

Hochschule Ulm



Module Description

Computer Science
Bachelor of Sciences (B.Sc.)

Hochschule Ulm
Ulm University of Applied Sciences

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Semester 1

Calculus 1

1. Content

- Basics: sets, logic, totals and methods of proof
- Elementary functions: rational functions, trigonometric functions, exponential function, hyperbolic functions (and their inverse functions)
- Limits of sequences of numbers and functions
- Continuity of functions
- Differential calculus: derivation rules, higher derivatives, rule of Bernoulli l'Hospital, extreme value problems
- Basic methods of integration for determining primitives

2. Learning Outcomes

On completing the module successfully, the students will be able to:

Professional Competence

- use functions in order to describe and analyse mathematical relationships
- work on application problems using methods of differential and integral calculus

Methodological Competence

- argue logically confidently
- comprehend abstract tasks and break them down into individual tasks
- develop mathematical models for simple application problems

Social and Self-competence

- collaborate with other students in small groups so as to find solutions for abstract and practical tasks
- assess their own skills in analysing problems and in devising solutions

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: 90 min, Examination

Exam qualifications: Other

5. Literature

Peter Hartmann. Mathematik für Informatiker. Springer Vieweg, 2015. ISBN 978-3834800961

Thomas Westermann. Mathematik für Ingenieure. Springer, 2011

Lothar Papula. Mathematik für Ingenieure und Naturwissenschaftler, Ausgabe 1 Springer Vieweg, 2014

Programming 1

1. Content

- Basics (programming paradigms, runtime environment, von Neumann architecture, number representations, algorithms, complexity of algorithms, grammar)
- Procedural programming (elementary data types, arithmetic expressions, control structures, single and multi-dimensional arrays, strings, static methods)
- Object-oriented programming (classes and objects, data abstraction, inheritance, polymorphism)
- Basic algorithms and data structures (conversion between different representations of numbers, simple sorting algorithms, recursive algorithms, stack)
- Modelling (designing simple object structures, UML class diagram)

2. Learning Outcomes

On completing the module successfully, the students will be able to:

Professional Competence

- describe basic algorithms and data structures
- create simple algorithms
- design small class structures and represent them as UML class diagram
- implement limited programming tasks in an object-oriented language
- use a current IDE to develop the program meaningfully

Methodological Competence

- apply systematic approaches to software development
- analyse problems and evaluate alternative solutions comparatively

Social and Self-competence

- discuss work results with fellow students and tutors
- compile the work results in a small team

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: 90 min, Examination

Exam qualifications: Lab Work

5. Literature

Guido Krüger, Heiko Hansen. Handbuch der Java-Programmierung. Addison-Wesley, 2011. ISBN 978-3868940312

Christian Ullenboom. Java ist auch eine Insel. Galileo Computing, 2009. ISBN 978-3836213714

Introduction to Computer Science

1. Content

- Introduction (What is computer science? - Core subjects of computer science: data, algorithms, computers)
- Representation of data, number representation, Computer Arithmetic
- Design and functioning of a computer (computer organization, processor, memory system, I/O devices and their programming interfaces)
- Data processing in computer systems (abstraction layers and interfaces of a computer system, virtual machines, principle of interpretation and translation)
- Basics of programming (software development process; Algorithm: definition and forms of representation; the path from the algorithm to the program)
- Construction and handling of Operating Systems (OS architectures and functions, user interfaces, handling file systems)

2. Learning Outcomes

On completion of the module, the students will be able to:

Professional Competence

- understand encoding of information and computer internal representation of data and figures
- explain the basic structure and the functionality of a computer system
- describe the data processing in computer systems over various abstraction layers
- understand the basic principles of programming
- explain the functions of an Operating System and to handle their user interfaces

Methodological Competence

- apply the acquired knowledge based on practical tasks and to develop their own solutions
- analyse problems systematically and to evaluate alternative solutions

Social and Self-competence

- participate actively in small groups and jointly develop solutions

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: 90 min, Examination

Exam qualifications: Lab Work

5. Literature

Gesellschaft für Informatik e.V. (GI). Was ist Informatik?. Unser Positionspapier, Bonn, 2006

Heinz-Peter Gumm und Manfred Sommer. Einführung in die Informatik. Oldenbourg, 2010. ISBN 978-3486587241.

Helmut Herold, Bruno Lurz, Jürgen Wohlrab. Grundlagen der Informatik. Pearson, 2007. ISBN 978-3827373052

Technical Foundations of Computer Science

1. Content

- Fundamentals of Electrical Engineering (current, voltage, resistance, energy, power, time-related course of currents and voltages, sources of current and voltage, simple resistor networks)
- Simple electronic components (capacitor, coil, diode, transistor)
- Basic digital circuits (Open Collector, tri-state, etc.)
- Boolean algebra
- Combinatorial circuits (description of logical problems, derivation of switching function)
- Standard switching networks (comparator, coder, code converters, multiplexers, arithmetic circuits)
- Flip-flops (FF base, clock state control, clock edge control, other FF)
- Switchgears (registers, ring counters, counting circuits, finite state machines)

2. Learning Outcomes

On completion of the module, the students will be able to:

Professional Competence

- describe and understand the functioning of simple electronic components
- analyse simple electronic circuits
- understand and use simple metrological circuits
- understand the basic principles of classical digital technology
- design and build combinatorial basic circuits and operate them
- design and build sequential basic circuits and operate them

Methodological Competence

- apply and discuss about the technical know-how through practical tasks and develop their own solutions
- analyse problems and evaluate alternative solutions comparatively

Social and Self-competence

- discuss work results with fellow students and tutors
- compile the work results in a small team

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: 90 min, Examination

Exam qualifications: Lab Work

5. Literature

Fricke K.. Digitaltechnik., 2009. ISBN 978-3834804594

Lipp, H. M. Grundlagen der Digitaltechnik., 2007. ISBN 978-3486582741

Wirth, N. Digital Circuit Design., 1995. ISBN 3-540-58577-X

Führer, Nerreter, Heidemann. Grundgebiete der Elektrotechnik Band., Ausgabe 1, 2006. ISBN 978-3446190672

Führer, Nerreter, Heidemann. Grundgebiete der Elektrotechnik Band., Ausgabe 2, 2007. ISBN 978-3446190689

Paul. Elektrotechnik für Informatiker., 2004. ISBN 978-3519003601

Introductory Project

1. Content

In a project, the content of which is related to computer science, students are guided in small groups through the processing of manageable problems and tasks to self-reliant study, working in teams and to scientific working methods. This is supported by accompanying workshops on the topics, such as:

- University organization and student participation
- Study organization and time management
- Reference work researching and information retrieval
- Publish and Present
- Learning and working techniques
- Techniques of preparing for the examination

2. Learning Outcomes

On completion of the module, the students will be able to:

Methodological Competence

- apply methods of self-reliant study and scientific work approach
- apply learning strategies and techniques and strategies for preparing for the examination

Social and Self-competence

- argue in small groups based on facts and objectives
- assume their own role in small groups
- adapt early enough to the challenges of studying and later professional life

3. ECTS

5 ECTS-Credits

4. Assessments

Exam qualifications: Other

5. Literature

Semester 2

Programming 2

1. Content

- Concepts for handling exceptions
- Standard containers (lists, search trees, hash tables) and their usage
- Generic programming with type parameters
- Creation of graphical user interfaces
- Concurrent programming with Threads
- Handling streams and serialization

2. Learning Outcomes

On completing the module successfully, the students will be able to:

Professional Competence

- understand and apply advanced concepts of modern programming languages
- understand simple recursive data structures and use them meaningfully
- design and implement simple user interfaces
- use Threads for concurrent programming

Methodological Competence

- apply systematic approaches to software development
- analyse problems and evaluate alternative solutions comparatively

Social and Self-competence

- discuss work results with fellow students and tutors
- compile the work results in a small team

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: 90 min, Examination

Exam qualifications: Lab Work

5. Literature

Guido Krüger, Heiko Hansen. Handbuch der Java-Programmierung, Standard Edition Version 7. Addison-Wesley, 2011

Reinhard Schiedermeier. Programmieren mit Java. Pearson Studium., 2010. ISBN 978-3868940312

Christian Ullenboom. Java ist auch eine Insel. Galileo Computing, 2009. ISBN 978-3836213714

Kathy Sierra, Bert Bates, Lars Schulten, Elke Buchholz. Java von Kopf bis Fuß. O'Reilly, 2006

Computer Networks

1. Content

- Physical principles and limitations of the data transmission
- Concepts of media access, error detection and error handling
- Local Network Technologies for Ethernet and Wi-Fi
- Concepts of routing and of reliable data transport
- Network and transport protocols using the example of the Internet Protocol Suite
- Planning, configuration and administration of computer networks
- Inter-process communication using the example of socket programming
- Introduction to Programming Distributed Applications

2. Learning Outcomes

On completing the module successfully, the students will be able to:

Professional Competence

- describe the architectural approaches of common network technologies
- explain and classify basic communication protocols
- describe the functioning of network components and their interaction

Methodological Competence

- apply the acquired knowledge to implement heterogeneous communication networks
- assess the suitability of network technologies for a given application scenario and develop their own solutions

Social and Self-competence

- handle tasks by collaborate in practice mode in small groups

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: 90 min, Examination

Exam qualifications: Lab Work

5. Literature

Kurose, J.F.; Ross, K.W.. Computer Networks. Addison Wesley, 4 2009. ISBN 978-0136079675

Tanenbaum, A.. Computernetzwerke. Pearson Studium, 7 2003. ISBN 978-3827370464

Karl, H.; Willig, A.: Protocols and Architectures for Wireless Sensor Networks. John Wiley & Sons, 8 2007. ISBN 978-0470519233

Badach, A.; Hoffmann, E. Technik der IP-Netze. Hanser Fachbuch,, 9 2007. ISBN 978-3446219359

Theoretical Computer Science

1. Content

- Basic concepts of graph theory
- Formal Languages
- Deterministic and non-deterministic finite automata
- Regular expressions and regular languages
- Context-free grammars
- Pushdown automata
- Efficient top-down parsing
- Predictability, Church's thesis
- Undecidable problems
- Introduction to Predicate Logic

2. Learning Outcomes

On completing the module successfully, the students will be able to:

Professional Competence

- explain basic concepts from the graph theory, logic, formal languages, automata theory and the computability theory
- explain and apply important descriptive, analytical and proof methods from the field of formal languages
- explain important characteristics of different language and automata classes
- identify fundamental limitations on the computability and decidability

Methodological Competence

- identify typical class of problems in application problems and formalize the description of methods handled so as to lead them to a systematic solution
- prove the characteristics of the systems described on the basis of formal descriptions

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: 90 min, Examination

Exam qualifications: Paper

5. Literature

Socher. Theoretische Grundlagen der Informatik. Hanser Verlag, 2007. ISBN 978-3446412606

Hoffmann. Theoretische Informatik. Hanser Verlag, 2009. ISBN 978-3446415119

Hopcroft, Motwani, Ullman. Einführung in die Automatentheorie, Formale Sprachen und Komplexitätstheorie. Addison- Wesley, 2002. ISBN 978-3827370204

Sipser. Introduction to the Theory of Computation. Thomson, 2005. ISBN 978-0619217648

Tittmann. Graphentheorie. Fachbuchverlag, Leipzig, 2003. ISBN 978-3446223431

Aho, Lam, Sethi, Ullman. Compiler. Pearson Studium, 2008. ISBN 978-3827370976

Microcomputer Technology

1. Content

- Programming model of a microprocessor
- Case study: instruction set of a modern RISC microprocessor
- Interrupts (vector-interrupt-controller)
- I/O units and operation modes (polling, interrupts, DMA)
- System bus and address mapping
- Memory technologies (SRAM, DRAM, SDRAM, ROM)
- Memory hierarchy (main memory, caches, virtual memory)

2. Learning Outcomes

On completing the module successfully, the students will be able to:

Professional Competence

- term and describe the components of the programming model of a modern microprocessor
- explain and classify most important I/O operation modes (polling, interrupt, DMA)
- select a suitable operation mode for dedicated I/O units
- specify the components together with their pros and cons of computer's memory hierarchy

Methodological Competence

- read the technical documentation of a computer system in order to develop system software for that computer
- develop software for basic I/O devices in assembly language

Social and Self-competence

- handle tasks by collaborate in practice mode in small groups

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: 90 min, Examination

Exam qualifications: Lab Work

5. Literature

Altera Corporation. DE1-SoC Computer System with ARM Cortex-A9

David A. Patterson, John L. Hennessy. Computer Organization & Design - The Hardware/Software Interface. Morgan Kaufmann, 2014

Altera Corporation. Tutorial: Introduction to the Altera Nios II Soft Processor

Linear Algebra

1. Content

- Vector and matrix algebra
- Systems of linear equations
- Linear mappings and their applications
- Eigenvalues and eigenvectors with applications
- Vector spaces and number fields (complex numbers)
- Iterative methods for solving systems of linear equations

2. Learning Outcomes

On completing the module successfully, the students will be able to:

Professional Competence:

- compute with vectors and matrices and perform application tasks
- represent and analyse systems of linear equations and linear transformations using matrices
- understand the structure of a vector space and transfer them to various mathematical objects
- perform calculations with complex numbers

Methodological Competence:

- apply the knowledge based on practical tasks and develop their own solutions
- understand the benefits of abstract structures for reusability of detected relationships

Social and Self-competence:

- support each other while solving tasks in study groups and in the context of self-learning units
- assess their own skills in analysing problems and in devising solutions

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: 90 min, Examination

Exam qualifications: Paper

5. Literature

Peter Hartmann. Mathematik für Informatiker. Springer Vieweg, 2015

Thomas Westermann. Mathematik für Ingenieure: Ein anwendungsorientiertes Lehrbuch. Springer Verlag, 2011

Lothar Papula. Mathematik für Ingenieure und Naturwissenschaftler., Ausgabe 1 Springer Vieweg, 2014

Semester 3

Calculus 2

1. Content

- Function series (Taylor series, Fourier series, DFT and FFT)
- Applications of integral calculus, including simple differential equations of 1st order
- Numerical integration methods (Simpson, Runge-Kutta)
- Numerical iteration methods for (Lmpson, Runge-Kutta) differential equations of the 1st order
- Multidimensional analysis (partial derivatives, optimization, error propagation)

2. Learning Outcomes

On completing the module successfully, the students will be able to:

Professional Competence

- represent functions by Taylor or Fourier series
- set up and solve simple differential equations as a model of a dynamic system
- apply numerical methods and to interpret the results
- calculate extrema of functions of several variables with and without constraints
- linearize nonlinear relations using the total differential

Methodological Competence

- comprehend more complex tasks, break them down into individual steps and solve the problem through the acquired numeracy
- solve numerical problems in MATLAB

Social and Self-competence

- mutually support in solving problems and in the context of self-learning units
- assess their own skills in analysing problems and in devising solutions

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: 90 min, Examination

Exam qualifications: Paper

5. Literature

Peter Hartmann. Mathematik für Informatiker. Springer Vieweg, 2015

Thomas Westermann. Mathematik für Ingenieure. Springer, 2011

Lothar Papula. Mathematik für Ingenieure und Naturwissenschaftler., Ausgabe 1 Springer Vieweg, 2014

Lothar Papula. Mathematik für Ingenieure und Naturwissenschaftler., Ausgabe 2 Springer Vieweg, 2014

Programming 3

1. Content

- Differences between Java and C++
- C++ concepts of object-oriented programming (classes, objects, inheritance, polymorphism)
- Storage Management
- Multiple inheritance, operator overloading, Friend-concept, exception handling, I/O
- Error analysis of programs
- Generic Programming and Introduction to C++ - standard library

2. Learning Outcomes

On completing the module successfully, the students will be able to:

Professional Competence

- create object-oriented programs using the language resources of C++
- use the C++ programming concepts
- handle templates and use the elements of the STL

Methodological Competence

- independently develop efficient, robust application programs
- assess as to which programming technique is useful for employing it in a particular context.

Social and Self-competence

- develop a software solution in a small group

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: 90 min, Examination

Exam qualifications: Lab Work

5. Literature

P. Prinz, U. Kirch-Prinz. C++ Lernen und professionell anwenden. mitp-Verlag, Bonn, 2002. ISBN 3-8266-0824-0

J. Wolf. C++ von A bis Z. Galileo Press, Bonn, 2006. ISBN 3-89842-816-8

U. Breymann. C++ - Einführung und professionelle Programmierung. Hanser, 2007

B. Stroustrup. Die C++ Programmiersprache. Addison Wesley, 1998. ISBN 0-201-88954-4

S. Meyers. Effektiv C++ Programmieren. Addison Wesley, 1998. ISBN 3-8273-1305-8

S. Kuhlins, M. Schader. Die C++ Standardbibliothek. Springer Verlag, 2002. ISBN 3-540-43212-4

Algorithms and Data Structures

1. Content

- Analysis of algorithms: correctness, termination, runtime analysis, asymptotic notation, amortized analysis
- Efficient sorting: efficient comparison-based method (Heap sort, Merge sort, Quick sort), lower threshold for comparison-based sorting, non comparison based sorting methods (Bucket sort, Radix sort)
- Simple data structures: abstract data types, Stack, Queue, Priority Queue
- Hash algorithm: hash functions, collision resolution with concatenation of deservers and exploratory, dynamic hashing
- Trees: AVL trees, B-trees, red-black trees, self-organizing trees (Splay trees), digital trees (Tries)
- Graph algorithms: width and depth search, cycle detection, topological sorting, shortest paths (Bellman-Ford, Dijkstra), minimum spanning trees (Kruskal, Prim), flows in networks (Ford-Fulkerson), bipartite matching
- Design methods: Divide and Conquer, Greedy method, backtracking, Dynamic programming, randomized algorithms
- Outlook: complexity classes P, NP, NP completeness

2. Learning Outcomes

On completion of the module, the students will be able to:

Professional Competence

- explain and apply important algorithms and data structures for sorting, for searching and for solving graph-based problems
- assess as to what kind of effect the choice of data structures has on the efficiency of algorithms
- explain the limits that exist for solving problems algorithmically

Methodological Competence

- identify the basic algorithmic problems in applications and to select suitable algorithms and data structures for them
- apply techniques of estimating the runtime of algorithms
- develop own and efficient algorithms based on general methods of designing.

Social and Self-competence

- discuss problems and possible solutions with domain experts.

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: 90 min, Examination

Exam qualifications: Lab Work

5. Literature

T.H. Corman, et. al.. Algorithmen. Oldenbourg, 2010. ISBN 978-3486582628

Ottman und Widmayer. Algorithmen und Datenstrukturen. Spektrum, 2002. ISBN 978-3827410290

G. Saake, K.-U. Sattler. Algorithmen und Datenstrukturen. dpunkt.verlag, 2006. ISBN 3-89864-385-9

Steven S. Skiena. The Algorithm Design Manual. Springer, 2008. ISBN 978-1-84800-069-8

Semester 4

Stochastics

1. Content

- Descriptive statistics
- Probability theory, random variables
- Discrete and continuous distributions
- Inductive statistics: interval estimates
- Markov chains and queuing
- Simulation and MATLAB

2. Learning Outcomes

On completion of the module, the students will be able to:

Professional Competence

- describe and interpret data by a few key indicators meaningfully
- expect probabilities
- apply the most important discrete and continuous distributions meaningfully

Methodological Competence

- recognize the random component in abstract tasks and formulate in the language of the random variables
- model stochastically and recognize tasks and
- break complex textual problems into steps and solve exercise tasks

Social and Self-competence

- support each other in solving tasks and in the context of self-learning units
- assess their own skills in analysing problems and in developing solutions

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: 90 min, Examination

Exam qualifications: Paper

5. Literature

Peter Hartmann. Mathematik für Informatiker. Vieweg, 978-3834800961, 3 2006

Gerhard Hübner. Stochastik. , 978-3834807175, 3 2009

Michael Baron. Probability and Statistics for Computer Scientists. Chapman & Hall, 978-1584886419, 11 2006

Ottmar Beucher. Wahrscheinlichkeitsrechnung und Statistik mit MATLAB. Springer, 978-3540721550, 9 2007

Software Engineering

1. Content

- Importance of Software Engineering
- Major software development processes such as Unified Process and Agile Software Development
- Unified Modelling Language
- Requirements analysis
- Domain Modelling
- Logical Software Architecture
- Object Design and Design Patterns
- SW Quality Assurance: Inspection / Review, Software Testing

2. Learning Outcomes

On completing the module successfully, the students will be able to:

Professional Competence

- explain the importance of software engineering for today's software development and to identify and describe the sub-areas of software engineering
- describe agile development processes and explain the differences with regard to other software development processes
- use the linguistic capabilities of Unified Modelling language to create abstract views of a system
- apply selected design patterns

Methodological Competence

- apply agile development processes in the software development
- analyse problems and develop alternative solutions
- assess software designs in terms of quality criteria and compare various alternative solutions
- plan and implement systematically quality assurance measures in the development of software systems

Social and Self-competence

- discuss alternatives in development results (e.g. software design) with factual arguments in a team and reach decisions

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: 90 min, Examination

Exam qualifications: Lab Work

5. Literature

I. Sommerville. Software Engineering. Addison Wesley, München, 2007. ISBN 978-3827372574

B. Oestereich. Analyse und Design mit UML 2. Oldenburg Wissenschaftsverlag, München, 2009. ISBN 978-3486588552

C. Larman. UML 2 und Patterns angewendet - Objektorientierte Softwareentwicklung. mitp-Verlag, Bonn, 2005. ISBN 978-3826614538

C. Rupp, S. Queins, B. Zengler. UML 2 glasklar. Hanser, 2007. ISBN 978-3446411180

E. Gamma, R. Helm, R. Johnson, J. Vlissides. Design Patterns - Elements of Reuseable Object-Oriented Software. Addison-Wesley, München, 1994. ISBN 978-0201633610

P. Kruchten. Der Rational Unified Process. Addison-Wesley, München, 2003. ISBN 978-0321197702

G. Starke. Effektive Software-Architekturen. Hanser Verlag, München, Wien, 2009. ISBN 978-3446420083

M. Fowler, K. Scott. UML konzentriert, Die neue Standard-Objektmodellierungssprache anwenden. Addison Wesley, Bonn, 2003. ISBN 978-3827321268

Operating Systems

1. Content

- Introduction
- Operating System structures
- Command interfaces
- File systems
- Address spaces
- Processes, Threads
- Synchronization and synchronization errors
- Inter-process communication
- System services
- Security

2. Learning Outcomes

On completing the module successfully, the students will be able to:

Professional Competence

- select Operating Systems for a specific purpose
- plan a specific purpose of an Operating System
- install and administrate Operating Systems

Methodological Competence

- develop system programs for different Operating Systems
- recognize problems when using the computer systems

Social and Self-competence

- assess Operating Systems in cooperation with the overall IT and discuss their use with all those responsible.

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: Oral Examination

Exam qualifications: Lab Work

5. Literature

Andrew S. Tanenbaum. Modern Operating Systems. Prentice Hall, 2008. ISBN 978-0138134594

Databases

1. Content

- Data management, file and database systems, ANSI/SPARC architecture
- Entity-Relationship model, generalization, and aggregation
- Relational database model, DDL
- Functional dependencies, normal morphology, synthesis and decomposition algorithms
- Relational algebra
- Database query languages, DML, OLAP
- Database programming, PSM, ESQL, ODBC, JDBC, ADO

2. Learning Outcomes

On completing the module successfully, the students will be able to:

Professional Competence

- assess relational databases for information management in the context of information systems, and to plan and apply their use
- create Entity-Relationship models of the real world using a modelling tool
- identify and implement model optimization with normal morphology
- derive relational databases from Entity-Relationship models and to create and query using standard SQL
- apply the standard interfaces of database programming in procedural languages

Methodological Competence

- apply and discuss the expertise through practical tasks in the fields of ERM, RM, DDL, RA, DML and DB programming and to develop their own solutions

Social and Self-competence

- collaborate in small groups with elaborations on predefined tasks and create them jointly while assuming their own role.

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: 90 min, Examination

Exam qualifications: Lab Work

5. Literature

Elmasri, R.; Navathe, S.. Grundlagen von Datenbanksystemen. Pearson Studium, 1 2009. ISBN 978-3868940121

Ramakrishan, R.; Gehrke, J.. Database Management Systems. MacGraw-Hill, 9 2002. ISBN 978-0071151108

Semester 5

Seminar

1. Content

- Overview of current areas of application of computer engineering
- Presentation of concrete case studies from practical life
- Classification of case studies into the curriculum
- Independent elaboration of concrete case studies
- Presentation of the results
- Presentation of results on paper

2. Learning Outcomes

On completing the module successfully, the students will be able to:

Professional Competence

- represent complex issues concisely
- report on results in one's own words
- select areas of interest for further consolidation of know-how

Methodological Competence

- replenish expertise didactically meaningfully
- use expertise to practical case studies

Social and Self-competence

- cooperate with others and actively participate in joint findings
- prepare expertise didactically and present the same successfully.

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: Student Research Project/Presentation

5. Literature

Distributed and Webbased Systems

1. Content

- Definition
- Transparency requirements
- Architectural models and software concepts
- Communication and Processes
- Object-based Distributed Systems
- Special challenges of distributed systems
- Security requirements and protective measures

2. Learning Outcomes

On completing the module successfully, the students will be able to:

Professional Competence

- identify the most important architectural models of distributed systems
- describe simple distributed applications in their architecture and function
- design new distributed applications and implement a prototype
- describe the advantages of using a middleware
- select and explain suitable protective measures

Methodological Competence

- apply expertise in a practical case studies
- develop and document concepts for new applications

Social and Self-competence

- develop and introduce solutions for medium-weight problems independently

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: Oral Examination

5. Literature

Andrew S. Tanenbaum und Maarten van Steen. Verteilte Systeme: Prinzipien und Paradigmen. Pearson Studium, 11 2007. ISBN 978-3827372932

Ulrike Hammerschall. verteilte Systeme und Anwendungen. Addison-Wesley Verlag, 1 2005. ISBN 978-3827370969

John Viega and Gary McGraw. Building Secure Software: How to Avoid Security Problems the Right Way. Addison-Wesley Longman, Amsterdam, 10 2001. ISBN 978-0201721522

Software Project

1. Content

2. Learning Outcomes

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: Student Research Project/Presentation

Exam qualifications: Protocol

5. Literature

Semester 6

Business Economics

1. Content

1.1 The economic activity - Economy as a system

- The economic principle / business economic principles
- The market and its forms
- Economic Policy Institutions

1.2 The Company

- Basic concepts
- Operational functional areas
- Organization

1.3 The Management Accounting

- Managerial Accounting
- Cost accounting, annual financial statements
- Feasibility and Investment Appraisal
- Financing

1.4 The business plan

- Decision making in the company
- Strategic / Operational Planning
- Controlling

2. Learning Outcomes

On completing the module successfully, the students will be able to:

Professional Competence

- define business functions and describe their interrelationships
- describe and apply constitutive decisions (among other things social forms, location factors) and the links between companies
- understand and apply economics principles as well as business methods and procedures
- differentiate, identify and assess the decision-making process and the planning, organization and control in businesses

Methodological Competence

- develop, discuss and present various approaches of solutions to business problems in the context of case studies
- analyse and discuss scientific reference works

Social and Self-competence

- argue in small groups based on facts and assert their own role in small groups

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: 90 min, Examination

5. Literature

Wöhe/Döring. Einführung in die Allgemeine Betriebswirtschaftslehre. Gabler, Wiesbaden, 2010

Team-oriented Project

1. Content

2. Learning Outcomes

On completing the module successfully, the students will be able to:

Professional Competence

- use the knowledge acquired until then with interdisciplinary approach to solve a complex problem

Methodological Competence

- analyse and manage requirements
- apply methods for project planning and project management
- select suitable modelling techniques (UML) and development tools and use the same pragmatically
- carry out a complete project from the point of vision to its deployment autonomously on the basis of a suitable process model
- apply design patterns sensibly

Social and Self-competence

- develop new topics autonomously
- cooperate in the preparation and implementation of artefacts in groups cooperate with clearly defined roles and jointly work on the results
- master challenges with specific objectives and persistence

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: Practical Work/Design and Presentation

5. Literature

I. Sommerville. Software Engineering. Addison Wesley, München, 2007. ISBN 978-3827372574

T. DeMarco, T. Lister. Wien wartet auf Dich. Der Faktor Mensch im DV- Management. Hanser Fachbuch, 10 1999. ISBN 978-3446162297

C. Larman. UML 2 und Patterns angewendet - Objektorientierte Softwareentwicklung. mitp-Verlag, Bonn, 2005. ISBN 978-3826614538

E. Gamma, R. Helm, R. Johnson, J. Design Patterns - Elements of Reuse. Addison Wesley, München, 1994. ISBN 978-0201633610

Communication and Moderation

1. Content

- Basics of communication: Verbal and nonverbal communication, communication and behavioural styles, strategies for successful communication
- Conflict management in teams: causes and indications of conflicts, the cycle of conflict management, conflict resolution strategies
- Facilitation techniques: definition of targets and moderation environment, moderation phases
- Art of negotiation: steps of negotiation and strategies, preparation and conduct of negotiations

2. Learning Outcomes

On completing the module successfully, the students will be able to:

Social and Self-competence

- recognize the importance of communication in companies
- use tools, techniques and rules of communication according to the situation
- recognize and resolve conflicts
- perform facilitation in different situations

3. ECTS

2 ECTS-Credits

4. Assessments

Examinations: Presentation

5. Literature

Semester 7

Project Management / Team-oriented Project

1. Content

- Introduction to Project Management
- Process Models of Software Development
- Project life cycle and relevant project management activities
- Methods of project management
- Classic and Agile Project Management

2. Learning Outcomes

On completing the module successfully, the students will be able to:

Professional Competence:

- correctly rank the importance of project management for IT projects
- demonstrate knowledge of techniques and methods for project management
- demonstrate knowledge of the key project roles and their tasks and responsibilities
- demarcate between classical and agile project management

Methodological Competence:

- handle project management software such as MS-Project, Mind Map and other tools
- create design documents (GANTT charts, critical path method)
- prove their project management skills incl. self-organization of a project team and evaluation

Social and Self-competence:

- manage projects
- deal with each other as a team

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: Presentation

5. Literature

Kapur K. Gopal. Project Management for Information, Technology, Business, and certification. Pearson Education, 2005. ISBN 0-13-112335-1

Highsmith, James A. Agile Project Management: creating innovative products. Pearson Education, 2004. ISBN 0-321-21977-5

Balzert, Helmut. Lehrbuch der Software-Technik: Software-Management, Software-Qualitätssicherung, Unternehmensmodellierung. Spektrum, Akad. Verl., 1998

H. W. Wiczorrek, P. Mertens. Management von IT-Projekten: Von der Planung zur Realisierung. Springer, 9 2009. ISBN 978-3540852902

H. M. Sneed. Software-Projektkalkulation. Praxiserprobte Methoden der Aufwandsschätzung für verschiedene Projektarten. Hanser, 5 2005. ISBN 978-3446400054

Alternative Modules

Ad hoc & Sensor Networks

1. Content

- Typical applications and requirements in the area of ad hoc and sensor networks
- Wireless technologies (WiFi, Bluetooth, ZigBee, UMTS, LTE)
- RFID (Radio Frequency Identification) - and NFC (Near Field Communication) technologies
- Sensor types, sensor properties and sensor data analysis
- Routing protocols for ad hoc and sensor networks
- Hardware platforms and architectures for sensor networks
- Software platforms for sensor networks
- Implementation of an application based on an ad hoc or sensor network in a small team

2. Learning Outcomes

On completion of the module, the students will be able to:

Professional Competence

- assess requirements for software and hardware components for application scenarios
- explain the concepts and technologies for implementing ad hoc and sensor networks and evaluate their suitability for different application scenarios

Methodological Competence

- apply the acquired knowledge for designing a custom application and to implement it as part of a team project

Social and Self-competence

- cooperate in exercise mode in small groups with regard to tasks

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: Oral Examination

Exam qualifications: Lab Work

5. Literature

Holger, K.; Willig. Protocols and Architectures for Wireless Sensor Networks. John Wiley & Sons, 2005. ISBN 978-0470095102

Waltenegus, D.; Poellabauer, C.. Fundamentals of Wireless Sensor Networks: Theory and Practice (Wireless Communications and Mobile Computing). John Wiley & Sons, 2010. ISBN 978-0470997659

Finkenzeller, K. RFID Handbook. John Wiley & Sons, 2010. ISBN 978-0470695067

Levis, P.; Gay, G. TinyOS Programming. Cambridge University Press, 2011. ISBN 978-0521896061

Autonomous Systems

1. Content

- Introduction and basic concepts (history, autonomy, mobility, classic, reactive and hybrid architectures)
- Methodological basics (kinematics, holonomy, reactive behaviour, speed controller, position controller)
- Planned movement (algorithms, work and configuration space, path planning, motion control, mapping)
- Probabilistic approaches in robotics (motion model, sensor model, position tracking)
- Selected topics (e.g. behavioural coordination, symbolic planning, software frameworks)
- Practical exercises on mobile robots, for example, Pioneer P3DX platforms

2. Learning Outcomes

On completing the module successfully, the students will be able to:

Professional Competence

- describe and explain algorithms for control, path planning, navigation and architecture as well as behaviour control by external and internal sensor systems for selected robot systems
- describe the basic mechanisms of processing uncertain information in complex systems using the example of mobile robots

Methodological Competence

- apply and discuss the knowledge based on practical tasks and develop their own solutions

Social and Self-competence

- assume (partial) responsibility for a work product of a small group
- contribute their own skills in a team with specific objectives

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: 90 min, Examination

5. Literature

R. Siegwart, I. Nourbakhsh, D. Scaramuzza: Introduction to Autonomous Mobile Robots. MIT Press, 2011. ISBN 9780262015356

T. Bräunl. Embedded Robotics: Mobile Robot Design and Applications with Embedded Systems, 2006

J. Hertzberg, K. Lingemann, A. Nüchter. Mobile Roboter, 2012

Computer Architecture

1. Content

- Architectural features of modern processors
- Memory hierarchies and memory management
- Performance evaluation of computer systems
- Multiprocessor and multi-computer architectures
- System structure and connecting structures

2. Learning Outcomes

On completing the module successfully, the students will be able to:

Professional Competence

- assess the concepts underlying the modern processors and their impact on an application
- evaluate the architectural features and performance data of memory hierarchies
- identify and evaluate the structural forms and communication structures of multiprocessor and multi-computer systems

Methodological Competence

- determine and apply a suitable method for testing the suitability of a computer for a dedicated application

Social and Self-competence

- compile a common documentation and evaluation of the results achieved in the team

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: Oral Examination

Exam qualifications: Lab Work

5. Literature

William Stallings. Computer Organization & Architecture. Pearson Education, 2003. ISBN 0-13-049307-4

John L. Hennessy, David A. Patterson. Computer Architecture - A Quantitative Approach. Elsevier Science, 2003. ISBN 1-55860-724-2

Andrew S. Tanenbaum. Computerarchitektur. 3-8273-7016-7, 2001

Computer Graphics

1. Content

- Raster Images
- Ray Tracing
- Transformation Matrices & Viewing
- The Graphics Pipeline
- Signal Processing
- Surface Shading & Texture Mapping
- Data Structures for Graphics
- Light and Color
- Using a Tool for Modelling Scenes in 3D
- Using a Graphics API for Game Programming

2. Learning Outcomes

On completing the module successfully, the students will be able to:

Fachkompetenz

- Explain, how photo-realistic images can be synthesized by ray tracing.
- Explain, how images are synthesized using the graphic pipeline.
- Apply linear algebra to transform three dimensional models, determine angles, and compute intersection points.
- Understand, how illumination changes our perception of a scene and how this can be simulated.
- Describe, how material aspects and detailed surface structures can be modelled.
- Describe, how convolution can be used to post process images.

Methodenkompetenz

- Use a standard modelling tool to create a 3D-scene.
- Use a standard tool to render an image from a scene using special camera and lightning settings.
- Use an API to control graphic functions of a computer in the context of game programming.
- Select appropriate data structures to meet given efficiency requirements in graphical applications.
- Select appropriate rendering techniques to meet given requirements with respect to efficiency and image quality.

Sozial- und Selbstkompetenz

- Experience how to make practical use of mathematical theories ;-)

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: 90 min, Examination

Exam qualifications: Lab Work

5. Literature

Peter Shirley & Steve Marschner. Fundamentals of Computer Graphics. CRC Press, 2009

John F. Hughes et al. Computer Graphics - Principles And Practice. Addison-Wesley, 2013

Database Programming

1. Content

- PHP
- Stored Procedures (e.g. Cursor concept)
- SQL-extensions (e.g. Inline Views, CASE construct)
- Tools for data cleansing (ETL Tools)

2. Learning Outcomes

On completing the module successfully, the students will be able to:

Professional Competence

- develop PHP applications
- select tools for improving the data quality
- recognize the benefits of stored procedures

Methodological Competence

- apply and discuss the knowledge based on practical tasks and develop their own solutions

Social and Self-competence

- cooperate in the application development
- appreciate the skills of other team members
- assume their own role in small groups

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: Student Research Project

5. Literature

Theis. Einstieg in PHP 5.3 und MySQL 5.4. Galileo Press, 2009

Harrison, Feuerstein. MySQL stored Procedure Programming. O'Reilly, 2006

Data Warehousing

1. Content

- Schema integration and multidimensional data models (star and snowflake schema)
- ETL Process and ETL Tools
- SQL OLAP
- Historicizing
- Data Mining

2. Learning Outcomes

On completing the module successfully, the students will be able to:

Professional Competence

- describe the ETL process
- identify and resolve problems in the integration of operational (database) systems in a data warehouse
- evaluate the advantages of SQL OLAP
- apply the methods of analysis (reporting, OLAP, Data Mining) based on tools

Methodological Competence

- apply and discuss the knowledge on the basis of practical tasks and develop their own solutions

Social and Self-competence

- assume (partial) responsibility of a work product of a small group
- contribute their own skills in a team with specific objectives

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: Oral Examination

Exam qualifications: Student Research Project

5. Literature

Gabriel/Gluchowski/Pastwa. Data Warehouse und Data Mining. w3l Verlag, 2010

Bauer/Günzel. Data-Warehouse-Systeme. dpunkt, 2009

Kemper/Mehanna/Unger. Business Intelligence - Grundlagen und praktische Anwendungen. ViewegTeubner, 2006

Digital Forensics

1. Content

- Tasks of digital forensics
- The digital crime scene
- The tools of the digital forensics
- Data analysis
- Documentation

2. Learning Outcomes

On completion of the module, the students will be able to:

Professional Competence

- act appropriately at the digital crime scene
- plan and build independently a Forensics Field Set
- find evidence of unauthorized activities and document the same conclusively
- restore data deleted from the storage media

Methodological Competence

- secure evidence with judicial authorization
- evaluate evidential clues and synthesize simple lines of evidence

Social and Self-competence

- familiarize themselves with new topics independently and in a team and present results

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: Other

5. Literature

Lorenz Kuhlee, Victor Völzow. Computer Forensik Hacks. O'Reilly Verlag GmbH & Co. KG, 5 2012. ISBN 978-3868991215

John R. Vacca: Computer Forensics. Computer Crime Scene Investigation. Charles River Media, 5 2002. ISBN 978-1584500186

John R. Vacca, K. Rudolph. Computer Forensics: Computer Crime Scene Investigation. Jones & Bartlett Publ, 9 2010. ISBN 978-0763791346

Cory Altheide, Harlan Carvey. Digital Forensics with Open Source Tools. Syngress, 1700. ISBN ASIN B00LI84Y28

Digital Systems

1. Content

1.1 Programmable logic devices (PLDs)

- Terminology, classification of digital circuits
- Basic architectures
- Complex PLDs
- FPGAs

1.2 Circuit design with VHDL

- Entity and architecture
- Signals, Data types
- Concurrency
- Selective and conditional signal assignment
- Structural design with components, processes, Sequential Statements
- Synthesis of Registers
- Design of state machines

2. Learning Outcomes

On completing the module successfully, the students will be able to:

Professional Competence

- understand the principles of programmable logic circuits
- design, simulate, operate and test digital circuits with the hardware description language VHDL

Methodological Competence

- apply and discuss the knowledge based on practical tasks and develop their own solutions
- analyse problems and evaluate alternative solutions comparatively

Social and Self-competence

- discuss work results with fellow students and tutors
- compile the work results in a small team

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: 90 min, Examination

Exam qualifications: Lab Work

5. Literature

Hamblen, J.O., Furman, M.D.. Rapid Prototyping of Digital Systems. Springer, 2007. ISBN 978-0387726700

Reichardt, J., Schwarz, B.. VHDL-Synthese. Oldenbourg, 2009. ISBN 978-3486589870

Sikora, A.. Programmierbare Logikbauelemente. Fachbuchverlag, Leipzig, 2001. ISBN 978-3446216075

Herrmann, G., Müller, D.. ASIC - Entwurf und Test. Hanser Fachbuchverlag, 2004. ISBN 978-3446217096

Embedded Systems

1. Content

- Introduction
- Embedded Systems Hardware (microcontroller-based systems, use of special processors, Systems on a Programmable Chip, communication and extension interfaces)
- Embedded Systems Software (typical architectures, Embedded Operating Systems)
- Systematic design, modelling Embedded Systems

2. Learning Outcomes

On completing the module successfully, the students will be able to:

Professional Competence

- explain the development and expansion of interface microcontroller-based embedded system
- identify different construction forms of embedded systems and assess their advantages and disadvantages
- classify the problem of hardware / software partitioning
- identify and evaluate typical software structures of embedded systems
- assess the importance of model-driven design

Methodological Competence

- design and develop simple embedded systems

Social and Self-competence

solve a problem in a small group

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: 90 min, Examination

Exam qualifications: Lab Work

5. Literature

Michael Barr. Programming Embedded Systems. O'Reilly, 10 2006. ISBN 978-0596009830

David E. Simon. An Embedded Software Primer. Addison Wesley, 8 1999. ISBN 978-0201615692

Peter Marwedel. Eingebettete Systeme. Springer, Berlin, 2007. ISBN 978-3540340485

Game Programming - Development

1. Content

2. Learning Outcomes

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: Practical Work/Design and Presentation

5. Literature

Hardware Oriented Programming

1. Content

- Simple Computer Architecture
- Special hardware-oriented programming
- Introduction to C programming language (specifically: dealing with pointers)
- Interrupt programming

2. Learning Outcomes

On completion of the module, the students will be able to:

Professional Competence

- use a cross-platform development environment
- explain the specifics of the hardware-oriented programming and name typical approaches to solutions

Methodological Competence

- discuss typical problems in the field of hardware-oriented programming in the C programming language
- solve a given problem in a small group

3. ECTS

5 ECTS-Credits

4. Assessments

Examination: 90 min, Examination

Exam qualifications: Lab Work

5. Literature

Bollow, Homann. K971. C und C++ fnn, K971.ed Systems. Mitp-Verlag, 11 2008. ISBN 978-826659492

Michael Barr. Programming Embedded Systems. O'Reily Media, 10 2006. ISBN 978-0596009830

Kernighan, Ritchie. Programmieren in C. Hanser, 2 1990. ISBN 978-3446154971

Information Security

1. Content

- Safety objectives of information security
- Information Security Management System - ISMS
- Hazards and typical attack patterns
- Risk analysis and safety concept
- Current topics on the subject

2. Learning Outcomes

On completing the module successfully, the students will be able to:

Professional Competence

- systematically analyse and assess specific risks of distributed systems
- derive and justify concrete protective measures
- complete an existing safety concept and justify additional measures

Methodological Competence

- implement a safety analysis in conformity with standards
- generate and defend a coherent security policy

Social and Self-competence

- familiarize themselves with new topics independently and present the results in a team

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: 90 min, Examination

5. Literature

Heinrich kersten et al. IT-Sicherheitsmanagement nach ISO 27001 und Grundschutz. Springer Vieweg, 2014. ISBN 978-3658017231

Sebastian Klipper. Information Security Risk Management: Risikomanagement mit ISO/IEC 27001, 27005 und 31010. Vieweg+Teubner Verlag, 2 2012. ISBN 978-3834813602.
ISO 27001, ISO 27002

Medical Information Systems

1. Content

- Architecture and functioning of hospital information systems
- Data traffic in the healthcare system
- Special application systems: patient management, surgical documentation systems, PACS
- Documentation systems of diagnostic findings, document management and archive systems
- Information systems for medical practices
- Electronic patient record, electronic health record
- Modelling of information systems in the health sector
- Standards for data exchange: HL7, EDIFACT, xDT, XML

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2. Learning Outcomes

On completing the module successfully, the students will be able to:

Professional Competence:

- substantiate their knowledge of information systems in different areas of healthcare system
- demonstrate their knowledge of the issues and challenges in this area (e.g. electronic health records, information retrieval from the patient's perspective)

Methodological Competence:

- analyse complex information systems in the medical environment
- analyse requirements in given situations, for example, in a medium-sized hospital, and formulate them into user requirements (specifications)
- design complex information systems in the medical environment
- correctly apply appropriate technologies (multi-tier systems, Thin Client, distributed systems, SOA)

Social and Self-competence:

- solve problems independently and / or in teams

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: Oral Examination

5. Literature

P. Haas. Medizinische Informationssysteme und elektronische Krankenakten. Springer, 2005. ISBN 3-540-20425-3.

Mobile Application Development

1. Content

- Mobile devices: platforms and Operating Systems, features of mobile applications
- Engineering mobile applications: methods, development and testing tools
- User interfaces and multimedia
- Networking in mobile applications (Internet, PAN)
- Use of sensors (camera / audio, Location / Accelerometer, etc.), localization and location-based services
- Energy Management
- Integration with Web applications (Web APIs)

2. Learning Outcomes

On completion of the module, the students will be able to:

Professional Competence

- describe the characteristics and constraints of mobile applications
- implement applications on at least one current platform (e.g. Android)
- select and use sensor, localization and networking technologies
- design and implement graphical user interfaces
- integrate mobile applications in server-based environments
- understand and apply techniques for energy efficiency

Methodological Competence

- conceptualize, design and implement own mobile applications in various application fields

Social and Self-competence

- develop work products independently and in small groups
- develop solutions for design tasks independently

3. ECTS

5 ECTS-Credits

4. Assessments

Examination: 90 min, Examination

Examqualification: Lab Work

5. Literature

J. Roth. Mobile Computing: Grundlagen, Technik, Konzepte. dpunkt.verlag, 2005. ISBN 978-3898643665

T. Bollmann, K. Zeppenfeld. Mobile Computing. W3L, 2010. ISBN 978-3868340051

Z. Mednieks. Programming Android. O'Reilly, 2012. ISBN 978-1449316648

Pentesting

1. Content

- Typical security vulnerabilities
- Types of attack, attack vectors, Top 10 list of common attacks
- The most important tools of a penetration tester
- Practical implementation of attacks
- Selected topics on the subject

2. Learning Outcomes

On completion of the module, the students will be able to:

Professional Competence

- select typical types of attack on concrete information systems
- demonstrate practically vulnerabilities under laboratory conditions

Methodological Competence

- analyse the results of a penetration test and justify specific measures of protection
- prepare a management report

Social and Self-competence

- familiarize independently and in team with new topics and present the results

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: 90 min, Examination

5. Literature

Michael Messner. Metasploit: Das Handbuch zum Penetration-Testing-Framework. dpunkt.verlag GmbH, 2011. ISBN 978-3898647724

Peter Kim. The Hacker Playbook: Practical Guide to Penetration Testing. Independent Publishing Platform, 1700. ISBN ASIN: B00LI6OSS0

Daniel Dieterle. Basic Security Testing with Kali Linux. CreateSpace Independent Publishing Platform, 1700. ISBN 978-1494861278

Robert W. Beggs. Mastering Kali Linux for Advanced Penetration Testing. Packt Publishing, 2014. ISBN 978-1782163121

Realtime Systems

1. Content

- Features and characteristics of real-time systems
- Real-time Operating Systems (e.g. real-time Linux) and real-time programming languages (e.g. RT Java)
- Real-time programming and modelling (Design Pattern for real-time systems)
- Scheduling in Real-Time Systems (Rate Monotonic Scheduling, Rate Monotonic Analysis)
- Synchronization (priority inversion, Priority Inheritance, Priority Ceiling Protocol, calculation of blockade times)
- Hybrid Task Sets
- Applications (alternatively, e.g. real-time communications, control engineering, signal processing, multimedia, robotics, automation)

2. Learning Outcomes

On completing the module successfully, the students will be able to:

Professional Competence

- select the real-time scheduling procedures adequate for the problems
- implement principles of real-time programming in typical programming languages
- apply methods for the identification of time-related correctness of systems of moderate complexity for the system design

Methodological Competence

- apply and discuss the knowledge based on practical tasks and develop their own solutions

Social and Self-competence

- assume (partial) responsibility for a work product of a small group
- contribute their own skills in a team with specific objectives

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: Oral Examination

Exam qualifications: Lab Work

5. Literature

Jane W. S. Liu. Real-Time Systems. Prentice Hall, 2000. ISBN 0-13-099651-3

Giorgio C. Buttazzo. Hard Real-Time Computing Systems - Predictable Scheduling Algorithms and Applications. Springer, 2005. ISBN 0-387-23137-4

Qing Li. Real-Time Concepts for Embedded Systems. CMP Books, 2003. ISBN 1-57820-124-1

Jürgen Quade, Michael Mächtel. Moderne Realzeitsysteme kompakt. dpunkt Verlag, 2012

Peter C. Dibble. Real-Time JAVA Platform Programming. Prentice Hall, 2002. ISBN 0-13-028261-8

Web Engineering

1. Content

- Introduction
- Basics of HTML and XML
- XSLT Transformations
- XML Scheme
- Protocols in HTTP
- CGI Scripts, Servlets
- JSP, PHP, ASP
- ASP.NET, JSF
- Browser code
- Security aspects

2. Learning Outcomes

On completing the module successfully, the students will be able to:

Professional Competence

- identify the basics of web logs and standards
- describe the specific features of web-based applications compared to normal applications
- apply the different programming interfaces

Methodological Competence

- analyse the special requirements of web applications and implement them in a project
- plan and apply the right web frameworks
- Social and Self-competence

Social and Self-competence

- discuss and plan with the various project participants about the optimal use of a web project

3. ECTS

5 ECTS-Credits

4. Assessments

Examinations: 90 min, Examination

5. Literature

H. Wöhr. Web-Technologien. Dpunkt Verlag, 2004. ISBN 978-3898642477

R. Dumke, M. Lothar, C. Wille, F. Zbrog. Web Engineering. Pearson Studium, 2003. ISBN 978-3827370808