, II, Programming I, II |
| Learning Outcome / Skills: | The students are able to transfrom mathematrical methods into algorithms and computer programs.<br>They can evaluate algorithms on the basis of the following criteria: correctness, efficiency, numerical stability.<br>The students have acquired knowledge in mathematical modelling. |
| Course Content: | • Number representations<br>• Calendar computations<br>• Extended Euklidean Algorithm<br>• Crypto graphy (Cesar-, Vigenère-Code, RSA)<br>• Primality tests (Miller-Rabin-Test)<br>• Gauß-Algorithm for inverting square matrices<br>• Error correcting codes<br>• Graph algorithms |
| Mode of Assessment: | Semester project with discussion<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with mixed media (mostly interactively filled slides), computer lab exercises |
| Literature: | Sedgewick: Algorithms in Java, Pearson-Studium 2002 |

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| | Cormen, Leiserson, Rivest: Algorithms - An Introduction, Oldenbourg 2004 |

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| Module Name: | Mobile Applications and Systems |
| Study Semester: | 4th semester |
| Module Coordinator: | Prof. Dr. Martin Schafföner |
| Main Lecturer(s): | Prof. Dr. Martin Schafföner |
| Teaching Language: | German or English |
| Level within Curriculum: | B.Sc. Informatik, 4th. sem., core elective module<br>B.Sc. Applied Computer Science, 4th. sem., core elective module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | Programming I<br>Programming II<br>Fundamentals of Cloud Computing |
| Learning Outcome / Skills: | Students understand the architecture and the functionality of operating systems for mobile devices as well as the fundamental principles, challenges and technical solution patterns for mobile applications and systems.<br>They are able to apply basic technologies for developing distributed applications and systems.<br>They can design and prototypically implement mobile applications on selected platforms natively or with cross-platform frameworkds. Funtional requirements, correctness, usability and resource constraints are equally considered.<br>Students know the security technologies of mobile devices and operating systems and are able to adequately select and apply them to concrete problems. |
| Course Content: | • Operating systems for mobile devices: Android, iOS<br>• Properties and specific features of mobile applications<br>• Frameworks for creating mobile GUIs |

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| | • Design and implementation of local persistence<br>• Connection of mobile applications with cloud-based systems<br>• Use of third party application data; sharing of data with third party applications<br>• Use of environmental sensors, e.g. camera and position reckoning<br>• Hybrid and cross-platform-development for mobile devices<br>• Basics of threat and vulnerability analysis and evaluation of counter measures for mobile applications |
| Mode of Assessment: | - semester probject with oral discussion<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with mixed media (mostly interactively filled slides), computer lab exercises |
| Literature: | Nutting J., Mark D., LaMarche J.: Beginning Iphone Development, Apress, 2011<br>Mednieks Z., Meike B., Dornin L.: Programming Android, O'Reilly, 2011<br>Fribert, P.: Web-Apps mit jQuery Mobile: Mobile Multiplattform-Entwicklung mit HTML5 und JavaScript, dpunkt.verlag, 2013<br>Nielsen, J., Raluca, B.: Mobile Usability: Für iPhone, iPad, Android, Kindle, mitp business, 2013 |

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| Module Name: | Object-Oriented Scripting Languages |
| Study Semester: | 4th semester |
| Module Coordinator: | Prof. Dr. Thomas Preuss |
| Main Lecturer(s): | Prof. Dr. Thomas Preuss |
| Teaching Language: | German Lectures; English slides |
| Level within Curriculum: | B.Sc. Informatik, 4th sem., core elective module<br>B.Sc. Applied Computer Science, 4th sem., core elective module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | Programming I<br>Programming II<br>Fundamentals of Cloud Computing |
| Learning Outcome / Skills: | Students know the fundamental concepts of scripting langugages. They are able to use scripting languages in multiple fields of applications.<br>At design and implementation students use established libraries, frameworks and pattern. |
| Course Content: | • Introduction to Python<br>• Object oriented Programming in Python<br>• Systems administration in Python / Command Line Interfaces<br>• 2D Games with PyGame<br>• GUI with Tkinter<br>• Django based web applications<br>• Scripting, extention and automatization of applications with Python |
| Mode of Assessment: | - Semester project with discussion<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with mixed media (mostly interactively filled slides), computer lab exercises |

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| Literature: | Michael Weigend: Python 3: Lernen und professionell anwenden, mitp Professional, 2016<br>Johannes Ernesti, Peter Kaiser: Python 3: Das umfassende Handbuch: Sprachgrundlagen, Objektorientierung, Modularisierung, 2015<br>Al Sweigart: Automate the boring Stuff with Python, No Starch Press, 2017. (https://automatetheboringstuff.com/) |

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| Module Name: | Screen and Motion Design |
| Study semester: | 4th semester |
| Module coordinator: | Prof. Julia Schnitzer |
| Main lecturer(s): | Prof. Julia Schnitzer, Prof. Stefan Kim, Prof. Alexander Peterhänsel |
| teaching language: | German |
| Level within Curriculum: | Bachelor Informatik, Bachelor Applied Computer Science, 4th semester, core elective module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | |
| Learning Outcome / Skills: | The students understand dramaturgical and creative principles and are able to implement them into interactive and / or animated digital media. They are able to:<br>design and produce 2-dimensional animations for different output media.<br>Apply different forms of interaction and usability for animated content and level-design.<br>Apply equipment and software skills professionally to generate high-fidelity rapid prototypes<br>Code frontend-interfaces to implement animated and interactive components for different devices |
| Course Content: | 1. Image technology<br>2. Visual Design<br>3. Image editing: colour grading and visual effects<br>4. Dramaturgy and Interaction: narrative techniques, types of menues, user guidance<br>5. Forms of interactions for static and animated media<br>6. Computer games: leveldesign, interaction design<br>7. Typography for animated und interactive media<br>8. Cutting |

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| | 9. Codebased animation and interactive realtime visuals<br>10. Implementation of 3D- and 2D-animated content in a Browser<br>11. Rapid prototyping technques |
| Mode of Assessment: | Semester project with discussion<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with mixed media (mostly interactively filled slides), computer lab exercises |
| Literature: | Wang: Typgraphy for Screen: Type in Motion, Hoaki Books 2020<br>Hilton: Design in Motion: Applying Design Principles to Filmmaking; Bloomsbury Academic 2020<br>McEltroy: Prototyping for Designers: Developing the best Digital and Physical Services. O'Reilly Verlag 2017<br>Goldbold A.: Mastering UI Development with Unity, Packt Publishing 2018<br>Pluralsight – Online Learning Plattform |
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| Module Name: | Security of Mobile and Distributed Systems |
| Study Semester: | 4th semester |
| Module Coordinator: | Prof. Dr. Claus Vielhauer |
| Main Lecturer(s): | Prof. Dr. Claus Vielhauer |
| Teaching Language: | German or English |
| Level within Curriculum: | B.Sc. Informatik, 4th sem., core elective module<br>B.Sc. Applied Computer Science, 4th sem., core elective module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | Fundamentals of Security |
| Learning Outcome / Skills: | After students have completed the module successfully, they can describe and distinguish the essential termini and concepts of IT security, especially in context of mobile, distributed and embedded systems such as security aspects, risk concepts, attacker scenarios, media security and forensics.<br>They are able to differentiate which security aspects and attack scenarios have special relevance for applications in distributed and mobile IT systems, they can derive vulnerabilities which arise from the concepts and complexities of mobile & distributed IT systems and they are capable to estimate their threat and risk potential.<br>Graduates are able to identify and evaluate well-chosen technical protection methods on different layers of the OSI network model, in mobile and distributed systems, as well as to relate them to the targeted security aspects. |
| Course Content: | - Introduction: Security in context of distributed, mobile and embedded systems<br>- Malicious Software: Viruses, Worms, Trojan |

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| | Horses etc.<br><br>- Software Security on the example of WEB Applications: Threats & Defense of Cross-Site-Scripting and SQL Injection etc.<br><br>- Security in the OSI network model:<br><br>- Wireless Security: WLAN<br><br>- VPN, IPSec, TLS (SSL)<br><br>- KERBEROS, PGP<br><br>- Cloud Security:<br><br>- Specific Risks of the Cloud<br><br>- Selected Technical Solutions<br><br>- Security Aspects of Mobile Devices<br><br>- Specific Risks in Mobile Devices<br><br>- Selected Security Approaches on System Level<br><br>- Perspectives to further Security Domains: Media Security, Biometrics, Forensics and Internet of Things (IoT) |
| Mode of Assessment: | - Written examination<br><br>- Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with mixed media (mostly interactively filled slides), computer lab exercises, elaboration and presentation of a projects in small groups. |
| Literature: | Matt Bishop: Computer Security: Art and Science, Addison Wesley, ISBN-10: 9780201440997, 2002<br><br>Matt Bishop, Introduction to Computer Security, Addison Wesley, ISBN-10: 9780321247445, 2004<br><br>Charles P. Pfleger et al.: Security in Computing, Prentice Hall, 4th edition, ISBN-10: 9780132390774, 2006<br><br>Claudia Eckert: IT-Sicherheit. IT-Sicherheit: Konzepte - Verfahren - Protokolle, 9th Edition, Oldenbourgh Verlag, ISBN 978-3486778489, 2014<br><br>Raymond R. Panko: Corporate Computer and Network Security, Prentice Hall, ISBN-10: 9780130384713, March 2003<br><br>Murugiah Souppaya, Karen Scarfone: Guidelines for Managing the Security of Mobile Devices in the |

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| | Enterprise, NIST Special Publication 800-124, Revision 1, http://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.800-124r1.pdf, 2013<br><br>Himanshu Dwivedi, Chris Clark, David Thiel: Mobile Application Security 1st Edition,McGraw-Hill Education, 1st edition, ISBN-13: 978-0071633567, 2010<br><br>Vic (J.R.) Winkler: Securing the Cloud: Cloud Computer Security Techniques and Tactics 1st Edition, Syngress, ISBN-13: 978-1597495929, 2011<br><br>Michael Cross, Steven Palmer: Web application vulnerabilities: detect, exploit, prevent, ISBN-10: 9781597492096, 2007<br><br>Bruce Schneier: Angewandte Kryptographie, ISBN-10: 3893198547, 1996<br><br>Klaus Schmeh: Kryptografie: Verfahren, Protokolle, Infrastrukturen (iX-Edition), 6. Auflage, dpunkt.verlag GmbH, 3864903564, 2016<br><br>Dittmann: Digitale Wasserzeichen, ISBN-10: 3540666613, 2000 |

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| Module Name: | Communicative Competence |
| Study Semester: | 4th semester |
| Module Coordinator: | Dr. Annett Kitsche |
| Main Lecturer(s): | Dr. Annett Kitsche |
| Teaching Language: | English |
| Level within Curriculum | B.Sc. Applied Computer Science, B.Sc. Informatik, B.Sc. Medizininformatik, 4th sem., General Studies |
| Teaching Methods: | Seminar: 2 hours weekly per semester |
| Workload: | 75 hrs = 30 contact hrs + 45 hrs directed self-study |
| Credit Points: | 2,5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | Good English language skills |
| Learning Outcome / Skills: | Students are interculturally competent and can communicate interculturally.<br>They master virtual teamwork and presentation techniques. |
| Course Content: | Theoretical basics of intercultural competence and interculturally communication<br>Theory and practice of virtual teamwork. Advantages and Disadvantages<br>Students collaborate with other students at a partner university in Belgium (Hogeschool-Universiteit Brussel) on a subject-related topic<br>They present the results of their work via video conference |
| Mode of Assessment: | - Term paper and oral discussion<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Moodle, wikis, video conference |
| Literature: | Brake T: Where in the world is my team? Chichester, 2008<br>Byram M., Nichols A., Stephens D.: Developing Intercultural Competence in Practice. Stevenage, 2001<br>Comfort J., Franklin P. The Mindful International Manager. London, 2008 |

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| | Hofstede G., Hofstede G.-J.: Cultures and Organizations. New York, 2010<br>Rowe B.: How Virtual Teams Work. Texas, 2009 |

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| Module Name: | Fundamentals of Project Management |
| Study Semester: | 4th semester |
| Module Coordinator | Prof. Dr. Andreas Johannsen |
| Main Lecturer(s): | Prof. Dr. Andreas Johannsen |
| Teaching Language: | German or English |
| Level within Curriculum: | B.Sc. Applied Computer Science, B.Sc. Informatik, B.Sc. Medizininformatik, 4th sem., General Studies |
| Teaching Methods: | Seminar: 2 hours weekly per semester |
| Workload: | 75 hrs = 30 contact hrs + 45 hrs directed self-study |
| Credit Points: | 2,5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | |
| Learning Outcome / Skills: | Students know the basics and methods of professional project management.<br>They master project management methods and how to deal with relevant software (e.g. MS-Project).<br>They are able to plan projects independently and take on responsibility for essential project tasks |
| Course Content: | • Basic concepts / fundamentals of project management in the classic and agile environment<br>• Project planning process; Forms of project organisation; Project control and management<br>• Social Skills in project management (Motivation; resolution strategies; team management; conversational skills)<br>• Success factors of project management<br>  • Presentation of tools and methods of project management: Survey techniques, methods for effort estimation, creative techniques, requirement specifications, handling project risks, planning techniques (phase planning, critical path analysis), Prototyping, Scrum, Push & Pull techniques etc. |
| Mode of Assessment: | Written exam, or term paper with oral discussion |

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| | (will be decided at the beginning of the semester) Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Seminar with lectures by the professor, group work and flanking laboratory exercises. |
| Literature: | Johannsen, A.; Kramer, A.; Kostal, H.; Sadowicz, E.: Basiswissen für Software-Projektmanager im klassischen und agilen Umfeld, Dpunkt-Verlag, 2017.<br>Balzert, H.: Software-Technologie, Bd. 2, Berlin et al., 2001.<br>Burghardt M.: Projektmanagement:, 8. Auflage 2008<br>More references will be given during the course of the year during lectures. |
| Special features: | Case studies from corporate practice, possibility of obtaining a certificate in „Certified Professional in Project Management“ of the ASQF/ISQI through voluntary participation in an additional block course. |

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| Modul Name: | Ethics |
| Study Semester: | 4th semester |
| Module Coordinator: | Prof. Dr. Claus Vielhauer |
| Main Lecturer(s): | Prof. Dr. Claus Vielhauer |
| Teaching Language: | German |
| Level within Curriculum | B.Sc. Applied Computer Science, B.Sc. Informatik, B.Sc. Medizininformatik, 4th sem., General Studies |
| Teaching Methods: | Seminar: 2 hours weekly per semester |
| Workload: | 75h = 30 contact hrs und 45 hrs directed self-study |
| Credit Points: | 2,5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | |
| Learning Outcome / Skills: | After successfully completing the module, students can name, characterize, and distinguish the main ethical theories in application to IT (e.g., relativism, consequentialism, deontology, etc.).<br>They are able to critically discuss their own actions as computer scientists in terms of social and contextual adequacy, to conduct and classify value discussions on social norms and values, as well as to assess applications and trends in IT on a multi-faceted basis with regard to their consequences for nature and society. |
| Course Content: | - Introduction, motivation<br>- Ethical theory (Introduction)<br>- Explanation of terms: Values, Responsibilities and Norms<br>- The philosophical value term<br>- Ethics information technology<br>- Presentation and discussion of different views<br>- Examples of engagement for practical ethics<br>- Presentation and discussion of actual, practical issues as part of seminar work |
| Mode of Assessment: | Term paper and oral discussion<br>Additional assessments during the semester may be included in the final grading. |

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| Teaching Media: | Seminar, elaboration or development of a topic in small groups and lectures |
| Literature: | Weber-Wulff D., Class C., Coy W., Kurz C., Zellhöfer D.: Gewissensbisse, transcipt Verlag, ISBN 978-3-8376-1221-9 , 2009<br><br>Johnson D.G.: Computer Ethics, Pearson, 4th edition, ISBN-10: 0131112414, 2009<br><br>Johnson D.G., Nissenbaum H.: Computers, Ethics & Social Values. 2nd edition, Prentice Hall, ISBN-10: 0130923796, 2006<br><br>Kling R.: Computerization and Controversy, 2nd edition, Elsevier, ISBN 9780124150409, 1996 |

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| Module Name: | Law |
| Study Semester: | 4th semester |
| Module Coordinator: | Prof. Dr. Katrin Blasek |
| Main Lecturer(s): | Prof. Dr. Katrin Blasek |
| Teaching Language: | German |
| Level within Curriculum | B.Sc. Applied Computer Science, B.Sc. Informatik, B.Sc. Medizininformatik, 4th sem., Module in General Studies |
| Teaching Methods: | Lecture: 1 hour weekly per semester<br>Seminar: 1 hour weekly per semester |
| Workload: | 75hrs = 30 contact hrs and 45 hrs directed self-study |
| Credit Points: | 2,5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | |
| Learning Outcome / Skills: | Students understand the basic structures of the German legal system.<br>They know the basic principles of contract and liability law which are relevant for their future employment. Students recognize the core issues of labor law and company law with particular reference to the occupation of a computer scientist.<br>The students understand how to deal with unknown legal texts. |
| Course Content: | The lecture offers a general introduction to law, especially in civil and commercial law. In accordance with the occupational requirements, the focus is on the law of obligations (in particular contract law) and property law (in particular furniture, real estate, credit protection) as well as on the principles of labor law (individual labor law) and company law (BGB- Company, OHG, KG, GmbH, UG). |
| Mode of Assessment: | Written exam, or term paper with oral discussion (will be announced at the beginning of the semester) |

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| | Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with integrated exercise (case discussion) using presentation media |
| Literature: | Legislation BGB (or German Civil Law) |

**An English module description is currently not available**

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| Modulbezeichnung: | Organisation & Prozessmanagement |
| Studiensemester: | 4. Semester |
| Modulverantwortliche(r): | Prof. Dr. Eberhard Beck |
| Dozent(in): | Prof. Dr. Eberhard Beck, Dr. Birgit Didczuneit-Sandhop |
| Sprache: | Deutsch |
| Zuordnung zum Curriculum | Ba Informatik, Ba Applied Computer Science, Ba Medizininformatik, 4. Sem., Modul im Studium Generale |
| Lehrform/SWS: | Vorlesung: 1 SWS<br>Übung: 1 SWS |
| Arbeitsaufwand: | 75h = 30h Präsenz + 45h Selbststudium |
| Kreditpunkte: | 2,5 |
| Voraussetzungen nach Prüfungsordnung | Keine |
| Empfohlene Voraussetzungen: | Keine |
| Angestrebte Lernergebnisse: | 1. Wissen:<br>- Die Studierenden kennen die grundlegenden Prinzipien der Organisation.<br>- Sie kennen grundlegende Ansätze verschiedener organisationstheoretischer Modelle und können diese erläutern.<br>2. Verstehen:<br>- Sie kennen und verstehen die wesentlichen Möglichkeiten zur Gestaltung der Aufbau- und Ablauforganisation in Unternehmen.<br>3. Anwenden:<br>- Die Studierenden haben ein grundlegendes Wissen zur prozessorientierten Organisationsgestaltung.<br>- Sie können verschiedene Werkzeuge zur Prozessbeschreibung anwenden, insbesondere im Rahmen des Prozessentwurfs, der Prozessoptimierung und -implementierung sowie des Prozesscontrolling. |
| Inhalt: | • Grundlagen der Organisation<br>• Organisationstheoretische Ansätze<br>• Gestaltung der Aufbauorganisation (Begriff und Wesen der Aufbauorganisation, Leitungs- |

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| | organisation, Arbeitsteilung, Spezialisierung und Generalisierung, Stellenbildung und Stellen-beschreibung, Abteilungsbildung, System der Weisungsbefugnisse, Organisationsstrukturen)<br>• Prozessmanagement (Begriff, Aufgaben und Ziele des Prozessmanagements, Identifizierung und Differenzierung von Prozessen, Modellierung und Analyse der bestehenden Prozesse (Prozessentwurf), Prozessoptimierung und -implementierung, Prozesscontrolling, Tools zur Prozesssimulation, -optimierung und -visualisierung) |
| Studien-<br>/Prüfungsleistungen: | - Klausur<br>Semesterbegleitende Leistungen können in die Bewertung einbezogen werden. |
| Medienformen: | Beamer, Tafel |
| Literatur: | Schulte-Zurhausen M.: Organisation, 5. Aufl., Vahlen Verlag,2010<br>Vahs D. Organisation – Ein Lehr und Managementbuch. 8. Aufl. Schäfer & Pöschel Verlag, 2012<br>Gadatsch A. Grundkurs Geschäftsprozess-Management. Vieweg & Teubner Verlag, 6. Auflage, 2009<br>EABPM (Hrsg.) Business Process Management. Verlag Dr. Götz Schmitz, Gießen, 2009 |

**An English module description is currently not available**

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| Modulbezeichnung: | Wissenschaftsethik |
| Studiensemester: | 4. Semester |
| Modulverantwortliche(r): | Prof. Dr. Eckehard Binas |
| Dozent(in): | Prof. Dr. Eckehard Binas |
| Sprache: | Deutsch |
| Zuordnung zum Curriculum | Ba Informatik, Ba Applied Computer Science, Ba Medizininformatik, 4. Sem., Modul im Studium Generale |
| Lehrform/SWS: | Vorlesung: 2 SWS, Seminar: 2 SWS |
| Arbeitsaufwand: | 150h = 60h (Präsenz) und 90h (Selbststudium) |
| Kreditpunkte: | 5 |
| Voraussetzungen nach Prüfungsordnung | |
| Empfohlene Voraussetzungen: | |
| Angestrebte Lernergebnisse: | Wissenschaftliche Arbeit und Forschungsprojekte müssen darauf hin bewertet werden können, welche Verwertbarkeit in sehr unterschiedlichen und auch gegensätzlichen Handlungsfeldern aus ihnen folgen können. Deshalb muss erlernt und erprobt werden, ethisch problematische Konsequenzen sichtbar zu machen und Alternativen aufzuzeigen. Zielkonflikte erzeugen zumeist moralische Dilemmata. Deshalb müssen Studierende lernen, Konzepte und deren (mögliche) Folgen in ein ethisches Wertegefüge einzuordnen und ausgehend von einem konsensuellen Wertefundament Varianten zu entscheiden bzw. Entscheidungen vorzubereiten, sowie Prozesse und Ergebnisse der eigenen technisch-technologischen bzw. fachlich und wissenschaftlichen Aktivitäten in ein ethisches Konzept einzubetten, insbesondere bezogen auf die soziale Technikfolgenabschätzung. Politische, kulturelle und wirtschaftliche Wettbewerbe sind Agens gesellschaftlicher Entwicklung. Die Bewertung und die Selektion von bearbeitbaren Problemen erfolgt immer in Abhängigkeit von Deutungen und der Verfügbarkeit bestimmter Ressourcen. Fachkulturen generieren dabei nicht nur spezifische Deutungsfelder sondern tendieren auch zur Ausprägung wettbewerblicher Deutungsmacht. Studierende sollten erfassen, welche Logiken diese haben und welche Risiken, schließlich wie diese in einem demokratischen Gemeinwesen zu handhaben |

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| | sind. |
| Inhalt: | Die Lehrveranstaltung rekonstruiert sowohl die Genese moralischer Werte aus den jeweiligen sozialen Konstellationen und versucht, die darin eingelagerten Interessen und Ziele bzw. Konflikte sichtbar zu machen. Es werden auch besonders relevante Handlungsfelder analysiert, die für Studierende an einer technischen Hochschule als künftige und brisante zu erwarten sind.<br><br>1. Diese werden in folgendem systematischen Rahmen eingeordnet und diskursiv (und wo nötig, historisch) entwickelt: Metaethik / Normative Ethik / Angewandte Ethik / Deskriptive Ethik. Dabei werden folgende Schritte gegangen und Begriffe und Konzepte eingeführt:<br><br>a) Begründungen normativer Sätze, Gründe für und gegen Moral, absolute Begründung von Moral, relative Begründungen von Moral, Dezisionismus<br><br>b) Ethische Grundbegriffe, moralische Handlungen, Absicht und Freiwilligkeit, Wissen und Willen, Handlungsprinzipien, Handlungsfolgen, Tun und Unterlassen<br><br>c) Ziel menschlichen Handelns, Glück als letztes Ziel, Sinn und Ziel, Das Gute (der Begriff „gut“, das höchste Gut)<br><br>d) Werte, Gerechtigkeit, Tugend, Sollen, Können<br><br>e) Durchsetzungsprobleme, Sein, Sollen und Müssen<br><br>f) Besondere Aspekte: Das Problem des Bösen, reduktionistische Erklärungsversuche, nicht-reduktionistische Erklärungsversuche<br><br>g) Zur Paradoxie zwischen zweckrationalem Handeln einzelner sowie von Teilsystemen und irrationalem „Verhalten, Reagieren“ von komplexen und ganzheitlichen Systemen; Hinweise auf systemimmanente Antagonismen<br><br>2. "Wissenschaftsethik" - Kurzbeschreibung und Einordnung in die wissenschaftlichen Fragestellungen einer Technischen Hochschule, Schnittstellen zwischen Technik und Gesellschaft, Wissenschaftskultur, ihre jeweiligen historisch-konkreten ethischen Maßstäbe etc..<br><br>3. Innovation und gesellschaftliche Transformation: zur Abhängigkeit zwischen Werten, Zielen und Problemdefinitionen auf der einen Seite |

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| | und gesellschaftlicher Entwicklung auf der anderen. |
| Studien-/Prüfungsleistungen: | - Klausur oder mündliche Prüfung (wird am Anfang der Vorlesungszeit festgelegt)<br>Semesterbegleitende Leistungen können in die Bewertung einbezogen werden. |
| Medienformen: | |
| Literatur: | Jonas, Hans: Prinzip Verantwortung<br>Sloterdijk, Peter: Du musst Dein Leben ändern<br>Grundwald, Armin: Handbuch der Technikethik<br>Brecht, Bertolt: Galileo Galilei<br>Nietzsche, Friedrich: Genealogie der Moral<br>Anders, Günter: Die Antiquiertheit des Menschen |

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| Module Name: | Committee work and self-administration |
| Study Semester: | 4th and 5th semester |
| Module Coordinator: | Dean of Studies at the Department of Computer Science and Media |
| Main Lecturer(s): | Varying, depending on availability |
| Teaching Language: | German |
| Level within Curriculum: | B.Sc. Applied Computer Science, B.Sc. Informatik, B.Sc. Medizininformatik, 4th and 5th sem., General Studies |
| Teaching Methods: | Committee meetings, approx. 10 per year; 2 hours weekly per semester |
| Workload: | 75 hrs = 30 contact hrs + 45 hrs directed self-study |
| Credit Points: | 2,5 |
| Prerequisites according to Study and Exam Regulations: | Being elected into an office of academic self-administration in the status group of students |
| Recommended Prerequisites: | |
| Learning Outcome / Skills: | The students consolidate the overview of the academic self-administration of the student status group, esp. in the committees AStA, StuPa, Senate, Student Council for Computer Science and Media, Department Council for Computer Science and Media or their commissions. They know the processes in committees of academic self-administration and help to organize them as part of their committee membership. Documents such as draft resolutions, agendas, invitations, minutes can be created independently and formally evaluated. The relevant legal framework of academic self-government is known and can be applied securely.<br>The learning outcomes from the bodies of academic self-government enable a transfer to non-university bodies or administrative work such as specialist groups, administrative bodies, commissions, or committees. |
| Course Content: | |
| Mode of Assessment: | - Semester project with discussion<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | |

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| Literature: | |

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| Module Name: | Preparation for Study Abroad |
| Lectures, if necessary: | Seminar on Study Abroad |
| Study Semester: | 5th semester |
| Module Coordinator: | Prof. Dr. Reiner Creutzburg |
| Main Lecturer(s): | Prof. Dr. Reiner Creutzburg |
| Teaching Language: | English |
| Level within Curriculum | B.Sc. Applied Computer Science, 5th sem., mandatory module |
| Teaching Methods: | Seminar: 2 hours per semester weekly |
| Workload: | 120 h = 30 contact hrs + 90hrs directed self-study |
| Credit Points: | 4 |
| Prerequisites according to Study and Exam Regulations: | Pass grades in all modules up to the 4th semester |
| Recommended Prerequisites: | |
| Learning Outcome / Skills: | The students can document and illustrate their skills acquired in specific subjects during their semester abroad.<br>During the seminar, the students are able to present the results of their study abroad to their audience in a technical manner.<br>The students know how to present their results at different levels of abstraction in shorter or more detailed reports and to convey them to their fellow students as well as the staff of the Department of Computer Science and Media. |
| Course Content: | Content and organisational support<br>Presentation and discussion of the results of the study abroad seminar<br>Creation of a presentation and a report of study abroad and presentation of the results. |
| Mode of Assessment: | Report of study abroad and lecture with simple assessment, presentation of proof of study at a foreign university with 25 ECTS credits. |
| Teaching Media: | Presentations in audiovisual form, via projector and if necessary with audio-technical equipment |
| Literature: | Specific material will be made available on the departments's server at the beginning of each semester. This will be announced to the students. |

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| Module Name: | Study Abroad Modules |
| Lectures, if necessary: | Study Abroad Modules |
| Study Semester: | 5th semester |
| Module Coordinator: | Prof. Dr. Reiner Creutzburg |
| Main Lecturer(s): | Prof. Dr. Reiner Creutzburg |
| Teaching Language: | English, or in the language of the host country |
| Level within Curriculum | Ba Applied Computer Science, 5th sem., Mandatory module |
| Teaching Methods: | Lectures, Seminars, Exercises, Work Placement, about 20 – 30hrs per Week (depending on university abroad) |
| Workload: | About 14 Weeks as a regular student at a university abroad (about 280 – 450hrs) |
| Credit Points: | 25 |
| Prerequisites according to Study and Exam Regulations: | Pass grades in all modules of the 4th semester |
| Recommended Prerequisites: | Proficient English language skills, or language skills of the host country |
| Learning Outcome / Skills: | Students are able to apply the knowledge acquired during their studies at their host university abroad.<br>Students deepen their skills in computer science and a foreign language at a university abroad, in appropriately selected modules (such as the modules pre-defined and selected in the Erasmus Exchange Learning Agreement)<br>Students gain international experience and intercultural competence and are able to deal in depth with topics computer science as well as general academic, mathematical and scientific topics. |
| Course Content: | Students are required to provide proof of completion of modules abroad with a total of 25 Credit Points (CP). 50% of these CPs must be acquired in fields relevant to Computer Science and Media |
| Mode of Assessment: | Study and Exam Regulations according to university abroad. Proof needed. |
| Teaching Media: | Teaching Media offered by university abroad |
| Literature: | Literature offered by university abroad. |

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| Module Name: | Autonomous Mobile Systems |
| Study Semester: | 5th semester |
| Module Coordinator: | Prof. Dr. Jochen Heinsohn |
| Main Lecturer(s): | Dipl.-Inform. Ingo Boersch,<br>Prof. Dr. Jochen Heinsohn, Prof. Dr. Sven Buchholz |
| Teaching Language: | German |
| Level within Curriculum: | 5th sem., core elective module for:<br>B.Sc. Informatik, B.Sc. Applied Computer Science |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | Introduction to Knowledge Processing, 4th semester |
| Learning Outcome / Skills: | The students know the application as well as the fusion of methods from different areas of computer science in autonomous mobile systems. This covers also the knowledge about practical applications.<br>They command the practical application of the knowledge attained and the interaction between theory and practice using the example of a mobile robot (Pioneer 2 and 3 amongst others).<br>The students are able to apply and to integrate procedures and algorithms from the specific domains, esp. from signal and image processing, mechatronic and electronics, and artificial intelligence |
| Course Content: | • State of the art in autonomous mobile systems<br>• Main Components of autonomous mobile systems, actuators and sensors<br>• Image processing by mobile systems<br>• Navigation and planning methods and devices<br>• Selected algorithms to determine features, and to recognize and follow objects<br>• Integrating AI and image processing algorithms<br>• Group work: Handling an application scenario |

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| | using a mobile robot, for example navigating, finding and transporting an object flagged with a certain color (e.g. catbot, dogbot, etc.) |
| Mode of Assessment: | Successful group work plus course examination/ colloquium |
| Teaching Media: | Lecture with mixed media (mostly interactively filled slides), computer lab and mobile robot exercises in small groups |
| Literature: | Slides of the course are available in moodle<br>www.mobilerobots.com<br>Boersch I., Heinsohn J., Socher R.: Wissensverarbeitung - Eine Einführung in die KI, Spektrum, 2. Auflage 2007<br>Herbert Süße, Erik Rodner: Bildverarbeitung und Objekterkennung: Computer Vision in Industrie und Medizin, Springer 2014<br>Thrun S., Burgard W., Fox D.: Probabilistic Robotics. MIT Press, Cambridge, MA, 2006<br>Weitere Literatur wird in der Lehrveranstaltung angegeben |

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| Module Name: | Cross Device Interaction |
| Study Semester: | 5th semester |
| Module Coordinator: | Prof. Julia Schnitzer |
| Main Lecturer(s): | Prof. Julia Schnitzer, Prof. Dr. Martin Christof Kindsmüller |
| Teaching Language: | english |
| Level within Curriculum: | B.Sc. Informatik, 5th sem., core elective module<br>B.Sc. Applied Computer Science, 5th sem., core elective module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | Human Computer Interaction,<br>Fundamentals of Interactive Media |
| Learning Outcome / Skills: | Students understand the specific properties and potentials of different input and output devices. They are able to :<br>plan, design and realize usable, fit-for-purpose solutions for cross-device interactions.<br>develop roadmaps for connecting physical and virtual objects and services.<br>they are familiar with current forms of interaction and can design them as part of a human-machine-interface with and without using extremities.<br>They know platform-independent frameworks and current web technologies. |
| Course Content: | - cross-media user experience<br>- user journeys<br>- media convergence<br>- interface design<br>- internet of things<br>- cross platform framework<br>- HTML5, CSS3, Javascript<br>- Json<br>- XML, SVG |

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| | - internet of things<br>- ubiquitous computing<br>- brain computer interface |
| Mode of Assessment: | - Semester project with discussion<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with mixed media (mostly interactively filled slides), computer lab exercises |
| Literature: | Levin, M. (2014). Designing Multi-Device Experiences, O'Reilly.<br>James Kalbach (2016). Mapping Experiences: A Guide to Creatinig Value through Journeys, Blueprints and Diagrams, O'Reilly.<br>Lomas R. (2017). Learn to Code Now. SuperHI<br>Blokdyk G (2019). Computer-Brain Interface: A Complete Guide. Verlag 5STAR Cooks<br>Stickdorn M (2017) This is Service Design Doing. User Research & Customer Journey Maps to Create Successful Services. BIZ Publishing<br>Kumar, Payvar (2020). Applications in Ubiquiitous Computng. Springer Verlag |

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| Module Name: | Embedded Systems |
| Study Semester: | 5th semester |
| Module Coordiantor: | Prof. Dr. Karl-Heinz Jänicke |
| Main Lecturer(s): | Prof. Dr. Karl-Heinz Jänicke |
| Teaching Language: | German |
| Level within Curriculum | B.Sc. Applied Computer Science, 5th sem., core elective module<br>B.Sc. Informatik, 5th sem., core elective module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | Fundamentals of technical computer science, Computer organisation and Programming |
| Learning Outcome / Skills: | Students will know the primary technologies for the realisation of embedded systems and have acquired practical skills, especially in microcontrollers, software development and software testing for target platforms.<br>They can develop microcontroller-based applications as foreground /background applications and initialise necessary periphery components. They also have a basic knowledge of real-time processing and real-time operating. |
| Course Content: | Overview of technologies: embedded PCs and microcontrollers, presentation of important platforms (demonstrations); microcontroller architecture, functions and applications, selection and programming of a specific microcontroller, internal architecture, processor kernel, instruction set, memory organisation, E/A-Ports, timer, interrupt; initialisation and application of controller function (E/A-Ports, A/D converter, timer, interfaces,...); development tools: Assembler, C-Compiler, Debugger, Monitor, Simulator; programming examples and exercises in Assembler and C; development of small real time applications;<br>Microcontroller platform for exercises: primarily SAB80C517A with development environment and |

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| | application hardware (sensors, aktors, display elements) |
| Mode of Assessment: | - Written exam<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with mixed media (mostly blackboard, slides, beamer), exercises on blackboard and on computer |
| Literature: | Klaus R.: Die Mikrocontroller 8051, 8052 und 80C517, Zürich, vdf Verlag, 2001<br>Schaaf B.-D.: Mikrocomputertechnik – Mit Mikrocontrollern der Familie 8051, Hanser Verlag, 2005<br>Manual SAB80C517A, Infineon<br>Laboratory materials, manuals of development environments and programming languages used (Assembler A and C)<br>Further Literature from journals and the internet shall be recommended during the course. |

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| Module Name: | Enterprise Applications |
| Study Semester: | 5th Semester |
| Module Coordinator: | Prof. Dr. Martin Schafföner |
| Main Lecturer(s): | Prof. Dr. Martin Schafföner |
| Teaching Language: | German or Englisch |
| Level within Curriculum: | B.Sc. Informatik, 5th sem., core elective module<br>B.Sc. Applied Computer Science, 5th sem., core elective modules |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | Programming I<br>Programming II<br>Fundamentals of Cloud Computing<br>JEE Technologies and Applications |
| Learning Outcome / Skills: | Students understand fundamental design principles of server-side enterprise applications. They understand the architecture of enterprise applications targeting the requirements availability, scalability, security, componentization.<br>Students are versed in current trends and technologies in software engineering for enterprise applications.<br>Students are able to apply the approaches covered in lectures and exercises to different domains and to develop near-production prototypes in small teams. |
| Course Content: | • overview of current trends in server-side applications<br>• software architecture of server-side applications<br>• resource management, concurrency and communication in large-scale distributed systems<br>• modularization and dependency management |

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| | • structured logging<br>• separation of concerns with aspect-oriented programmingInternationalisierung/Lokalisierung von graphischen Benutzeroberflächen<br>• message-based coupling of components<br>• web-services, esp. http/REST<br>• design and evolution of APIs |
| Mode of Assessment: | - Semester project with discussion<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with mixed media (mostly interactively filled slides), computer lab exercises |
| Literature: | Dr. Danny Coward: *Java EE 7: The Big Picture.* McGraw-Hill Osborne Media, 2014. ISBN 978-0071837347<br>Derek C. Ashmore: *The Java EE Architect's Handbook, Second Edition.* DVT Press, 2014. ISBN 978-0972954884<br>Rademakers T., Dirksen J.: *Open Source ESBs in Action*, Manning Publications, 2007<br>Gregor Hohpe, Bobby Woolf: *Enterprise Integration Patterns: Designing, Building, and Deploying Messaging Solutions,* Addison-Wesley Professional, 2003<br>Martin Fowler: *Patterns of Enterprise Application Architecture*, Addison-Wesley Professional, 2002<br>Jaroslav Tulach: Practical API Design. Apress, 2012<br>S. Gupta: Pro Apache Log4j. APress, 2014<br>R. Laddad: AspectJ in Action. Manning, 2009 |

**An English module description is currently not available**

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| Modulbezeichnung: | Bildverarbeitung |
| Studiensemester: | 5. Semester |
| Modulverantwortliche(r): | Prof. Dr. Thomas Schrader |
| Dozent(in): | Prof. Dr. Thomas Schrader |
| Sprache: | Deutsch, ggf. Englisch |
| Zuordnung zum Curriculum | Ba Medizininformatik, Ba Informatik, 5. Sem., Wahlpflichtmodul |
| Lehrform/SWS: | Vorlesung: 2 SWS<br>Übung: 2 SWS |
| Arbeitsaufwand: | 150 h = 60 h Präsenz- und 90 h Eigenstudium |
| Kreditpunkte: | 5 |
| Voraussetzungen nach Prüfungsordnung | |
| Empfohlene Voraussetzungen: | mHealth/Digitale Signalverarbeitung |
| Angestrebte Lernergebnisse: | Verstehen<br>Die Studierenden kennen die unterschiedlichen Bildtypen und ihre Verwendung im medizinischen Kontext. Sie verstehen die unterschiedlichen Modalitäten der Bilderzeugung.<br>Analysieren<br>Sie können Daten aus den genannten Quellen auswerten und präsentieren.<br>Beurteilen<br>Die Studierenden können die Bilddaten bezüglich der Qualität und der inhaltlichen Informationen beurteilen. Sie sind in der Lage, relevante Informationen in den Daten identifizieren.<br>Anwenden<br>Sie wenden verschiedene Algorithmen der Bildverarbeitung zur Verbesserung der Bildqualität, zur Segmentierung und Klassifikation von (medizinischen) Bildern an. Sie programmieren Algorithmen in Python (Informatiker:innen) oder Matlab (Medizininformatiker:innen)<br>Erschaffen<br>Sie sind in der Lage, einen bildanalytischen Prozess selbständig zu planen und durchzuführen. |
| Inhalt: | Bildgebende Verfahren<br>Kamera<br>Hyperspektralkamera, Medizin: Bildgebende Verfahren in der Medizin (CT, Rö, Virtuelle Mikroskopie) |

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| | Bildanalyse<br>Histogramme, Grauwertverteilungen, Farbräume<br>Bildverarbeitung<br>Filterung, Segmentierung, Klassifikation, Auswertung<br>Fortschrittliche Methoden der Bildanalyse: Deep-Learning |
| Studien-/Prüfungsleistungen: | - Klausur<br>Semesterbegleitende Leistungen können in die Bewertung einbezogen werden. |
| Medienformen: | Vorlesung mit gemischten Medien (überwiegend Tafel, Folien, Beamer), Übungen am Computer |
| Literatur: | 1. Zhou SK, Greenspan H, Shen D. Deep learning for medical image analysis [Internet]. 2017 [zitiert 12. Juli 2017]. Verfügbar unter: http://public.eblib.com/choice/publicfullrecord.aspx?p=4789490<br><br>2. Solomon C, Breckon T. Fundamentals of digital image processing: a practical approach with examples in Matlab. Chichester, West Sussex ; Hoboken, NJ: Wiley-Blackwell; 2011. 328 S.<br><br>3. García GB, Herausgeber. Learning image processing with OpenCV: exploit the amazing features of OpenCV to create powerful image processing applications through easy-to-follow examples. Birmingham: Packt Publ; 2015. 208 S. (Packt open source).<br><br>4. Bovik AC. The essential guide to image processing. London ; Boston: Academic Press; 2009. 853 S. |

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| Module Name: | Knowledge based systems in medicine |
| Study Semester: | 5th semester |
| Module Coordinator: | Prof. Dr. Jochen Heinsohn |
| Main Lecturer(s): | Dipl.-Inform. Ingo Boersch,<br>Prof. Dr. Jochen Heinsohn |
| Teaching Language: | German |
| Level within Curriculum: | 5th sem., core elective module for:<br>B.Sc. Informatik, B.Sc. Medizininformatik, B.Sc. Applied Computer Science |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | Introduction to Knowledge Processing, 4th semester |
| Learning Outcome / Skills: | The students know and command the basics of knowledge processing and artificial intelligence (AI) with respect to the development of knowledge based systems in medicine. This covers the ability to know, to design, and to evaluate AI applications in medicine. |
| Course Content: | • introduction (knowledge based systems in medicine, kinds of knowledge to be modeled, application areas)<br>• Formal/Theoretical/Logical basics for knowledge representation and inference<br>• Rule-based systems and expert systems in medicine / Rule Engines<br>• Vocabularies in medicine / semantic networks<br>• description logics (ALC, EL, etc.)<br>• Ontologies und Web Ontology Languages<br>• Self organizing maps<br>• Other actual topics depending on the interests of students and teachers |
| Mode of Assessment: | Successful group work plus course examination/ colloquium |

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| Teaching Media: | Lecture with mixed media (mostly interactively filled slides), computer lab exercises in small groups |
| Literature: | Slides of the course are available in moodle<br>Boersch I., Heinsohn J., Socher R.: Wissensverarbeitung - Eine Einführung in die KI, Spektrum, 2. Auflage 2007<br>Baader et al.: The Description Logic Handbook, 2nd ed., Cambridge, 2010<br>Spreckelsen C., Spitzer K.: Wissensbasen und Expertensysteme in der Medizin: KI-Ansätze zwischen klinischer Entscheidungsunterstützung und medizinischem Wissensmanagement, Vieweg+Teubner, 2008<br>Horridge M., et al.: A Practical Guide To Building OWL Ontologies Using The Protégé-OWL Plugin and CO-ODE Tools Edition 1.2, The University of Manchester, 2009<br>Pommerening, K.; Deserno, T. M.; Ingenerf, J.; Lenz, R. & Schmücker, P. Der Impact der Medizinischen Informatik. Informatik-Spektrum, 2015, 38, 347-369 |

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| Module Name: | Knowledge Processing II |
| Study Semester: | 5th semester |
| Module Coordinator: | Prof. Dr. Jochen Heinsohn |
| Main Lecturer(s): | Prof. Dr. Jochen Heinsohn, Dipl.-Inform. Ingo Boersch, NN |
| Teaching Language: | German |
| Level within Curriculum: | 5th sem., core elective module for:<br>B.Sc. Informatik, B.Sc. Medizininformatik |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed selfstudy |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | Fundamentals of Knowledge Processing (4th Sem.) |
| Recommended Prerequisites: | |
| Learning Outcome / Skills: | The students know and command special topics of information processing and artificial intelligence (AI) as well as their practical applications in computer science, medical informatics and digital media. This covers also the ability to know, to design, and to evaluate AI applications in these domains as well as the knowledge about practical applications.<br><br>The students are able to apply, to construct and to implement relevant processes and algorithms, including estimating and judging their performance, also with respect to a simulation of human intelligence. Special applications can be the domain of autonomous mobile systems or knowledge based systems in medicine. |
| Course Content: | Based on the „Fundamentals of Knowledge Processing“ (4th Sem.) special topics of artificial intelligence are in the focus of this module. The set of selected topics depends on the available and possible teaching methods (online or on-site) as well as on the skills oft the students.<br><br>Examples for the topics are:<br>• introduction, formal/theoretical/logical basics |

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| | for knowledge representation and inference<br>• logical programming<br>• rule-based systems and expert systems (in medicine, for example) / Rule Engines<br>• Vocabularies / semantic networks<br>• description logics (representing knowledge by terminological logics and automatic reasoning)<br>• ontologies and Web Ontology Languages<br><br>• autonomous mobile systems, service robotics<br>• action and behavior planning / control architectures<br>• navigation – self localization and path planning<br><br>where applicable: self organizing maps or image processing |
| Mode of Assessment: | Written exam.<br><br>Additional assessments during the semester may be included in the final grading.<br>Examples are a successful group work or a homework plus course examination/colloquium |
| Teaching Media: | Lecture with mixed media (mostly interactively filled slides), computer lab exercises in small groups.<br><br>In the case of online teaching, the use of online conferences (BBB, Zoom, ….), Moodle-Chats and individual mentoring (e.g. email, telephone, skype, BBB) and free available software. |
| Literature: | Slides of the course are available in moodle<br>Boersch I., Heinsohn J., Socher R.: Wissensverarbeitung - Eine Einführung in die KI, Spektrum, 2. Auflage, 2007<br>Spreckelsen, C., Spitzer, K.: Wissensbasen und Expertensysteme in der Medizin: KI-Ansätze zwischen klinischer Entscheidungsunterstützung und medizinischem Wissensmanagement, Vieweg+Teubner, 2008<br>Baader et al.: The Description Logic Handbook, 2nd ed., Cambridge, 2010<br>Lämmel U., Cleve J.: Künstliche Intelligenz, Hanser |

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| | Fachbuch, 2020<br>Beierle C., Kern-Isberner G.: Methoden wissensbasierter Systeme: Grundlagen, Algorithmen, Anwendungen. 6. Auflage, Springer 2019<br>Russell S., Norvig P.: Artificial Intelligence: A Modern Approach, (4th Edition), 2020<br>Horridge M., et al.: A Practical Guide To Building OWL Ontologies Using The Protégé-OWL Plugin and CO-ODE Tools Edition 1.2, The University of Manchester, 2009<br>Thrun S., Burgard W., Fox D.: Probabilistic Robotics. MIT Press, Cambridge, MA, 2006 |

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| Module Name: | Media Psychology I |
| Study Semester: | 5th semester |
| Module Coordinator: | Prof. Dr. Martin Christof Kindsmüller |
| Main Lecturer(s): | M. A. Gerd Fittkau |
| Teaching Language: | German; optional English |
| Level within Curriculum: | B.Sc. Informatik, 5th semester, core elective module<br>B.Sc. Applied Computer Science, 5th semester, core elective module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | |
| Learning Outcome / Skills: | - The students know the basics of media psychology and related scientific approaches, such as media and communication theory as well as media effects research and communication psychology.<br>- Students will be able to explain current theories and findings in media psychology using examples from digital media.<br>- They are able to draw conclusions from scientific contributions of media psychology and to assess the use and effect of media on the basis of media psychological findings. |
| Course Content: | - Media choice<br>- Media use, media reception<br>- Media effects, media competence<br>- Gamification<br>- Social networks |
| Mode of Assessment: | Documentary work with oral interview.<br>Additional assessments during the semester may be included in the final grading. |

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| Teaching Media: | Lecture (digital presentation slides), e-learning content in Moodle learning platform, assignments on computer |

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| Module Name: | Media Technology Audio |
| Study Semester: | 5th semester |
| Module Coordinator: | Prof. Eberhard Hasche |
| Main Lecturer(s): | Prof. Eberhard Hasche |
| Teaching Language: | German |
| Level within Curriculum: | B.Sc. Informatik, 5th sem., core elective module<br>B.Sc. Applied Computer Science, 5th sem., core elective module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | Basics of Audio and Video |
| Learning Outcome / Skills: | The students master the essential principles of handling digital audio material.<br>They can create sounds and simple pieces of music themselves.<br>The students know the different sampler technologies and can create their own sampler instruments and control them with MIDI.<br>They can assess the quality of an audio production and create simple mixes themselves and then master them in the recording studio.<br>They can design and apply sound according to aesthetic criteria.<br>Students can use the relevant software programs (stereo editors, LogicExpress/Pro, ProTools HD). |
| Course Content: | 1. Further aspects of digital audio<br>2. Basics of sound generation<br>3. Introduction to music theory (melody, rhythm and harmony) and its implementation in audio sequencers<br>4. Basics and application of MIDI<br>5. Loop-based creation of simple pieces of music<br>6. Sampler technology |

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| | 7. Mixing and mastering<br>8. Basics of the aesthetics of sound |
| Mode of Assessment: | Semester project with discussion<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with mixed media (mostly interactively filled slides), computer lab exercises, practical audio exercises |
| Literature: | Roads C.: The computer music tutorial, MIT Press, Cambridge 1996<br>Owsinsky B: The Recording Engineer's Handbook 4th Edition (2017), ISBN-13: 978-0998503356<br>Katz B: Mastering Audio: The Art and the Science (2014), ISBN-13**:** 978-0240818962<br>Webers J: Tonstudiotechnik, Poing, Franzis-Verl., 2003 ISBN: 3-7723-5528-5<br>Burt G: The art of film music, Boston, Mass., Northeastern Univ. Press, 1994<br>http://www.sengpielaudio.com<br>www.electronic-musician.com<br>www.mixonline.com<br>www.keys.de<br>www.filmsound.org |

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| Module title: | Multimedia Production |
| Semester level: | 5th semester |
| Module coordinator: | Prof. Stefan Kim |
| Lecturer/s: | Prof. Stefan Kim |
| Language of instruction: | German |
| Level within curriculum: | BA in Computer Science, 5th semester, core elective module<br>BA in Applied Computer Science, 5th semester, core elective module |
| Teaching strategy / weekly hours: | Lectures: 2 hours weekly<br>Laboratory course: 2 hours weekly |
| Study hours: | 150 hrs. = 60 contact hrs. and 90 hrs. directed study |
| Credit points: | 5 |
| Prerequisites according to study regulations: | |
| Recommended prerequisites: | Successful participation in the modules media design, Introduction to audio and video |
| Learning outcomes / skills: | Students will be familiar with the process of integrating (multi) media into interactive applications and they are able to synchronize these types of media.<br>They understand current standards and media architectures.<br>They will be able to design screens and navigation for multimedia applications, taking criteria such as aesthetics, usability and ergonomics into account.<br>In the development steps from the conception over the design up to the technical realization the students can apply their competences in the teamwork and present their results to third parties. |
| Course content: | The course contents are taught in a thematic framework - the development of a computer game. In addition to technical skills, media-theoretical content is also the subject of the courses - for example:<br>- the history of computer games<br>- socio-cultural aspects of computer games<br>- different genres of computer games<br>- economic and organizational aspects of game production |

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| | - interactive storytelling, non-linear dramaturgy<br>- design aspects of game development (designing interfaces, characters and levels)<br>- Game engines<br>- C# programming in Unity<br>- lighting, shading, render pipelines<br>- animation and interaction in Unity<br>- terrain editing<br>- cross-plattform production, distribution (Desktop, Web, Mobile, AR/VR) |
| Mode of assessment: | - Documentary work with oral conversation<br>Semester-related work can be included in the assessment. |
| Types of media: | Lectures (digital presentation slides), computer exercises |
| Indicative reading: | Kent, Steven: The Ultimate History of Video Games, Three Rivers Press, 2001<br>Wolf, Marc: The Medium of the Video Game, Paperbackshop, 2002<br>Steinmetz, Ralph: Multimedia-Technologie: Grundlagen, Komponenten und Systeme, Springer, 2014<br>Lintrami, Tommaso: Unity 2017 Game Development Essentials, Packt Publishing 2018<br>Seifert, Carsten: Spiele entwickeln mit Unity 5: 2D- und 3D-Games mit Unity und C# für Desktop, Web & Mobile, Carl Hanser Verlag, Auflage: 3 (2017)<br>David Perry on Game Design, Course Technology, 2009<br>Pluralsight – Online Learning Platform |

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| Module Name: | Network security |
| Study Semester: | 4th or 5th semester |
| Module Coordinator: | Prof. Dr. Michael Pilgermann |
| Main Lecturer(s): | Prof. Dr. Michael Pilgermann |
| Teaching Language: | German; optional English |
| Level within Curriculum: | B.Sc. Informatik, 4th or 5th sem., core elective module<br>B.Sc. Applied Computer Science, 4th sem., core elective module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | Security fundamentals<br>Operating Systems / Computer Networks |
| Learning Outcome / Skills: | The students understand the relevance of attack scenarios on IP based communication networks. They can apply introduced tools in order to independently run security assessments.<br>The students can draft a solution for protecting against attacks within the LAN or from the Internet.<br>The students have a basic understanding about the technologies and methodologies for monitoring and detection of cyber attacks in IP based networks, in order to contribute to the establishment of a corresponding organizational unit (Security Operation Center). They can assess security incidents and can suggest reasonable reactions. |
| Course Content: | 1. MAC attacks and Port-Security<br>2. ARP attacks and VLANs<br>3. Attacks on TCP+UDP and in higher layers as well as countermeasures (ICMP, DHCP, DNS)<br>4. Port-based access control<br>5. Security of WLANs<br>6. Virtual Private Networks (VPN)<br>7. Packet filters und Firewalls |

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| | 8. Intrusion Detection Systems (IDS)<br>9. Monitoring, Security Information Event Management und Security Operations Center |
| Mode of Assessment: | Oral exam or written exam (settled at beginning of semester)<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with mixed media, computer / network lab exercises |
| Literature: | Claudia Eckert: IT-Sicherheit: Konzepte – Verfahren – Protokolle, 10. Aufl., De Gruyter, 2018.<br><br>James Kurose, Keith Ross, "Computernetzwerke", 6. Auflage, PearsonStudium, 2014<br><br>Matthias Hofherr: WLAN-Sicherheit: Professionelle Absicherung von 802.11-Netzen<br><br>Andreas Aurand: LAN-Sicherheit: Schwachstellen, Angriffe und Schutzmechanismen in lokalen Netzwerken - am Beispiel von Cisco Catalyst Switches<br><br>Eric Amberg, Daniel Schmid: Hacking – der umfassende Praxis-Guide (978-3-95845-218-3)<br><br>Arun E Thomas: Security Operations Center – Analyst Guide<br><br>Norbert Pohlmann: Cybersicherheit – Das Lehrbuch für Konzepte, Prinzipien, Mechanismen, Architekturen und Eigenschaften von Cybersicherheitssystemen in der Digitalisierung<br><br>Carson Zimmerman (Mitre): Ten Strategies of a World-Class Cybersecurity Operations Center, 2014[1] |

[1] https://www.mitre.org/sites/default/files/publications/pr-13-1028-mitre-10-strategies-cyber-ops-center.pdf

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| Module Name: | Software Quality |
| Study Semester: | 5th semester |
| Module Coordinator: | Prof. Dr. Gabriele Schmidt |
| Main Lecturer(s): | Prof. Dr. Gabriele Schmidt |
| Teaching Language: | German |
| Level within Curriculum: | B.Sc. Informatik, B.Sc. Medizininformatik,<br>B.Sc. Applied Computer Science:<br>4th semester, core elective module |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Exercise: 2 hours weekly per semester |
| Workload: | 150 hrs = 60 contact hrs and 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | Programming I-III<br>Software Engineering |
| Learning Outcome / Skills: | Students know the tasks of quality management.<br>Students can apply quality assurance measures with tool support.<br>Students can differentiate quality assurance measures, assess them with the help of metrics and build them in a project.<br>In teamwork, students develop their teamwork skills and acquire application analysis and initial synthesis skills. |
| Course Content: | Basics of software testing<br>Software quality management and test management<br>Software Quality Assurance<br>Constructive quality measures<br>configuration management<br>Build Process<br>Test Driven Design / Development (TDD)<br>Analytical quality measures<br>Review (inspection)<br>Unit and behavior-based testing<br>TDD |

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| | Integration Tests (Continuous Integration)<br>Metrics |
| Mode of Assessment: | Course examination or oral examination<br>Overall grade is the course examination grade or oral examination grade. Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with mixed media (blackboard and mostly interactively filled slides), computer based exercises in small groups |
| Literature: | German Testing Board: Basiswissen Softwaretest Certified Tester, http://www.german-testing-board.info/<br>Liggesmeyer P.: Software-Qualität, Testen, Analysieren und Verifizieren von Software, Spektrum-Verlag<br>Schneider K.: Abenteuer Software Qualität, Grundlagen und Verfahren für Qualitätssicherung und Qualitätsmanagement, 1. Auflage, dpunkt Verlag |

**An English module description is currently not available**

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| Modulbezeichnung: | Systementwurf |
| Studiensemester: | 5. Semester |
| Modulverantwortliche(r): | Prof. Dr. Gerald Kell |
| Dozent(in): | Prof. Dr. Gerald Kell |
| Sprache: | Deutsch |
| Zuordnung zum Curriculum | Ba Informatik, 5. Sem., Wahlpflichtmodul<br>Ba Applied Computer Science5. Sem., Wahlpflichtmodul |
| Lehrform/SWS: | Vorlesung: 2 SWS<br>Übungen: 2 SWS |
| Arbeitsaufwand: | 150 h = 60 h Präsenz- und 90 h Eigenstudium |
| Kreditpunkte: | 5 |
| Voraussetzungen nach Prüfungsordnung | |
| Empfohlene Voraussetzungen: | Grundkenntnisse in Digitaltechnik, Mikrocomputertechnik und Programmiertechniken |
| Angestrebte Lernergebnisse: | Die Studierenden kennen die wesentlichen Strategien und Vorgehensweisen beim Entwurf digitaler Systeme und sind in der Lage, auf verschiedenen Abstraktionsebenen zu agieren.<br>Sie beherrschen die spezifischen Methoden des strukturalen und des funktionalen Entwurfs und können geeignete Hardware-Plattformen sowie auch periphere Systemkomponenten auswählen und in der Hardwarebeschreibungssprache VHDL konfigurieren.<br>Sie beurteilen die Leistungsfähigkeiten verschiedener Hardware-Plattformen und sind in der Lage, Syntheseergebnisse bis auf der Systemebene zu entwickeln und Verhaltensanalysen durchzuführen. |
| Inhalt: | Arbeitsschritte und Methodik des Systementwurfs, Besonderheiten bei der Arbeit auf den unterschiedlichen Abstraktionsebenen, Übersicht über die gebräuchlichen Hardware-Plattformen und die jeweils damit verbundenen Arbeitswerkzeuge, Grundlagen der Hardware-Beschreibungssprache VHDL, Methoden zur Einbindung von Bibliothekselementen in digitale Systeme. |
| Studien-/Prüfungsleistungen: | - Klausur<br>Semesterbegleitende Leistungen können in die |

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| | Bewertung einbezogen werden. |
| Medienformen: | Lehrmaterialien, Aufgaben und Vorlesungsmanuskripte in elektronischer Form, Laborpraktika und Übungen am Computer |
| Literatur: | Hertwig A., Brück R.: Entwurf digitaler Systeme, Hanser Verlag 2000 ISBN 3-446<br>Siroka A., Drechsler R.: Software-Engineering und Hardware-Design, Hanser Verlag 2002, ISBN 3-446-21861-0<br>Reichardt J., Schwarz B.: VHDL-Synthese, Oldenbourg 2000, ISBN 3-486-25128-7<br>Siemers C.: Hardware-Modellierung, Hanser Verlag 2001 ISBN 3-446-21361-9<br>Kemnitz G.: Technische Informatik, ISBN 978-3-642-17446-9, Springer Verlag 2011 |

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| Module Name: | Business Administration |
| Study Semester: | 5th semester |
| Module Coordinator: | Prof. Dr. Jürgen Schwill |
| Lecturer(s): | Prof. Dr. Jürgen Schwill |
| Teaching Language: | German |
| Level within Curriculum | B.Sc. Applied Computer Science, B.Sc. Informatik, B.Sc. Medizininformatik, 5th sem., Module in General Studies |
| Teaching Methods: | Lecture: 2 hours weekly per semester<br>Seminar: 2 hours weekly per semester |
| Workload: | 150 h = 60 contact hrs + 90 hrs directed self-study |
| Credit Points: | 5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | |
| Learning Outcome / Skills: | Students acquire basic knowledge of central decision-making fields of business administration.<br>They can make and evaluate basic business decisions. |
| Course Content: | • Subject matter of business administration (20 %)<br>- Business administration as a science<br>- Basic concepts of business administration<br>- Assets<br>- Principle of economic efficiency<br>- Parameters of economic activity<br>- Company production factors<br>• Guidelines, principles and objectives in companies (15 %)<br>- Guidelines and principles<br>- Business objectives and target content<br>- Target systems and target relationships<br>- Target educational processes<br>• Constitutive decision fields (30 %)<br>- Business field determination and evaluation<br>- Legal form alternatives<br>- Location factors and methods |

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| | - Business combinations+<br>• Business management and organisation (20 %)<br>- Management tasks<br>- Organisational Structure<br>- Process Organisation<br>• Functional areas of company performance process (15 %)<br>- Supply-Management<br>- Production Management<br>- Marketing<br>- Human Resources<br>- Finance and Investment<br>- Information Technology und Accounting |
| Mode of Assessment: | Written exam<br>Points gained during the semester can be included in the final assessment |
| Teaching Media: | projector, flip chart, overhead projector, blackboard |
| Literature: | Balderjahn, I.; Specht, G.: Einführung in die Betriebswirtschaftslehre, 6. Aufl., Stuttgart 2011<br>Hutschenreuter, T.: Allgemeine Betriebswirtschafts-lehre. Grundlagen mit zahlreichen Praxisbeispielen, 6. Aufl., Wiesbaden 2015<br>Jung, H.: Allgemeine Betriebswirtschaftslehre, 13. Aufl., Berlin, Boston 2016<br>Olfert, K.; Rahn, H.-J.: Einführung in die Betriebswirtschaftslehre, 11. Aufl., Herne 2016<br>Paul, J.: Praxisorientierte Einführung in die Allgemeine Betriebswirtschaftslehre. Mit Beispielen und Fallstudien, 3. Aufl., Wiesbaden 2015<br>Thommen, J-P.; Achleitner, A.-K.; Gilbert, D. U.; Hachmeister, D.; Kaiser, G.: Allgemeine Betriebswirtschaftslehre. Umfassende Einführung aus managementorientierter Sicht, 8. Aufl., Wiesbaden 2017<br>Vahs, D.; Schäfer-Kunz, J.: Einführung in die Betriebswirtschaftslehre, 7. Aufl., Stuttgart 2015<br>Wöhe, G.; Döring U.; Brösel, G.: Einführung in die Allgemeine Betriebswirtschaftslehre, 26. Aufl., München 2016 |

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| Module Name: | Computer Science and Society |
| Study Semester: | 5th semester |
| Module Coordinator: | Prof. Dr. Thomas Schrader |
| Main Lecturer(s): | Prof. Dr. Thomas Schrader |
| Teaching Language: | German |
| Level within Curriculum | B.Sc. Applied Computer Science, B.Sc. Informatik, B.Sc. Medizininformatik, 5th sem., General Studies |
| Teaching Methods: | Lecture: 1 hour weekly per semester<br>Seminar: 1 hour weekly per semester |
| Workload: | 75 hrs = 30 contact hrs + 45 hrs directed self-study |
| Credit Points: | 2,5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | |
| Learning Outcome / Skills: | Students understand the impact, opportunities and risks of information technology on our society through individual topics from different areas of society.<br>The learning objective of this lecture can be best described with the words of Margaret Miller:<br>They begin to see that the impact of technology on society is more complex than they had previously realized. (Miller, p. 5).<br>The students can describe, analyse and assess the challenges of using modern information technologies in modern industrial society in a differentiated way, using concrete examples. |
| Course Content: | Introduction to the topic<br>Processing of the effects of information technology based on specific topics from different fields, such as medicine, industry, science, military, cybercrime, e-learning, e-commerce, e-voting, etc.<br>Students receive a list of topics from which they can choose, but they also have the possibility to propose their own topics. |
| Mode of Assessment: | Term paper and oral discussion<br>Additional assessments during the semester may be included in the final grading. |

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| Teaching Media: | Lecture with mixed media (mostly blackboard, slides, projectors), work in small groups alone and with the lecturer, presentation of the group results in a plenary sitting with mixed media (mainly blackboard, slides, projectors) |
| Literature: | Weizenbaum J.: Computermacht und Gesellschaft, surkamp taschenbuch wissenschaft 2001<br>Weizenbaum J.: Wo sind sie, die Inseln der Vernunft im Cyberstrom, Herder Verlag, 2006<br>Orwell G.: 1984, Ullstein Verlag, 1976<br>Clarke R. A., Knake R. K.: Word Wide War – Angriff aus dem Internet, Hoffman und Campe, 2011<br>Domscheit-Berg D.: inside WikiLeaks, Meine Zeit bei der gefährlichsten Website der Welt, Econ Verlag, 2011<br>Dunlop C., Kling, R.: Computerization and Controversy, Academic Press 1996<br>Huff C., Finholt T.: Social Issues in Computing, McGraw Hill 1994<br>Keil-Slawik: Von Informatik und Gesellschaft zum Kontext der Informatik. FIFF-Kommunikation 4/2001<br>THE RISKS DIGEST. Forum On Risks To The Public In Computers And Related Systems. moderated by Neumann, Peter G. www.risks.org<br>Neumann P. G. Computer Related Risks.<br>ACM Press / Addison Wesley 1995<br>Miller M.: Computers, Technology and Society: Special Projects to Enhance the Curriculum. Computers & Society, Vol. 23, No. 3-4 – December 1993, p. 4-9<br>http://www.computingcases.org/ |

**An English module description is currently not available**

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| Modulbezeichnung: | Fun-Preneurship |
| Studiensemester: | 5. Semester |
| Modulverantwortliche(r): | Prof. Dr. Eberhard Beck |
| Dozent(in): | Prof. Dr. Eberhard Beck , Prof. Dr. Thomas Schrader |
| Sprache: | Deutsch/Englisch |
| Zuordnung zum Curriculum | Ba Informatik, Ba Applied Computer Science, Ba Medizininformatik, 5. Sem., Modul im Studium Generale |
| Lehrform/SWS: | Vorlesung: 1 SWS<br>Seminar: 1 SWS |
| Arbeitsaufwand: | 75 h = 30 h Präsenz- und 45 h Eigenstudium |
| Kreditpunkte: | 2,5 |
| Voraussetzungen nach Prüfungsordnung | |
| Empfohlene Voraussetzungen: | |
| Angestrebte Lernergebnisse: | Die Studierenden kennen verschiedene Kreativtechniken und können diese für die Entwicklung einer Geschäftsidee anwenden<br>Die Studierenden sind in der Lage eine Geschäftsidee interdisziplinär bis hin zu einem marktfähigen Produkt/einer Dienstleistung zu entwickeln<br>Alle Teammitglieder erhalten ein vertieftes Verständnis über die Bereiche Produktion, Vertrieb, Finanzierung, etc. eines Unternehmens/Startups. |
| Inhalt: | Der Wettbewerb Fun-Preneurship wird für alle Fachbereiche der THB als offene, neue Lehrform im Rahmen des Studium generale verstanden. Auch Studierenden der Medizinischen Hochschule können an dem Modul teilnehmen und Ihre Kompetenzen mit einbringen.<br>Er wird durch die Wirtschaftsförderung Brandenburg (WFBB) unterstützt.<br>Mit dem Modul sollen das interdisziplinäre Arbeiten der Studierenden in Gruppen, die Projektentwicklung von der ersten gemeinsamen Idee bis zur ersten Umsetzung gestärkt werden sowie eine Unterstützung für künftige Gründungsvorhaben geschaffen werden.<br>• Interdisziplinäre Entwicklung von |

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| | Geschäftsideen in gemischten Teams<br>• Vermittlung und Anwendung von Grundkenntnissen auf den verschiedenen fachlichen Gebieten: Projektmanagement, Marketing, Vertrieb und Recht<br>• Gründung eines „Unternehmens auf Zeit“<br>• Mit einem festgelegten Startkapital bringen die Studierenden ihr Produkt oder ihre Dienstleistung in einem Zeitraum ca. 5 Wochen auf den Markt<br>Die Ergebnisse der Projektarbeit werden auf einer Abschlussveranstaltung vor Publikum vorgestellt. Die Bewertung erfolgt durch eine Jury.<br><br>Zukünftig ist es geplant, Sponsoren für Preisgelder zu gewinnen. |
| Studien-<br>/Prüfungsleistungen: | Projektarbeit, Abgabe mit mündlichem Prüfungsgespräch |
| Medienformen: | Seminar mit gemischten Medien |
| Literatur: | Plötz F. Das 4 Stunden-Startup: Wie Sie Ihre Träume verwirklichen ohne zu kündigen. Econ Verlag, 2016<br>Thönnessen F. Arbeitsbuch Start-up: Das 7 Stufen Programm. Redline Verlag, 2016<br>Lewrick M, Link P, Leifer L, Langensand N. Das Design Thinking Playbook: Mit traditionellen, aktuellen und zukünftigen Erfolgsfaktoren. Franz Vahlen Verlag, 2018 |

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| Module Name: | Media Law |
| Study Semester: | 5th semester |
| Module Coordinator: | Prof. Dr. Michaela Schröter |
| Main Lecturer(s) | Prof. Dr. Michaela Schröter<br>Dipl. BWL (FH) Dipl. Inf. (FH) Mario Tönse |
| Teaching Language: | German |
| Level within Curriculum | B.Sc. Applied Computer Science, B.Sc. Informatik, B.Sc. Medizininformatik, 5th Sem., General Studies |
| Teaching Methods: | Lecture: 2 hours weekly per semester |
| Workload: | 75hrs = 30 contact hrs and 45 hrs directed self-study |
| Credit Points: | 2,5 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | |
| Learning Outcome / Skills: | Students know and understand the legal foundations of media law.<br>They can comply with the legal requirements of press law, copyright law, trademark and competition law, in particular from a service providers and internet users point of view.<br>The students know and can apply the legal requirements of communication in the context of remote communication. |
| Course Content: | - Mastering the basic regulations of tele-media, broadcasting and press law<br>-Applicable knowledge in the area of copyright, trademark and competition law<br>-Compliance assessment with mandatory legal provisions in the field of tele-media services as well as criminal and civil law consequences |
| Mode of Assessment: | Term paper and oral discussion<br>Additional assessments during the semester may be included in the final grading. |
| Teaching Media: | Lecture with other teaching media (mostly blackboard, slides, projectors) |
| Literature: | Haug: Internetrecht, Verlag W. Kohlhammer |

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| | 2010<br>Gruber: Gewerblicher Rechtschutz und Urheberrecht, niederle media 2010<br>Wandtke, Bullinger, von Welser: Fallsammlung zum Urheber- und Medienrecht, Verlag C. H. Beck München 2010<br>Fechner: Entscheidungen zum Medienrecht, Mohr Siebeck Tübingen 2010<br>Current references shall be made known at the beginning of the module. |

**An English module description is currently not available**

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| Modulbezeichnung: | Medizin-Recht |
| Studiensemester: | 5. Semester |
| Modulverantwortliche(r): | Prof. Dr. Michaela Schröter |
| Dozent(in): | Prof. Dr. Michaela Schröter, Facharzt für Allgemeinmedizin Jens A. Drews |
| Sprache: | Deutsch |
| Zuordnung zum Curriculum | Ba Informatik, Ba Applied Computer Science, Ba Medizininformatik, 5. Sem., Modul im Studium Generale |
| Lehrform/SWS: | Vorlesung: 1 SWS, Seminar: 1 SWS |
| Arbeitsaufwand: | 75 h= 30 h Präsenz- und 45 h Eigenstudium |
| Kreditpunkte: | 2,5 |
| Voraussetzungen nach Prüfungsordnung | |
| Empfohlene Voraussetzungen: | |
| Angestrebte Lernergebnisse: | Die Studierenden haben generalistische Kenntnisse zum Medizinrecht.<br>Sie haben ein rechtliches Verständnis der organisatorischen und vertraglichen Vorgänge im medizinischen Bereich erworben.<br>Die Studierenden haben eine präventive Kompetenz zur Vermeidung bzw. Minderung der Haftungsrisiken und deren Rechtsfolgen entwickelt. |
| Inhalt: | -Einführung in medizinische Unternehmensformen, auch unter arbeitsrechtlichen Aspekten<br>-Vermittlung von Inhalten bzw. Differenzierungen von Behandlungsverträgen, Krankenhaus- und Krankenversicherungsverträgen<br>-Kenntnisse zu Voraussetzungen und Rechtsfolgen der Arzthaftung, den Aufklärungspflichten, Datenschutz, Beweislage und Schweigepflicht |
| Studien-/Prüfungsleistungen: | - mündliche Prüfung<br>Semesterbegleitende Leistungen können in die Bewertung einbezogen werden. |
| Medienformen: | Vorlesung mit gemischten Medien (überwiegend Tafel, Folien, Beamer) |
| Literatur: | Hrsg. Terbille, Clausen, Schröder-Prinzen: Münchner AnwaltsHandbuch Medizinrecht, Verlag C. H. Beck München 2009 |

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| | Bock: Recht für Krankenhaus und Arztpraxis, Medizinisch Wissenschaftliche Verlagsgesellschaft mbH Co. KG, Berlin 2009<br>Die Bekanntgabe der jeweils aktuellen Literatur erfolgt zu Beginn der Durchführung des Moduls. |

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| Module Name: | Work Placement and Work Placement Seminar |
| Study Semester: | 6th semester |
| Module Coordinator: | Prof. Dr. Sven Buchholz |
| Main Lecturer(s): | All Faculty members |
| Teaching Language: | German<br>optionally English for Applied Computer Science |
| Level within Curriculum: | B.Sc. Informatik, 6th sem., mandatory module<br>B.Sc. Applied Computer Science, 6th sem., mandatory module |
| Teaching Methods: | Seminar: 2 hours weekly per semester |
| Workload: | 450 hrs = 30 contact hrs and 420 hrs directed self-study (practical project) |
| Credit Points: | 3 (Work Placement Seminar) + 12 (Work Placement) = 15 |
| Prerequisites according to Study and Exam Regulations: | At least 120 CP are needed in order to start the practical project. |
| Recommended Prerequisites: | Students can transfer their acquired knowledge to problems on an operational level in a practical working context. Also, they can gain subject-specific insights from such a context. With their good command of practical working methods, they are able to tap tasks of their future occupational field. By virtue of the Work Placement Seminar the students are able to communicate results from their practical work to the specialised public. They know how to communicate the results on different levels of abstraction and in different forms to their peers and to the faculty. |
| Learning Outcome / Skills: | Training on different tasks, independent participation on operational projects, soft skills, presentational skills |
| Course Content: | Oral presentation |
| Mode of Assessment: | oral presentation, report, fulfillment of ompulsory attendance |
| Teaching Media: | Oral Presentation |
| Literature: | Material to guide the students in all aspects of the Work Placement are provided electronically on the department server (updated at the beginning of each semester). |

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| Module Name: | Bachelor Seminar |
| Study Semester: | 6th semester |
| Module Coordinator: | Prof. Dr. Harald Loose |
| Main Lecturer(s): | Prof. Dr. Harald Loose |
| Teaching Language: | German<br>optionally English for Applied Computer Science |
| Level within Curriculum: | B.Sc. Informatik, B.Sc. Applied Computer Science, B.Sc. Medizininformatik, 6th sem., mandatory module |
| Teaching Methods: | Seminar |
| Workload: | 90 hrs = 20 contact hrs and 70 hrs directed self-study |
| Credit Points: | 3 |
| Prerequisites according to Study and Exam Regulations: | |
| Recommended Prerequisites: | |
| Learning Outcome / Skills: | Students know, how to write a scientific work (thesis)<br>They are able to introduce the topic of their thesis in a short presentation.<br>They are able to summarize their scientific results in form of a poster. |
| Course Content: | • Mentoring of student work on the bachelor thesis.<br>• Introduction to scientific writing<br>• Presentation and discussion of the topics of the theses<br>Preparation of a poster summarizing the bachelor thesis. |
| Mode of Assessment: | - Poster<br>Additional assessments during the semester may be included in the final grading (attendance, presentation).<br><br>The seminar starts during the 5th semester and terminates with the bachelor colloquium (poster). |

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| Teaching Media: | Seminar with mixed media (mostly interactively filled slides), computer lab exercises |
| Literature: | • Bänsch, Axel: Wissenschaftliches Arbeiten, 4.verb. Aufl. München – Wien, 1999<br>• Eco, Umberto: Wie man eine wissenschaftliche Abschlussarbeit schreibt. 8. Auflage. Heidelberg 2000<br>• Werder, Lutz von: Grundkurs des wissenschaftlichen Schreibens, Berlin, 1995<br>• Specialized literature |

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| Module Name: | Bachelor Thesis |
| Study Semester: | 6th semester |
| Module Coordinator: | Dean of Studies at the Department of Computer Science and Media |
| Main Lecturer(s): | All teaching staff at the Department of Computer Science and Media |
| Teaching Language: | German or English or in other languages upon approval |
| Level within Curriculum | B.Sc. Applied Computer Science, 6th sem., mandatory module<br>B.Sc. Informatik, 6th sem., mandatory module<br>B.Sc. Medizininformatik, 6th sem., mandatory module |
| Teaching Methods: | |
| Workload: | 360hrs self-study |
| Credit Points: | 12 |
| Prerequisites according to Study and Exam Regulations: | Students can receive a topic for their Bachelor thesis if and only if all examinations, course requirements and work placement have been successfully completed according to the prescribed plan of study for the degree programme by the end of the 5th semester. |
| Recommended Prerequisites: | |
| Learning Outcome / Skills: | The students are able to work independently on a typical professional problem with the help of scientific, possibly artistic-creative methods or practical skills.<br>Students are able to scientifically illustrate and present the topic, solution process and results of their work.<br>Students can apply acquired rhetorical skills. |
| Couse Content: | • Broad interrelated study and the resulting solution to a practical or theoretical problem<br>• Presentation of the topic, solution process, as well as the results in a thesis written in a scientific style.<br>• Presentation and discussion during colloquium. |
| Mode of Assessment: | - Final thesis and colloquium |
| Teaching Media: | |

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| Literature: | Bänsch A.: Wissenschaftliches Arbeiten, 4.verb. Aufl. München – Wien, 1999<br>Eco U.: Wie man eine wissenschaftliche Abschlussarbeit schreibt. 8. Auflage. Heidelberg 2000<br>Werder L. von: Grundkurs des wissenschaftlichen Schreibens, Berlin, 1995<br>Fachliteratur (Themen bezogen) |