HOCHSCHULE SCHMALKALDEN
UNIVERSITY OF APPLIED SCIENCES

# Study Program Applied Computer Science (Master of Science)

Course Descriptions

University of Applied Sciences, Faculty of Computer Science

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# Contents

# Preamble

This document is an **unofficial reading** document of course descriptions for this study course. In case of a dispute, only the German version is binding.

# Compulsory Courses

## Seminar

| Name of Course | Seminar |
|---|---|
| module instructor | changing lecturers |
| Learning Goals | Students improve their ability to deal with new topics from their field. They will learn research techniques to process scientific topics and present the results in a scientific paper. |
| Module Content | Techniques of scientific work, academic writing, academic discourse of current topics in the field |
| Form of Instruction and Learning | Seminar (2 SWS) |
| Entry Requirements | none |
| Literature, Teaching Method and Media | Selected literature in the area of a current scientific topic |
| Author of Indenture | |
| Used in Study Programs | Master Applied Computerscience |
| Workload Components / Total Workload | overall 150h comprising of 30h in-person training, 100h of self-study and 20h exam preperation and exam |
| Credits and Weight in final Mark | 5ECTS weight: 5 / 120 |
| Assessment | Alternative Examination (Exact requirements will be issued by the responsible instructor) |
| Term | Term 3 |
| Frequency of Course | once per study year |
| duration | 1 term(s) |
| kind of module (compulsory, compulsory elective, elective) | compulsory |
| remarks | |

## Project

| Name of Course | Project |
|---|---|
| module instructor | changing lecturers |
| Learning Goals | Students improve their ability to apply the concepts and techniques acquired for practical software-development. Students apply design techniques, communicate within a team and reflect processes of software development. |
| Module Content | Development and implementation on a selected practical topic from the area of Smart Systems. |
| Form of Instruction and Learning | Lecture (1 SWS) |
| Entry Requirements | none |
| Literature, Teaching Method and Media | Selected literature relevant for the topic. |
| Author of Indenture | |
| Used in Study Programs | Master Applied Computerscience |
| Workload Components / Total Workload | overall 150h comprising of 30h in-person training, 100h of self-study and 20h exam preperation and exam |
| Credits and Weight in final Mark | 5ECTS weight: 5 / 120 |
| Assessment | Alternative Examination (Exact requirements will be issued by the responsible instructor) |
| Term | Term 3 |
| Frequency of Course | once per study year |
| duration | 1 term(s) |
| kind of module (compulsory, compulsory elective, elective) | compulsory |
| remarks | |

## Master Thesis

| Name of Course | Master Thesis |
|---|---|
| module instructor | thesis supervisor |
| Learning Goals | • Approaching a scientific problem.<br>• Structure and limitation of a topic.<br>• Creating a structure of inquiry.<br>• Support in finding a solution.<br>• Formal and other criteria for the creation of scientific work.<br>• Provide a clearly recognizable scientific contribution<br>• Design of the presentation and defense of contents as part of the colloquium. |
| Module Content | With a master's thesis, a student should demonstrate his/her command on academic knowledge and skills. Further, a student has practical skills to analyze and implement unique scientific contributions.<br>For this purpose engineering methods are used to solve practical task. The supervisor assists the student during thesis and advises on scientific matters. This module concludes with a written thesis. |
| Form of Instruction and Learning | Project (1 SWS) |
| Entry Requirements | Confirmation of the topic of the master thesis by the supervisor. A masters thesis can be started with a credit score missing no more than 10 creditpoints of the overall sum. |
| Literature, Teaching Method and Media | Selected literature relevant for the topic. |
| Author of Indenture | |
| Used in Study Programs | Master Applied Computerscience |
| Workload Components / Total Workload | overall 810h comprising of 10h in-person training, 800h of self-study |
| Credits and Weight in final Mark | 27ECTS weight: 27 / 120 |
| Assessment | Written Exam (submission of thesis) |
| Term | Term 4 |
| Frequency of Course | once per study year |
| duration | 1 term(s) |
| kind of module (compulsory, compulsory elective, elective) | compulsory |
| remarks | Timelimit for the thesis is 24 weeks. |

## Master Colloquium

| Name of Course | Master Colloquium |
|---|---|
| module instructor | thesis supervisor |
| Learning Goals | Students acquire the following skills:<br>• Designing a scientific presentation<br>• Presentation of a scientific project<br>• Scientific argument and defense<br>• Discuss questions of examiners and listeners |
| Module Content | |
| Form of Instruction and Learning | Project (1 SWS) |
| Entry Requirements | grade of module “Masterthesis” with at least grade 4.0 |
| Literature, Teaching Method and Media | Dependent on topic of thesis.<br>Excerpt from literature list:<br>• Helmut Balzert, C.Schäfer, M. Schröder, U.Kern: Wissenschaftliches Arbeiten, 2. Aufl. 2011.<br>• Werner Sesink, Einführung in das wissenschaftliche Arbeiten inklusive E-Learning, Web- Recherche, digitale Präsentation u.a., 9. Aufl. 2012.<br>• Theo Hug, Gerald Poscheschnik: Empirisch Forschen: Über die Planung und Umsetzung von Projekten im Studium, 2010. |
| Author of Indenture | |
| Used in Study Programs | Master Applied Computerscience |
| Workload Components / Total Workload | overall 90h comprising of 2h in-person time, 880h of self-study |
| Credits and Weight in final Mark | 3ECTS weight: 3 / 120 |
| Assessment | Oral Exam (presentation of 30min) |
| Term | Term 4 |
| Frequency of Course | once per study year |
| duration | 1 term(s) |
| kind of module (compulsory, compulsory elective, elective) | compulsory |
| remarks | |

# Compulsory Elective Courses

## Distributed Systems

| Name of Course | Distributed Systems |
|---|---|
| module instructor | Prof. Dr. Erwin Neuhardt |
| Learning Goals | Students learn about important architectures which are relied on in the development of distributed systems. They know about the properties of different architectures. They learn about the different technologies for communication and cooperation in distributed systems and are able to apply these technologies in real world projects. |
| Module Content | Concepts and technologies for the development of distributed Systems:<br>• architectures and properties of distributed systems: client server-architectures, transparency<br>• Programming concepts for the communication in distributed systems: sockets, remote procedure call, remote method invocation, component based distributed systems, message based distributed systems<br>• Concurrent programming: java thread, synchronization and coordination, concurrent data structures, java executor framework |
| Form of Instruction and Learning | Lecture (2 SWS), Lab Exersise (1 SWS) |
| Entry Requirements | No formal prerequisites. Skills and knowledge in Java programming and software engineering (at least 10 ECTS) are recommended. |
| Literature, Teaching Method and Media | • Andrew S. Tanenbaum, Maarten van Steen: Distributed Systems, Published by Maarten von Steen, 2017<br>• w/o author: Sockets, Java Remote Method Invocation, Concurrency, Online unter docs.oracle.com<br>• Leonard Richadson, Mike Amundsen: RESTful Web APIs, O'Reilly, 2013<br>• Brian Goetz, Joshua Bloch, Joseph Bowbeer, Doug Lea, David Holmes, Tim Peierls: Java Concurrency in Practice, Addison-Wesley, 2006<br>• David A. Chappell, Richard Monson-Haefel: Java Message Service, O'Reilly 2009 |
| Author of Indenture | |
| Used in Study Programs | Master Applied Computerscience |
| Workload Components / Total Workload | overall 150h comprising of 60h in-person training, 60h of self-study and 30h exam preperation and exam |
| Credits and Weight in final Mark | 5ECTS weight: 5 / 120 |
| Assessment | Written Exam (exam on a PC of 120min) |

| Name of Course | Distributed Systems |
|---|---|
| Term | Term 1 |
| Frequency of Course | once per study year |
| duration | 1 term(s) |
| kind of module (compulsory, compulsory elective, elective) | compulsory elective |
| remarks | |

## Signals and Systems

| Name of Course | Signals and Systems |
|---|---|
| module instructor | Prof. Dr. Martin Golz |
| Learning Goals | Students should be able to<br>• Analyse typical problems in signal processing,<br>• To understand integral transforms of continuous functions,<br>• Understand discrete transforms on sampled signals,<br>• Understand and apply the discrete Fourier transform,<br>• Understand and apply digital filters,<br>• Understand and apply spectral analysis of stochastic signals,<br>• Understand models of stochastic processes and their optimisation,<br>• Understand and apply methods of time-frequency analysis. |

| Name of Course | Signals and Systems |
|---|---|
| Module Content | 1. Introduction<br>2. Fourier integral<br>  1. Integral transforms, Fourier kernel function<br>  2. Dirichlet conditions<br>  3. Elementary signals<br>  4. Properties of the Fourier integral<br>  5. Signal energy, signal power, decibel unit<br>  6. Bandwidth<br>3. Fourier series<br>4. Convolution integral<br>5. Sampling theorem<br>6. Discrete Fourier transform<br>  1. Properties<br>  2. Discrete Walsh transform, z transform<br>7. Linear time invariant systems<br>  1. Properties<br>  2. Impulse response, transfer function, Bode plot<br>  3. Pole zero plot, stability<br>  4. State space description<br>8. Stochastic signals<br>  1. Properties<br>  2. Probability density function<br>  3. Wiener Khintchin theorem, power spectral density<br>  4. Cepstrum<br>  5. Spectral estimation<br>  6. Models of stochastic processes<br>  7. Optimisation of process models<br>  8. Time series forecasting<br>9. Time-frequency analysis<br>  1. Short-time Fourier transform<br>  2. Gabor series<br>  3. Continuous wavelet transform<br>  4. Discrete wavelet transform and multi-resolution analysis |
| Form of Instruction and Learning | Lecture (3 SWS), Lab Exersise (1 SWS) |
| Entry Requirements | There are no formal prerequisites. Basic knowledge in linear algebra, analysis, and statistics is required. |

| Name of Course | Signals and Systems |
|---|---|
| Literature, Teaching Method and Media | Blackboard lecture using:<br>• Course material with gap-texts<br>• computer aided presentation<br>• demonstration programmes<br>Exercises in the computer pool<br>• Programming with Python or MATLAB<br>• Clarification of open questions<br>Literature<br>• Haykin, van Veen (2003) Signals and systems. Wiley<br>• Percival, Walden (2000) Wavelet methods for time series analysis. Cambridge |
| Author of Indenture | |
| Used in Study Programs | Master Applied Computerscience |
| Workload Components / Total Workload | overall 150h comprising of 60h in-person training, 60h of self-study and 30h exam preperation and exam |
| Credits and Weight in final Mark | 5ECTS weight: 5 / 120 |
| Assessment | Written Exam (exam of 120min) |
| Term | Term 1 |
| Frequency of Course | once per study year |
| duration | 1 term(s) |
| kind of module (compulsory, compulsory elective, elective) | compulsory elective |
| remarks | |

## IT Security

| Name of Course | IT Security |
|---|---|
| module instructor | Prof. Ralf C. Staudemeyer, PhD |
| Learning Goals | In this course students will learn how to determine the level of security of a computer system or service, specify vulnerabilities, and to estimate the potential damage resulting from a successful attack. It covers the basic principles and key concepts for the operation of secure and (mostly) distributed systems, which includes partial components from operating systems and computer networks. The focus of this course is to deepen the understanding of network attacks and the cryptographic techniques to ensure integrity and confidentiality of information. Topics include various sub-components like cryptographic key management, biometrics, authentication in distributed systems, and basic security protocols and standards. |
| Module Content | The course starts with a general introduction into IT-Security, Cryptography and Privacy-Enhancing Technologies. The main focus of this course is on cryptographic algorithms and security protocols. Principally this module treats a selection of the following topics:<br>• Selected Attacks (attacks analysis, protection mechanisms)<br>• Cryptographic Algorithms (AES, RSA, ECC, MACs, signatures)<br>• Cryptographic Key Management (Diffie-Hellman key exchange, certificates, public-key infrastructure)<br>• Digital Identity (multi-factor authentication, challenge-response protocols, authentication in distributed systems)<br>• Mobile Security (mobile networks, Internet-of-Things, SmartCities)<br>• Network Security (security protocols, virtual private networks, secure Internet services)<br>• User-tools for IT-Security and Privacy in daily practise (email, web, chat, filesystems)<br>This module is under constant development to reflect the most recent developments. |
| Form of Instruction and Learning | Lecture (2 SWS), Lab Exersise (2 SWS) |
| Entry Requirements | No formal prerequisites. Decent programming skills and basic knowledge in IT-security are recommended. |

| Name of Course | IT Security |
|---|---|
| Literature, Teaching Method and Media | • Eckert, C. (2018). IT-Sicherheit. Berlin, München, Boston. De Gruyter<br>• Stallings, W. (2016). Cryptography and network security, principles and practices (7th edition). Prentice Hall.<br>• Paar, C., & Pelzl, J. (2010). Understanding Cryptography. Berlin, Heidelberg: Springer Berlin Heidelberg<br>• Schneier, B. (1996), Applied Cryptography, John Wiley & Sons<br>• Selected sources announced in the lecture. |
| Author of Indenture | |
| Used in Study Programs | Master Applied Computerscience |
| Workload Components / Total Workload | overall 150h comprising of 60h in-person training, 90h of self-study incl. exam preperation and exam |
| Credits and Weight in final Mark | 5ECTS weight: 5 / 120 |
| Assessment | Written Exam (exam 90min) |
| Term | Term 1 |
| Frequency of Course | once per study year |
| duration | 1 term(s) |
| kind of module (compulsory, compulsory elective, elective) | compulsory elective |
| remarks | |

## Computer Graphics

| Name of Course | Computer Graphics |
|---|---|
| module instructor | Prof. Hartmut Seichter, PhD |
| Learning Goals | Computer graphics is describing all techniques in computer science generating images perceivable by humans. Participants will have a broad overview of techniques and concepts of computer graphics. They will be able to apply theoretical concepts in practice. |
| Module Content | • Basics of human perception<br>• Concepts of image storage and manipulation<br>• Applications of computer graphics<br>• Display sytems<br>• 3D models,i.e. surface and volume models<br>• Transformationspipeline<br>• Homogenous vector spaces and transformations<br>• Scenegraphs and rendering APIs<br>• Methods for image-synthesis<br>• Sampling in computer graphics<br>• Light transport and shading models<br>• Texturing<br>• Overview visualizations<br>• Graphical User Interfaces |
| Form of Instruction and Learning | Lecture (2 SWS), Lab Exersise (1 SWS) |
| Entry Requirements | No formal prerequisites. For a successful participation attendees should have an understanding of linear algebra. |
| Literature, Teaching Method and Media | • H5P learning modules<br>• learning forum<br>• exersises<br>• slides and quizzes<br>• Literature:<br>– Bar-Zeev, Avi. Scenegraphs: Past, Present and Future, 2003 http://www.realityprime.com/scenegraph.php.<br>– Burley, Brent. “Physically-Based Shading at Disney.” In ACM SIGGRAPH, 2012:1–7, 2012<br>– Goldstein, E. Bruce. Sensation and Perception. 3rd ed. Belmont, Calif.: Wadsworth Pub. Co., 1989<br>– Hughes, John F. Computer Graphics: Principles and Practice. Third edition. Upper Saddle River, New Jersey: Addison-Wesley, 2014<br>– Shirley, Peter, and R. Keith Morley. Realistic Ray Tracing. 2. ed. Natick, Mass: A K Peters, 2003 |
| Author of Indenture | |

| Name of Course | Computer Graphics |
|---|---|
| Used in Study Programs | Master Applied Computerscience |
| Workload Components / Total Workload | overall 150h with 90h in-person training and 30h exam preperation and exam |
| Credits and Weight in final Mark | 5ECTS weight: 5 / 120 |
| Assessment | Written Exam (exam of 120min) |
| Term | Term 1 |
| Frequency of Course | once per study year |
| duration | 1 term(s) |
| kind of module (compulsory, compulsory elective, elective) | compulsory elective |
| remarks | |

## Mobile Systems

| Name of Course | Mobile Systems |
|---|---|
| module instructor | Dr.-Ing. David Sommer |
| Learning Goals | Students learn about substantial concepts and technologies for the development of smart, mobile applications. One focus area consists in the programming with sensor data. |
| Module Content | Concepts and technologies for the development of advanced mobile applications. Special focus lies on the contextual dependencies of system behavior and the communication between different components. The following topics are examined:<br>• Location-based Services: application of different localization services with different properties, services for the visualization of geographical data, management of geographical data, geofencing, location-based social networking (lbsn)<br>• Communication in mobile applications: bluetooth, NFC, http etc.<br>• Acquisition of environmental data using sensoric interfaces<br>• Activity Recognition<br>• Track & Trace-applications: acquisition of position data and environmental data, collection and management of data, automated situation monitoring and recognition |
| Form of Instruction and Learning | Lecture (2 SWS), Lab Exersise (2 SWS) |
| Entry Requirements | No formal prerequisites. Skills and Knowledge in Programming with Java and Android are recommended. |
| Literature, Teaching Method and Media | • Bill Philips, Chris Stewart, Brian Hardy, Kristin Marsiciano, Brian Gardner, Android– Programming, Big Nerd Ranch Guide (4th Edition), 2019<br>• Thomas Künneth, Android 11: Das Praxisbuch für Entwickler. Apps entwickeln mit Android Studio 4 und KotlinPress, Rheinwerk Computing, 2020<br>• Android Sensor Programming By Example, Packt Publishing, 2016 |
| Author of Indenture | |
| Used in Study Programs | Master Applied Computerscience |
| Workload Components / Total Workload | overall 150h comprising of 60h in-person training, 60h of self-study and 30h exam preperation and exam |
| Credits and Weight in final Mark | 5ECTS weight: 5 / 120 |
| Assessment | Alternative Examination (submitted project (95%) and a written documentation of three pages (5%)) |
| Term | Term 2 |

| Name of Course | Mobile Systems |
|---|---|
| Frequency of Course | once per study year |
| duration | 1 term(s) |
| kind of module (compulsory, compulsory elective, elective) | compulsory elective |
| remarks | |

## Computational Intelligence

| Name of Course | Computational Intelligence |
|---|---|
| module instructor | Prof. Dr. Martin Golz |
| Learning Goals | Students should be able to<br>• Analyse problems in computational intelligence,<br>• To know and understand the basics of learning theory,<br>• Design process chains of adaptive data analytics,<br>• Understand and apply classification methods,<br>• Understand and apply methods of multivariate regression,<br>• To know and analyse artificial neural networks,<br>• Know and analyse deep learning architectures. |
| Module Content | 1. Introduction<br>  1. Computational intelligence (CI) disciplines & definitions<br>  2. Six types of statistical inference (CI tasks)<br>  3. CI process chain<br>2. Statistical learning theory<br>  1. Empirical risk minimisation<br>  2. Probably approximately correct learning<br>  3. Generalised agnostic learning model<br>  4. Learning with uniform convergence<br>  5. Bias-complexity trade-off<br>  6. Vapnik Chervonenkis dimension<br>  7. Fundamental theorem of statistical learning<br>  8. Structural risk minimisation<br>3. Multivariate linear models<br>  1. Linear discriminant analysis (LDA)<br>  2. Multi-Class LDA<br>  3. Linear multivariate regression, maximum likelihood principle<br>  4. Principle of maximum a-posteriori probability<br>4. Generalised models<br>  1. Dual representation<br>  2. Kernel functions<br>  3. Theorem of Cover<br>  4. Radial basis function networks<br>  5. Recursive least mean squares minimisation |

| Name of Course | Computational Intelligence |
|---|---|
| | 5. Adaptive filter<br>1. Linear adaptive filtering algorithms: Least mean squares, recursive least squares, extended recursive least squares<br>2. Nonlinear adaptive filtering algorithms: Kernel least mean squares, extended kernel least mean squares<br>6. Support vector machines (SVM)<br>1. Largest margin concept<br>2. Soft margin concept<br>3. Kernel substitution concept (kernel trick)<br>7. Boosting methods<br>1. Strong and week learnability<br>2. AdaBoost: Adaptive boosting<br>3. Gradient boosting<br>4. Decision trees<br>8. Artificial neural networks (ANN)<br>1. Neurons, perceptrons, multilayer perceptron network<br>2. Feed forward neural networks, simple learning rules<br>3. Error back propagation<br>4. Validation analysis<br>9. Deep learning architectures: Long short-term memory networks (LSTM)<br>1. Forward and recurrence calculations<br>2. Enrolment through time<br>3. LSTM cell, LSTM cell layer, Vanilla LSTM cell layer<br>4. Gated recurrent units<br>10. Deep learning architectures: Convolutional neural networks (CNN)<br>1. Convolutional layers<br>2. Pooling layers<br>3. Fully connected layers, softmax layers<br>4. LeNet-5 & AlexNet architecture<br>5. Residual blocks & residual networks (ResNet)<br>11. Deep learning architectures: Transformer networks<br>1. Input preparation, embedding concept<br>2. Attention, multi-head attention, masking; layer normalisation<br>3. Encoder & decoder architecture<br>4. Visual transformer networks |
| Form of Instruction and Learning | Lecture (3 SWS), Lab Exersise (1 SWS) |

| Name of Course | Computational Intelligence |
|---|---|
| Entry Requirements | No formal prerequisites. Basic knowledge of linear algebra, analysis, statistics and probability calculus are recommended. |
| Literature, Teaching Method and Media | Blackboard lecture using<br>• Scripts with blank spaces<br>• Computer aided presentation<br>• Demonstration programmes<br>Exercises in the computer pool<br>• Programming with PYTHON or MATLAB<br>• Utilization of the Keras / TensorFlow® framework<br>• Clarification of open questions<br>Literature<br>• Vapnik (1998) Statistical Learning Theory. Wiley<br>• Duda, Hart, Stork (2001) Pattern classification. Wiley<br>• Bishop (2006) Pattern recognition & machine learning. Springer<br>• Mohri, Rostamizadeh (2012) Foundations of machine learning. MIT press<br>• Shalev-Shwartz, Ben-David (2014) Understanding machine learning. Cambridge<br>• Nielsen (2015) Neural networks and deep learning. Determination press<br>• Haykin (2018) Neural networks and learning machines. 3rd edition. Pearson |
| Author of Indenture | |
| Used in Study Programs | Master Applied Computerscience |
| Workload Components / Total Workload | overall 150h comprising of 60h in-person training, 90h of self-study incl. exam preperation and exam |
| Credits and Weight in final Mark | 5ECTS weight: 5 / 120 |
| Assessment | Written Exam (exam of 120min) |
| Term | Term 2 |
| Frequency of Course | once per study year |
| duration | 1 term(s) |
| kind of module (compulsory, compulsory elective, elective) | compulsory elective |
| remarks | |

## Agile Software Development

| Name of Course | Agile Software Development |
|---|---|
| module instructor | Prof. Dr. Kurt Englmeier |
| Learning Goals | **Knowing/Perceiving**: Students learn basic concepts and methods of agile software development. Based on their knowledge acquired in the Bachelor course project management they better understand how to adopt the concept of Agility in Project Management. The course addresses in particular the SCRUM methodology.<br>**Applying**: The students also learn tools supporting agile project management.<br>**Analyzing/Evaluating**: The course applies and reflects traditional project management tools in the light of agility. This contrasts the two approaches and highlights the differences and the applicability of agility to different project settings.<br>**Synthesizing**: The course trains also the use of Agile Project Management tools. The students set up a project in teams and manage their fictive work. They are encouraged to link their project management with a project they complete in a different course during the same semester. |
| Module Content | 1. Understanding Agile<br>a. Values and Principles<br>b. Agile Methodologies and Frameworks<br>c. Agile Project Management Model<br>2. Adopting the Agile Approach<br>a. Initiating an Agile Project<br>b. Creating Vision and Charting a Project<br>c. Agile Contracts<br>d. Agile Documentation<br>3. SCRUM<br>a. Fundamental Concepts (User Stories, Iteration, Sprints, Backlogs,…)<br>b. Roles and team development<br>c. Communication<br>4. Agile Lifecycle<br>a. Phase models<br>b. Release planning<br>5. Performance measurement |
| Form of Instruction and Learning | Lecture (2 SWS), Lab Exersise (2 SWS) |

| Name of Course | Agile Software Development |
|---|---|
| Entry Requirements | No formal prerequisites. For a successful participation basic knowledge of project management is needed. |
| Literature, Teaching Method and Media | • Highsmith, J.: “Agile Project Management: Creating Innovative Products”, 2nd Edition, Pearson Education/Addison Wesley Professional.<br>• Stenbeck, J.: PMI-ACP® and Certified Scrum Professional Exam Prep and Desk Reference.<br>• Cohn, M.: “User Stories Applied”, Addison-Wesley, 2004.<br>• Online Courses of ACM addressing User Stories und User-Centred Design” |
| Author of Indenture | |
| Used in Study Programs | Master Applied Computerscience |
| Workload Components / Total Workload | overall 150h comprising of 60h in-person training, 90h of self-study incl. exam preperation and exam |
| Credits and Weight in final Mark | 5ECTS weight: 5 / 120 |
| Assessment | Written Exam (exam of 90min) |
| Term | Term 2 |
| Frequency of Course | once per study year |
| duration | 1 term(s) |
| kind of module (compulsory, compulsory elective, elective) | compulsory elective |
| remarks | |

## Web Applications

| Name of Course | Web Applications |
|---|---|
| module instructor | Prof. Dr. Erwin Neuhardt |
| Learning Goals | The students get to know the structure and the functionality of a web application. They will know two frameworks for building web applications based on the programming language Java. They get to know REST which is a standard for communicating between applications. The students know how to apply a framework for building web applications. They know the advantages and disadvantages of different frameworks. |
| Module Content | Elements of a web application: HTML. CSS, HTTP, Model-View-Controller Pattern, creating different parts of a web application with a framework, forms, validation, creating a response page, error handling, layout of web pages, reusable parts of web pages, principles of REST, elements of a REST interface, implementation of a REST interface |
| Form of Instruction and Learning | Lecture (3 SWS), Lab Exersise (1 SWS) |
| Entry Requirements | No formal prerequisites. Skills and knowledge in Java programming and software engineering (at least 10 ECTS) are advisable. |
| Literature, Teaching Method and Media | • Rod Johnson, Rod et al.: Spring Framework Reference Documentation, Online unter docs.spring.io<br>• w/o author: Spring Guides, Online unter spring.io/guides<br>• w/o author: Apache FreeMarker, Online unter freemarker.org<br>• w/o author: Bootstrap, Online unter getbootstrap.com<br>• w/o author: Vaadin Documentation, Online unter vaadin.com<br>• Burke, B.: RESTful Java with JAX-RS 2.0, O'Reilly, 2014 |
| Author of Indenture | |
| Used in Study Programs | Master Applied Computerscience |
| Workload Components / Total Workload | overall 150h comprising of 60h in-person training, 60h of self-study and 30h exam preperation and exam |
| Credits and Weight in final Mark | 5ECTS weight: 5 / 120 |
| Assessment | Written Exam (exam on a PC of 120min) |
| Term | Term 3 |
| Frequency of Course | once per study year |
| duration | 1 term(s) |
| kind of module (compulsory, compulsory elective, elective) | compulsory elective |
| remarks | |

## IT Security - Advanced Chapters

| Name of Course | IT Security - Advanced Chapters |
|---|---|
| module instructor | Prof. Ralf C. Staudemeyer, PhD |
| Learning Goals | This course teaches students to improve their ability to understand and master current developments in IT-Security and Privacy-Enhancing Technologies (PET). Students learn research techniques that they will apply on pre-selected research topics. Aside from a comprehensive literature research, students will develop a scientific contribution. Results will be presented in form of a conference contribution. This includes a presentation and an academic publication. |
| Module Content | This course takes place in form of an academic conference. Students go thought the typical phases of a scientific contribution: extended abstract, review, camera ready version, full paper and 30minutes presentation. All presentations will be in the course of an internal conference-like event open to all university members near the end of the semester. A selection of the written contributions will be published in form of a technical report. Overall, the event comes with few meetings of all participants. Questions that arise during the processing of the individual research topics are clarified within working groups and with the lecturer at regular individual meetings.<br>Typical “hot” research topics are, for example, in the areas<br>• Security monitoring and visualization<br>• Internet-of-Things // Industry4.0<br>• Privacy-Enhancing Technologies<br>• Machine Learning in IT-Security |
| Form of Instruction and Learning | Lecture (2 SWS), Lab Exersise (2 SWS) |
| Entry Requirements | No formal requirements. For a successful attendance knowledge in foundations of IT-security is necessary. |
| Literature, Teaching Method and Media | Selected literature regarding current topics. |
| Author of Indenture | |
| Used in Study Programs | Master Applied Computerscience |
| Workload Components / Total Workload | overall 150h comprising of 60h in-person training, 60h of self-study and 30h exam preperation and exam |
| Credits and Weight in final Mark | 5ECTS weight: 5 / 120 |
| Assessment | Alternative Examination (Project proposal (5p) 10%, Short Paper (7p) 25%, Paper reviews (3x1p) 20%, Project presentation (25min) 20% Final report (25p) 25%) |

| Name of Course | IT Security - Advanced Chapters |
|---|---|
| Term | Term 3 |
| Frequency of Course | once per study year |
| duration | 1 term(s) |
| kind of module (compulsory, compulsory elective, elective) | compulsory elective |
| remarks | |

## Text Analysis and Data Search

| Name of Course | Text Analysis and Data Search |
|---|---|
| module instructor | Prof. Dr. Englmeier |
| Learning Goals | **Knowing/Perceiving**: Students learn essentials in content extraction and information retrieval as the basis of content analysis in texts, which, in turn, provide the theoretical basis for the successful design of advanced content analysis.<br>**Applying**: The students implement the methods they learn while using well-established tools for data analysis (for example, Apache Lucene), which are valuable for the design of search engines.<br>**Analyzing/Evaluating**: In the teamwork of the project, the students apply their theoretical design knowledge in the development of specialty search engines. They embrace thus the design versatility in the development of features for text analysis and retrieval. In their practical work they can reflect the effectiveness and potentials of their design approaches.<br>**Synthesizing**: The result of the course is manifested in a course-wide project that involves the development of a search engine with special search features. Application development is thereby broken down into smaller work packages. Each team (two or three students) assumes a work package, organizes its individual tasks, and contributes to the management of the overall project. The self-empowered organization of the project work also includes explorative learning. Students are so encouraged to learn new methodologies or tools on their own (with support from the professor), provided their individual part of the project work requires that. |

| Name of Course | Text Analysis and Data Search |
|---|---|
| Module Content | 1. Fundamentals in Information Retrieval (IR)<br>• Basic IR concepts<br>• Regular Expressions<br>• XML<br>2. User Interaction<br>• User story structure & validation<br>• Feature charts<br>• User support<br>3. Retrieval models & evaluation<br>4. Apache Lucene<br>• Modules<br>• Integration (Java)<br>5. Indexing<br>• Tokenization<br>• Stopwords<br>• Stemming<br>• Synonyms<br>6. Query matching<br>• Query vectors<br>• Matching models |
| Form of Instruction and Learning | Lecture (2 SWS), Lab Exersise (2 SWS) |
| Entry Requirements | No formal prerequisites. Solid practical programming skills are recommended. |
| Literature, Teaching Method and Media | • Baeza-Yates, R.; Ribeiro-Neto, B.: “Modern Information Retrieval”, ACM Press, New York, 1999.<br>• McCandless, M. et al: “Lucene in Action”, Second Edition, Manning, Stamford, 2010.<br>• Application examples from search engines in practice |
| Author of Indenture | |
| Used in Study Programs | Master Applied Computerscience, Master Wirtschaftsinformatik und Digitale Transformation |
| Workload Components / Total Workload | overall 150h comprising of 60h in-person training, 60h of self-study and 30h exam preperation and exam |
| Credits and Weight in final Mark | 5ECTS weight: 5 / 120 |
| Assessment | Alternative Examination (project (50%) with written documentation of approx. 10pgs and oral exam (50%)) |

| Name of Course | Text Analysis and Data Search |
|---|---|
| Term | Term 3 |
| Frequency of Course | once per study year |
| duration | 1 term(s) |
| kind of module (compulsory, compulsory elective, elective) | compulsory elective |
| remarks | |

## Selected Chapters Functional Programming

| Name of Course | Selected Chapters Functional Programming |
|---|---|
| module instructor | Prof. Dr. Erwin Neuhardt |
| Learning Goals | Students know the concepts of functional programming and their implementation in Scala. They can apply these concepts in a specific application context. |
| Module Content | Elements of functional programming - Functions, non-recursive and recursive - Error treatment in functional programs - Lists - Case classes - Functors and monads - Input and output in functional programs - traits-based tests |
| Form of Instruction and Learning | Lecture (2 SWS), Lab Exersise (2 SWS) |
| Entry Requirements | No formal prerequisites. Knowledge in basics of Java is advisable. |
| Literature, Teaching Method and Media | • Alvin Alexander: Functional Programming, Simplified, [CreateSpace Independent Publishing Platform], 2017<br>• Paul Chiusano, Runar Bjarnason: Functional Programming in Scala, Manning, 2014<br>• Jason Swartz: Learning Scala, O'Reilly, 2015 |
| Author of Indenture | |
| Used in Study Programs | Master Applied Computerscience |
| Workload Components / Total Workload | overall 150h comprising of 60h in-person training, 60h of self-study and 30h exam preperation and exam |
| Credits and Weight in final Mark | 5ECTS weight: 5 / 120 |
| Assessment | Written Exam (exam on a PC 120min) |
| Term | Term 2 |
| Frequency of Course | once per study year |
| duration | 1 term(s) |
| kind of module (compulsory, compulsory elective, elective) | compulsory elective |
| remarks | |

## Knowledge Discovery in Databases

| Name of Course | Knowledge Discovery in Databases |
|---|---|
| module instructor | Junior-Prof. Constantin Pohl |
| Learning Goals | • Getting an overview about algorithms and concepts of KDD and Data Science<br>• Ability to estimate, select and implement specific algorithms for a given application<br>• Perspective of Data Science techniques from a database viewpoint<br>• Knowing ongoing trends and challenges like analyzing graph structures, text documents, spatial and temporal data |
| Module Content | Basics of KDD, KDD term, KDD process (Selection, Preprocessing, Transformation, Data Mining, Evaluation), Data Mining Algorithms: Frequent Pattern Mining, Clustering, Classification, Stream Mining, Graph Mining, Text Mining |
| Form of Instruction and Learning | Lecture (3 SWS), Lab Exersise (1 SWS) |
| Entry Requirements | No formal prerequisites. Basic knowledge in Python programming language (Pandas Module) preferable. |
| Literature, Teaching Method and Media | • M. Ester, J. Sander: Knowledge Discovery in Databases, Springer Verlag, 2000<br>• V. Kumar, M. Steinbach, P. Tan: Introduction to Data Mining, Addison Wesley, 2005<br>• J. Han, M. Kamber: Data Mining: Concepts and Techniques, Morgan Kaufmann Publishers, 2000<br>• D. Hand, H. Mannila, P. Smyth: Principles of Data Mining, The MIT Press, 2001<br>• Lecture Slides |
| Author of Indenture | |
| Used in Study Programs | Master Applied Computerscience |
| Workload Components / Total Workload | overall 150h comprising of 60h in-person training, 45h of self-study and 45h exam preperation and exam |
| Credits and Weight in final Mark | 5ECTS weight: 5 / 120 |
| Assessment | Written Exam (exam on a PC of 90min) |
| Term | Term 1 |
| Frequency of Course | once per study year |
| duration | 1 term(s) |
| kind of module (compulsory, compulsory elective, elective) | compulsory elective |

| | |
|---|---|
| Name of Course | Knowledge Discovery in Databases |
| remarks | |

## 3D Content Creation

| Name of Course | 3D Content Creation |
|---|---|
| module instructor | Prof. Hartmut Seichter, PhD |
| Learning Goals | Students learn a wide range of fundamental computer graphics concepts to create 3D content for games, animations and visualizations. In-depth, practice-oriented knowledge in the field of 3D modeling animation and compositing is taught. In addition, students learn basics principles of aesthetics, composition of space make efficient use of computer graphics to conceptualize, plan and implement visually appealing content. Latest techniques are tought to adapt to a number of 3D content pipelines through project work. |
| Module Content | • Human perception<br>• Visual communication and design methodology<br>• Scenedesign, Gestalt and semiotics<br>• Tenets of space<br>• 3D model representations and visualization<br>• modelling techniques<br>• Animationprinciples and techniques<br>• Match-Moving and Motion-Capturing<br>• Scene- and project management<br>• Image synthesis (rasterization, raytracing, pathtracing and radiosity)<br>• Lighttransport, texturing and PBR workflow<br>• Lighting and camera work<br>• special FX and 3D compositing |
| Form of Instruction and Learning | Seminar (2 SWS), Lab Exersise (2 SWS) |
| Entry Requirements | No formal prerequisites. For a successful attendance the course *Computergraphics* is recommended. |
| Literature, Teaching Method and Media | • seminar<br>• exersises<br>• inpromptu designs<br>• video tutorials |
| Author of Indenture | |
| Used in Study Programs | Master Applied Computerscience |
| Workload Components / Total Workload | overall 150h comprising of 60h in-person training, 60h of self-study and 30h exam preperation and exam |
| Credits and Weight in final Mark | 5ECTS weight: 5 / 120 |
| Assessment | Alternative Examination (submitted project (70%) and oral exam (30% ~20min)) |

| Name of Course | 3D Content Creation |
|---|---|
| Term | Term 2 |
| Frequency of Course | once per study year |
| duration | 1 term(s) |
| kind of module (compulsory, compulsory elective, elective) | compulsory elective |
| remarks | |

## Interactive Systems

| Name of Course | Interactive Systems |
|---|---|
| module instructor | Prof. Hartmut Seichter, PhD |
| Learning Goals | Students acquire in-depth knowledge to analyse graphical user interfaces, analyse and make informed design decisions. Basics of perception are taught. Students develop applicable knowledge using prototypes to measure interactions and evaluate them using scientific methods. |
| Module Content | • Perception<br>• Visual design of graphical user interfaces<br>• Application design with a focus on GUI concepts<br>• User studies<br>• Evaluation methods with interactive visual systems |
| Form of Instruction and Learning | Lecture (2 SWS), Lab Exersise (2 SWS) |
| Entry Requirements | No formal prerequisites. Knowledge in statistics and programming are advisable. |
| Literature, Teaching Method and Media | • H5P learning modules, Q&A meetings and lab sessions<br>• Excerpt from literature list:<br>– Card, Stuart K., Thomas P. Moran, and Allen Newell. The Psychology of Human-Computer Interaction. Repr. Mahwah, NJ: Erlbaum, 2008.<br>– Cooper, Alan. About Face: The Essentials of Interaction Design, 4th Edition. 4th edition. Indianapolis, IN: John Wiley and Sons, 2014.<br>– Dix, Alan, Janet Finlay, Gregory D Abowd, and Russell Beale. Human-Computer Interaction. Pearson Education, 2003<br>– Krug, Steve. Don't Make Me Think, Revisited: A Common Sense Approach to Web Usability. Third edition. Berkeley, Calif.: New Riders, 2014.<br>– Nielsen, Jakob. Usability Engineering. Boston: Academic Press, 1993. |
| Author of Indenture | |
| Used in Study Programs | Master Applied Computerscience |
| Workload Components / Total Workload | overall 150h comprising of 60h in-person training, 60h of self-study and 30h exam preperation and exam |
| Credits and Weight in final Mark | 5ECTS weight: 5 / 120 |
| Assessment | Alternative Examination (submitted project (80%) and documentation (20%)) |
| Term | Term 3 |
| Frequency of Course | once per study year |

| Name of Course | Interactive Systems |
|---|---|
| duration | 1 term(s) |
| kind of module (compulsory, compulsory elective, elective) | compulsory elective |
| remarks | |

## Image Processing 1

| Name of Course | Image Processing 1 |
|---|---|
| module instructor | Prof. Dr. Klaus Chantelau |
| Learning Goals | Students should be able - to analyse typical problems of the development of audio-visual digital formats - to understand the foundations of the compression of audio-visual signals - to understand the methods and the structure of audio-visual digital standards (G7xx, mp3, GIF/PNG, JPEG, H26x, MPEG1 / 2 / 4 ) - to apply the most important mathematical and algorithmical methods for the development of compression software moduls |
| Module Content | Color Spaces, filtering processes, Fourier, DCT, and wavelet transform, image segmentation, motion estimation and image recognition. A method for data compression (entropy coding, transform coding, predictive coding), quantization, signal processing of the human visual system, motion prediction |
| Form of Instruction and Learning | Lecture (3 SWS), Lab Exersise (1 SWS) |
| Entry Requirements | No formal requirements. Knowledge in fundamentals of linear algebra and programming are advisable. |
| Literature, Teaching Method and Media | • „Digitale Bildcodierung“ - Jens Rainer Ohm Springer 1995, ISBN 3-540-58579-6<br>• “A Wavelet Tour of Signal Processing” - Stephane Mallat Academic Press 1999, ISBN 0-12-466606-X<br>• „Bildverarbeitung für die Medizin“ - Lehmann et al. Springer 1997, ISBN3-540-61458-3<br>• “Coding and Information Theory” - Steven Roman Springer 1992<br>• „Digitale Fernsehtechnik: Datenkompression und Übertragung für DVB“ 2.Auflage - Ulrich Reimers Springer 1997, ISBN 3-540-60945-8 |
| Author of Indenture | |
| Used in Study Programs | Master Applied Computerscience |
| Workload Components / Total Workload | overall 150h comprising of 60h in-person training, 90h of self-study including exam preperation |
| Credits and Weight in final Mark | 5ECTS weight: 5 / 120 |
| Assessment | Written Exam (exam 90min) |
| Term | Term 1 |
| Frequency of Course | once per study year |
| duration | 1 term(s) |
| kind of module (compulsory, compulsory elective, elective) | compulsory elective |
| remarks | |

| Name of Course | Image Processing 1 |
| --- | --- |

## Image Processing 2

| Name of Course | Image Processing 2 |
|---|---|
| module instructor | Prof. Dr. Klaus Chantelau |
| Learning Goals | Students should be able - to analyze typical problems of the processing of digital audio-visual signals - to understand the most important mathematical and algorithmic methods for feature extraction, classification and 3D analysis of audio-visual signals. - to apply mathematical and algorithmic methods for the development of audio and image analysis software modules. |
| Module Content | Image acquisition and illumination, image conversion (front-background separation, transformations, …), image enhancement (filtering, segmentation, labeling, …), feature extraction, (geometry / contour descriptors, texture descriptors, …), 3D scene analysis, classification and measurement |
| Form of Instruction and Learning | Lecture (1 SWS), Lab Exersise (1 SWS) |
| Entry Requirements | No formal requirements. For a successfull attendance knowledge acquired from “Image Processing 1” is needed. |
| Literature, Teaching Method and Media | • „Handbuch zur Industriellen Bildverarbeitung“, FhG IRB Verlag, ISBN 978-3-8167-7386-3<br>• “Introduction to MPEG 7” - Manjunath, Salembier, Sikora Wiley, ISBN 0-471-48678-7<br>• Stereoanalyse und Bildsynthese”, O. Schreer, Springer 2005, ISBN 3-540-23439-X |
| Author of Indenture | |
| Used in Study Programs | Master Applied Computerscience |
| Workload Components / Total Workload | overall 150h comprising of 30h in-person training, 65h of project work, 10h of project proposal preparation, 45h self-study and exam preperation |
| Credits and Weight in final Mark | 5ECTS weight: 5 / 120 |
| Assessment | Written Exam (exam 90min) |
| Term | Term 3 |
| Frequency of Course | once per study year |
| duration | 1 term(s) |
| kind of module (compulsory, compulsory elective, elective) | compulsory elective |
| remarks | |

## Media Production

| Name of Course | Media Production |
|---|---|
| module instructor | Prof. Dr. Klaus Chantelau |
| Learning Goals | • Students understand the advanced technical basics of modern camera and studio technology<br>• Students know the features of modern video production and transmission formats such as RAW and H.264<br>• Students know the advanced basics for understanding colour spaces, colour correction and keying<br>• Students are familiar with the problems and algorithmic-technical solutions for camera calibration<br>• Students know the problems and algorithmic-technical solutions for tracking and video compositing<br>• Students know the problems and algorithmic-technical solutions for 360-degree and stereovideo productions<br>• Students have the practical skills to produce audio-visual media and are particularly proficient in the use of modern video camera and lighting technology, audio recording technology, animation, audio and video post-production systems (such as Adobe CC products) as well as the use of green screen and mixed reality techniques |
| Module Content | • Studio and green screen technology for video production<br>• Camera calibration, tracking and video compositing<br>• Colour grading and post-production<br>• Practical realisation of green screen-based video productions. |
| Form of Instruction and Learning | Lecture (2 SWS), Lab Exersise (2 SWS) |
| Entry Requirements | No formal requirements. |
| Literature, Teaching Method and Media | Hasche, E., Ingwer, P., Games of Color - Moderne Bewegtbildproduktion, Springer Verlag, 2016 |
| Author of Indenture | |
| Used in Study Programs | Master Applied Computerscience |
| Workload Components / Total Workload | overall 150h comprising of 60h in-person training, 45h of self-study and 45h exam preperation and exam |
| Credits and Weight in final Mark | 5ECTS weight: 5 / 120 |
| Assessment | Alternative Examination (exam results are weighted over 50% video project and 50% written exam. Two presentations have to be held. The grade for the videoproject comprises 80% of the submitted video and 20% of the presentations.) |
| Term | Term 2 |

| Name of Course | Media Production |
|---|---|
| Frequency of Course | once per study year |
| duration | 1 term(s) |
| kind of module (compulsory, compulsory elective, elective) | compulsory elective |
| remarks | |

## Virtual and Augmented Environments

| Name of Course | Virtual and Augmented Environments |
|---|---|
| module instructor | Prof. Hartmut Seichter, PhD |
| Learning Goals | Students acquire in depth knowledge with technologies of Mixed, Augmented and Virtual Reality. The state of the art is discussed in detail in this seminar. Using today's VR/AR and MR technologies the participants will implement a prototype to learn about the possibilities of current immersive media products. |
| Module Content | • tracking technolgies<br>• display technologies in VR and AR<br>• interaction devices<br>• interaction techniques<br>• realtime rendering methods<br>• stereo rendering<br>• compositing<br>• UX and evaluation methods in VR/AR<br>• human factors in VR/AR |
| Form of Instruction and Learning | Seminar (2 SWS), Lab Exersise (2 SWS) |
| Entry Requirements | No formal prerequisites. For a successful attendance, knowledge of the topics covered in the module Computergraphics is required. |
| Literature, Teaching Method and Media | • slides, lecture, impulse talks<br>• excerpt of the literature list:<br>– Drummond, T., and R. Cipolla. "Real-Time Visual Tracking of Complex Structures." IEEE Transactions on Pattern Analysis and Machine Intelligence 24, no. 7 (July 2002): 932-46. https://doi.org/10.1109/TPAMI.2002.1017620.<br>– LaViola, Joseph J., Ernst Kruijff, Ryan P. McMahan, Doug A. Bowman, and Ivan Poupyrev. 3D User Interfaces: Theory and Practice. Second edition. Addison-Wesley Usability and HCI Series. Boston: Addison-Wesley, 2017.<br>– Stanney, Kay, Cali Fidopiastis, and Linda Foster. "Virtual Reality Is Sexist: But It Does Not Have to Be." Frontiers in Robotics and AI 7 (January 31, 2020). https://doi.org/10.3389/frobt.2020.00004.<br>– Wloka, Mathias M. "Interacting with Virtual Reality." In In Virtual Environments and Product Development Processes, edited by J. Rix, S. Haas, and J. Teixeira. Chapman and Hall, 199. |
| Author of Indenture | |
| Used in Study Programs | Master Applied Computerscience |
| Workload Components / Total Workload | overall 150h comprising of 60h in-person training, 90h of self-study and project preperation |

| Name of Course | Virtual and Augmented Environments |
|---|---|
| Credits and Weight in final Mark | 5ECTS weight: 5 / 120 |
| Assessment | Alternative Examination (submitted project (80%) and documentation (20%)) |
| Term | Term 3 |
| Frequency of Course | once per study year |
| duration | 1 term(s) |
| kind of module (compulsory, compulsory elective, elective) | compulsory elective |
| remarks | |

## Service-oriented Networks

| Name of Course | Service-oriented Networks |
|---|---|
| module instructor | TBA |
| Learning Goals | Students - will get advanced knowledge on the requirements of multimedia streams in networks, - should be able to correlate deficiencies in the quality of network services with properties of the network and traffic characteristics, - will get advanced knowledge on the approach of quality of service and congestion control, - should be able to identify and to analyze quality of service as well as congestion control approaches at all concerned OSI levels and - should be able to react on shift and variation of quality of service when programming distributed systems. |
| Module Content | • Modern applications and their requirements for networks<br>• Congestion control<br>– Quality of service<br>– classes of service<br>– signaling<br>– traffic management<br>– buffer management<br>• TCP congestion control<br>• quality of service at OSI level two (ATM, LAN, MPLS)<br>• Internet quality of service<br>– Integrated services<br>– Differentiated services<br>• Advanced transport control protocols |
| Form of Instruction and Learning | Lecture with Seminar (3 SWS), Lab Exersise (1 SWS) |
| Entry Requirements | No formal prerequisites. Good knowledge in communication networks is expected. |

| Name of Course | Service-oriented Networks |
|---|---|
| Literature, Teaching Method and Media | • Badach, A., Voice over IP Die Technik, Hanser, München, 2005.<br>• Badach, A. & Hoffmann, E., Technik der IP-Netze Internet Kommunikation in Theorie und Einsatz, 4. Auflage, München, 2019<br>• Braun, T. & Zitterbart, M.. Hochleistungskommunikation, Band 2: Transportdienste und –protokolle.Oldenbourg Verlag 1996.<br>• Kurose, J.F. & Ross, K.W. Computernetzwerke.Pearson Studium, München 2008.<br>• Lu, G., Communication and Computing for Distributed Multimedia Systems.Artech House 1996.<br>• Schmitz, R., Kiefer, R., Maucher, J., Schulze, J. &Suchy, T. Kompendium Medieninformatik. Mediennetze. Springer 2006.<br>• Shin, J., Lee, D.C. &Kuo, C.-C.J., Quality of Service for Internet Multimedia,Prentice Hall 2004<br>• Siegel, E.D., Quality of Service. Solutions for the Enterprise.Wiley 2000<br>• Wang, Z., Internet QoS Architectures and Mechanisms for Quality of Service, San Francisco, 2001 |
| Author of Indenture | |
| Used in Study Programs | Master Applied Computerscience |
| Workload Components / Total Workload | overall 150h comprising of 60h in-person training, 60h of self-study and 30h exam preperation and exam |
| Credits and Weight in final Mark | 5ECTS weight: 5 / 120 |
| Assessment | Written Exam (exam 120min) |
| Term | Term 2 |
| Frequency of Course | once per study year |
| duration | 1 term(s) |
| kind of module (compulsory, compulsory elective, elective) | compulsory elective |
| remarks | |

## Human Machine Interaction

| Name of Course | Human Machine Interaction |
|---|---|
| module instructor | Prof. Dr. Kurt Englmeier |
| Learning Goals | **Knowing/Perceiving**: Students learn essentials in cognitive science as the basis of human-machine communication, which, in turn, provide the theoretical basis for the successful design of user interaction. They deal in particular with the user and task analysis.<br>**Applying**: The theoretical knowledge guides the students in developing user stories that serve as blueprints for the user interaction. The course emphasizes the implementation of interaction in different environments using, for example, the description language for user interfaces in mobile applications (XAML etc.). It outlines in particular the role of natural language in interaction.<br>**Analyzing/Evaluating**: Students develop in teams concrete user interfaces for different tasks. According to the task and user analysis they set up objectives, that are validated in the actual implementation.<br>**Synthesizing**: The result of the course is manifested in a course-wide project that involves the development of an application with a high degree of user interaction. Application development is thereby broken down into smaller work packages. Each team (two or three students) assumes a work package, organizes its individual tasks, and contributes to the management of the overall project.<br>The self-empowered organization of the project work also includes explorative learning. Students are so encouraged to learn new methodologies or tools on their own (with support from the professor), provided their individual part of the project work requires that. |

| | |
|---|---|
| Name of Course | Human Machine Interaction |
| Module Content | 1. Basics<br>• Essentials in Cognition<br>• Basic Information Retrieval (IR) concepts<br>• Regular Expressions<br>• XML<br>2. User Analysis<br>• How to Define Users and Tasks<br>• Mental Models<br>• Development of User Stories<br>3. Design, Implementation<br>• GUI controls<br>• XAML<br>• GUI Development in Different Environments<br>4. Evaluation<br>• Usability Principles<br>• Methods |
| Form of Instruction and Learning | Lecture (2 SWS), Lab Exersise (2 SWS) |
| Entry Requirements | No formal prerequisites. Solid practical programming skills are advisable. |
| Literature, Teaching Method and Media | • Carroll, J.M.: ”Human-Computer Interaction in the New Millennium”, ACM Press, New York, 2001.<br>• Cohn, M.: “User Stories Applied”, Addison-Wesley, 2004.<br>• Online Courses of ACM addressing User Stories und User-Centred Design |
| Author of Indenture | |
| Used in Study Programs | Master Applied Computerscience |
| Workload Components / Total Workload | overall 150h comprising of 60h in-person training, 60h of self-study and 30h exam preperation and exam |
| Credits and Weight in final Mark | 5ECTS weight: 5 / 120 |
| Assessment | Alternative Examination (project (50%) with written documentation of approx. 10pgs and oral exam (50%)) |
| Term | Term 2 |
| Frequency of Course | once per study year |
| duration | 1 term(s) |

| Name of Course | Human Machine Interaction |
| --- | --- |
| kind of module (compulsory, compulsory elective, elective) | compulsory elective |
| remarks | |

## Metamodeling Platforms for Application Development

| | |
|---|---|
| Name of Course | Metamodeling Platforms for Application Development |
| module instructor | Prof. Dr. Florian Johannsen |
| Learning Goals | • Students are able to understand the connection between conceptual model types for various application fields (e.g., industry 4.0, quality management, IS development, etc.) and their corresponding meta models.<br>• Further, they will be able to design their own modeling methods via meta models.<br>• Additionally, students will learn about the functionalities of metamodeling platforms for realizing modeling applications.<br>• More, they will be able to develop their own modeling applications by help of the freely available metamodeling platform ADOxx (www.adoxx.org). |
| Module Content | The lecture includes the following topics:<br><br>1. Introduction and modeling scenarios<br>2. Basics of conceptual modeling<br>3. Metamodeling<br>4. Metamodeling platforms<br>5. Procedure for developing applications by help of metamodeling platforms<br>6. The ADOxx-platform & Hands-on with ADOxx |
| Form of Instruction and Learning | Lecture (2 SWS) |
| Entry Requirements | No formal prerequisites. |
| Literature, Teaching Method and Media | • Lecture slides<br>• Tutorials provided by the ADOxx platform<br><br>The following articles are recommended:<br><br>• Fill, H.-G. and D. Karagiannis (2013). “On the Conceptualization of Modelling Methods Using the ADOxx Meta Modelling Platform.” Enterprise Modelling and Information Systems Architectures – An International Journal 8(1): 4-25.<br>• Johannsen, F. and H.-G. Fill (2017). “Meta Modeling for Business Process Improvement.” Business & Information Systems Engineering 59(4): 251-275.<br>• Johannsen, F. and H.-G. Fill (2016). Supporting Business Process Improvement Through a Modeling Tool. In: Domain-Specific Conceptual Modeling. (Eds) D. Karagiannis, C. H. Mayr and J. Mylopoulos. Berlin/Heidelberg, Springer: 217-237. |

| Name of Course | Metamodeling Platforms for Application Development |
|---|---|
| Author of Indenture | |
| Used in Study Programs | Master Applied Computerscience |
| Workload Components / Total Workload | presence time 40 hours, self-study 55 hrs, exam preparation 55 hrs |
| Credits and Weight in final Mark | 5ECTS weight: 5 / 120 |
| Assessment | Written Exam (exam 90min) |
| Term | Term 1 |
| Frequency of Course | once per study year |
| duration | 1 term(s) |
| kind of module (compulsory, compulsory elective, elective) | compulsory elective |
| remarks | |