TECHNISCHE HOCHSCHULE
OSTWESTFALEN-LIPPE
UNIVERSITY OF
APPLIED SCIENCES
AND ARTS

Department of

Electrical Engineering and Computer Science

Module Handbook for the Master Degree Program

Information Technology (M.Sc.)

Content Management

Version	Datum / Date	Geändert von / Revised by	Änderung / Revision
1.0	14 Feb 2024	Rübner	Creation of a module handbook containing all modules included in the master's program Information Technology (M.Sc.) (Source: Version 1.8 of the department-wide master's module handbook dated 7 December 2023)
2.0	14 Nov 2024	Rübner	Addition of new module numbers
2.1	3 Dec 2024	Rübner	IDS / 5912 / 11763: Update of category 'form of teaching', ESD / 5917 / 11658: Update of lecturer (vacant), ATA / 5915 / 11952: Update of the lecturer's academic grade
2.2	9 Dec 2024	Rübner	IDS / 5912 / 11763: Update of the categories 'Lecturers' and 'Examination', IFU / 5919 / 11828: Update of the categories 'Lecturers', 'Examination' and 'Literature'

Inhalt

Advanced Topics in Algorithms (ATA / 5915 / 11952)

Course name:	**Advanced Topics in Algorithms** Abbr.: ATA MNR: 5915 / 11952
Frequency of offer:	Winter term
Responsible lecturer:	Prof. Dr. rer. nat. Helene Dörksen
Lecturer:	Dr. Jens Otto
Language:	English Last update: 03.12.2024
Use of the module in the programs/ Semester of study:	Information Technology (M. Sc.): Full-time study: first semester, part-time study: first or third semester; compulsory module
Form of teaching/ Hours per week:	Lecture / 2 hours per week, Computer lab / 2 hours per week
Contact hours/ Self-study:	60 hours confrontation time (lectures, exercises, and labs) plus 90 hours additional student individual work / homework time
Credit points / Workload:	5 CR / 150 h
Prerequisites:	**Formal requirements:** / **Content requirements:** Software development skills using object-oriented programming languages
Learning objectives, competencies:	Competence to describe, analyze and benchmark algorithms. Students of Information Technology have the skills to identify task-specific requirements and are capable of selecting suitable algo- rithms. They are able to implement algorithms in an object-oriented programming language.
Contents:	Complexity and benchmarking of algorithms, optimization of algo-rithms, knowledge engineering and machine learning algorithms, e.g. propositional and first order logic, probabilistic state machines and hidden Markov models, rule-based systems, adaptive resonance the-ory algorithms; implementation of algorithms
Examination	Written examination, oral examination, written report. The grade equals the grade for the module.
Literature:	Sedgewick, R.: Algorithms. Pearson, 2011. Cormen, T. H./Leiserson, C.E/Rivest, R.L./Stein, C: Introduction to Al-gorithms. MIT Press, 2nd edition, 2001. Dasgupta, S./Papadimitriou, C., Vazirani, U.: Algorithms. Higher Edu-cation. McGrawHill, 1st edition, 2008. Jones, M.T: AI Application Programming. Charles River Media, 2003. Russel, S. / Norvig, P.: Artificial Intelligence - A Modern Approach. Pearson Education / Prentice Hall, 2nd edition, 2003.

Advanced Topics in Machine Learning (AML / 5924 / 11663)

Course name:	**Advanced Topics in Machine Learning** Abbr.: AML MNR: 5924 / 11663
Frequency of offer:	Summer term
Responsible lecturer:	Prof. Dr. Markus Lange-Hegermann
Lecturer:	Prof. Dr. Markus Lange-Hegermann
Language:	English Last update: 14.11.2024
Use of the module in the programs/ Semester of study:	Elektrotechnik (M.Sc.): Second semester; compulsory optional module Information Technology (M. Sc.): Full-time study: second semester, part-time study: second or fourth semester; compulsory optional module
Form of teaching/ Hours per week:	Seminar / 4 hours per week
Contact hours/ Self-study:	60 hours confrontation time (lectures and exercises) plus 90 hours additional student individual work / homework time
Credit points / Workload:	5 CR / 150 h
Prerequisites:	**Formal requirements:** / **Content requirements:** Undergraduate mathematics; knowledge of probability and statistics, knowledge of programming and data structures
Learning objectives, competencies:	The students know and understand basic concepts of machine learning and are able to apply them to given problems. Students are able to look for and understand additional algorithms by studying the relevant literature in Machine Learning.
Contents:	Foundations of machine learning: (un)supervised learning, overfitting, double descent, Ockham's razor, and models. Loss functions and models in logistic and linear regression. Deep neural networks, recurrency, convolution, transformers, backpropagation, batchnorm, layernorm, groupnorm, including applications in time series, and images. Large language models and prompting. Gaussian processes, kernel methods and kernel algebra, covariance structures, sampling, and variance estimations. Generative methods like PCA, autoencoders and VAEs. The knowledge about these algorithms is in part acquired by the students themselves from both textbooks and current papers. Practical sessions are being held to implement such machine learning algorithms. The course ends with presentations by students on current papers in ML.
Examination	Oral examination, duration 30 minutes. The grade equals the grade for the module.
Literature:	Bishop, Pattern Recognition and Machine Learning, Springer, 2007. Courville, Goodfellow, Bengio, Deep Learning. MIT Press, 2016. Rasmussen, Williams, Gaussian Processes for Machine Learning. MIT Press, 2005. Jaynes, Probability Theory: The Logic of Science. Cambridge University Press /(CUP), 2003. Murphy, Probabilistic Machine Learning: An Introduction. CUP, 2022. Murphy, Probabilistic Machine Learning: Advanced Topics. CUP, 2023. Current papers: arXiv, JMLR, NeurIPS, ICML.

Authentication (AUT / 5928 / 11814)

Course name:	**Authentication** Abbr.: AUT MNR: 5928 / 11814
Frequency of offer:	Summer term
Responsible lecturer:	Prof. Dr. rer. nat. Helene Dörksen
Lecturer:	Prof. Dr. rer. nat. Helene Dörksen
Language:	English Last update: 14.11.2024
Use of the module in the programs/ Semester of study:	Information Technology (M. Sc.): Full-time study: second semester, part-time study: second or fourth semester; compulsory optional module Smart Health Sciences (M.Sc.): second semester; compulsory module
Form of teaching/ Hours per week:	Lecture / 2 hours per week Exercise / 1 hour per week Lab / 1 hour per week
Contact hours/ Self-study:	60 hours confrontation time (lectures and exercises) plus 90 hours additional student individual work / homework time
Credit points / Workload:	5 CR / 150 h
Prerequisites:	**Formal requirements:** / **Content requirements:** Mathematics 1-4, Machine Learning, Statistics, Applied and Discrete Mathematics
Learning objectives, competencies:	The students are able to familiarize themselves with the theoretical foundations of questions relevant to authentication. They are capable of developing suitable solution concepts for specific problems.
Contents:	Lecture: The lecture introduces theoretical topics with relevance to authentication; i.e.: • methods of non-linear signal and image processing, • multivariate data analysis, • feature engineering, • classification optimization and • automation methods for authentication systems. The lecture also tackles many application scenarios of authentication methods within health and life sciences. In addition, a look is taken at the following fields of application: • banknote authentication, • error identification in the monitoring of textile manufacturing processes, • authentication of geometric structures in digital spaces. Exercise / Lab: The lecture contents are deepened on the basis of appropriate tasks. For particular tasks, Matlab is used.
Examination	Preparation of Term Paper (length: 20 pages, preparation time period: 8 weeks). The grade equals the grade for the module.
Literature:	Guyon, I.M., Gunn, S.R., Nikravesh, M. and Zadeh, L. (eds.) (2006): Fea- ture Extraction, Foundations and Applications, Springer Ethem Alpaydin (2014): Introduction to Machine Learning (3nd ed.). The MIT Press. Alice Zheng, Amanda Casari (2018): Feature Engineering for Machine Learning: Principles and Techniques for Data Scientists, O'Reilly Media Maimon, Oded, Rokach, Lior. (2010). Data Mining and Knowledge Dis- covery Handbook, 2nd ed., Springer Esther M. Arkin, L. Paul Chew, Daniel P. Hüttenlocher, Klara Kedem, Joseph S. B. Mitchell (1991): An Efficiently Computable Metric for Comparing

	Polygonal Shapes. IEEE Trans. Pattern Anal. Mach. Intell. 13(3): 209-216 Isabelle Debled-Rennesson, Jean-Luc Rémy, Jocelyne Rouyer-Degli (2000): Detection of the Discrete Convexity of Polyominoes. DGCI, 491-504 L. J. Latecki and R. Lakäemper (2000): Shape Similarity Measure Based on Correspondence of Visual Parts. IEEE Trans. Pattern Analysis and Machine Intelligence (PAMI) 22 (10)

Autonomous Vehicles (AUV / 5636 / 15152)

Course name:	**Autonomous Vehicles** Abbr.: AUV MNR: 5636 / 15152
Frequency of offer:	Summer term
Responsible lecturer:	Prof. Dr.-Ing. habil. Ulrich Büker
Lecturer:	Prof. Dr.-Ing. habil. Ulrich Büker
Language:	English Last update: 14.11.2024
Use of the module in the programs/ Semester of study:	Elektrotechnik (M. Sc.): Second semester; compulsory optional module Mechatronische Systeme (M. Sc.): Second semester; compulsory optional module Information Technology (M.Sc.): Full-time study: second semester, part-time study: second or fourth semester; compulsory optional module
Form of teaching/ Hours per week:	Lecture/Seminar : 2 hours per week Lab : 2 hours per week
Contact hours/ Self-study:	60 hours confrontation time (lectures and exercises) plus 90 hours additional student individual work / homework time
Credit points / Workload:	5 CR / 150 h
Prerequisites:	**Formal requirements:** / **Content requirements:** /
Learning objectives, competencies:	The students know and understand the important areas of assisted driving and autonomous vehicles, including system design, the common sensor technologies, main functionalities. They are able to apply them and to implement algorithms for autonomous driving. The students are also able to independently develop a topic and to present it in front of a group.
Contents:	In this course, we will discuss: • Sensor technologies used for assisted and autonomous vehicles e.g. ultrasonic, camera, lidar, radar • Feature functions like intelligent cruise control, automatic emergency break, lane keeping, assisted and autonomous parking • Systems engineering for AVs • Functional safety of autonomous vehicles • Test and validation of AVs • Legal and ethical aspects of autonomous driving
Examination	Presentation with a length of 30 minutes and a processing time of 6 weeks. The grade equals the grade for the module.
Literature:	Hermann Winner, et al (Edts.): Handbook of Driver Assistance Systems, Springer, 2016 Markus Maurer, et al (Edts.): Autonomous Driving: Technical, Legal and Social Aspects, Springer, 2016 Daniel Watzenig, Martin Horn (Edts.): Automated Driving Safer and More Efficient Future Driving, Springer, 2017 Yan Li, Hualiang Shi: Advanced Driver Assistance Systems and Autonomous Vehicles, From Fundamentals to Applications, Springer, 2022 Further literature will be announced during the course

Communication for Distributed Systems (CDS / 5918 / 11951)

Course name:	**Communication for Distributed Systems** Abbr.: CDS MNR: 5918 / 11951
Frequency of offer:	Summer term
Responsible lecturer:	Prof. Dr.-Ing. Jürgen Jasperneite
Lecturer:	Prof. Dr.-Ing. Jürgen Jasperneite
Language:	English Last update: 14.11.2024
Use of the module in the programs/ Semester of study:	Elektrotechnik (M. Sc.): Second semester; compulsory optional module Information Technology (M. Sc.): Full-time study: second semester, part-time study: second or fourth semester; compulsory optional module
Form of teaching/ Hours per week:	Lecture / 2 hours per week, Lab / 2 hours per week
Contact hours/ Self-study:	60 hours confrontation time (lectures, exercises, and labs) plus 90 hours additional student individual work/homework time
Credit points / Workload:	5 CR / 150 h
Prerequisites:	**Formal requirements:** / **Content requirements:** /
Learning objectives, competencies:	**Knowledge:** The students are able to give an overview of protocol engineering for distributed real-time systems. This includes the presented formal description techniques, discrete event simulation and the performance evaluation of computer networks. **Comprehension:** The students are able to explain in detail the needed steps for a cred- ible performance evaluation of communication systems. They are able to describe the approach of discrete event simulation for per- formance evaluation. **Application:** The students are able to apply their knowledge to a practical case study using the DES tool omnet++.
Contents:	**Lecture:** 1. System theory and technologies: Basic communication concepts and patterns, services and protocols, layered communication system. 2. Performance evaluation of computer networks using discrete event simulation. **Lab:** 1. Exercises related to lectures 2. Performance evaluation study of a communication protocol with omnetpp; output analysis and representation with Matlab or R.
Examination	Written examination, duration 90 minutes. The grade equals the grade for the module.
Literature:	Coulouris, G., Dollimore, J., Kindberg, T.: Distributed Systems, Concepts and Design. 4th rev. ed. Addison Wesley, 2005. Jain, R.: The Art of Computer Systems Performance Analysis. Techniques for Experimental Design, Measurement, Simulation and Modeling. Wiley,

	1991. Popovic, M.: Communication Protocol Engineering. CRC, 2006. Tanenbaum, A. S., van Steen, M.: Distributed Systems. Principles and Paradigms. 2nd rev. ed. Prentice Hall, 2006.

Discrete Signals and Systems (DSS / 5914 / 11907)

Course name:	**Discrete Signals and Systems** Abbr.: DSS MNR: 5914 / 11907
Frequency of offer:	Winter term
Responsible lecturer:	Prof. Dr.-Ing. Uwe Meier
Lecturer:	Prof. Dr.-Ing. Uwe Meier
Language:	English Last update: 14.11.2024
Use of the module in the programs/ Semester of study:	Elektrotechnik (M. Sc.): First semester; compulsory module Information Technology (M. Sc.): Full-time study: first semester; part-time study: first or third semester; compulsory module
Form of teaching/ Hours per week:	Lecture / 3 hours per week Exercise / 1 hour per week
Contact hours/ Self-study:	60 hours confrontation time (lectures, exercises) plus 90 hours additional student individual work / homework time
Credit points / Workload:	5 CR / 150 h
Prerequisites:	**Formal requirements:** / **Content requirements:** Continuous signals and linear systems: com- plex notation, FOURIER series and transformation
Learning objectives, competencies:	The course provides basic knowledge of how discrete signals and discrete linear time-invariant systems are characterized and analyzed. Upon completion of the course students are able to - describe sampling and reconstruction of signals, - use appropriate transform methods, - understand filtering with window functions, - design frequency-selective filters, - use simulation software for signal processing. After completion of the course, students are able to critically analyze signal processing problems and create appropriate solutions.
Contents:	Repetition of time-continuous signals (energy and power signals, deterministic and random signals, cross- and auto-correlation, low- pass and band-pass signals, FOURIER and HILBERT transform, filter- ing with window functions, frequency-selective filters). Time-discrete signals (sampling theorem, discrete and fast FOURIER transform) Time-discrete systems (z-transform, filtering with window functions, frequency-selective filters)
Examination	Written examination, duration 120 minutes. The grade equals the grade for the module.
Literature:	Script with exercise problems for downloading. Hayes, M. H.: Schaum's Outlines. Digital Signal Processing. McGraw Hill. Oppenheim, A. V, Willsky, A. S.: Signals and Systems. Prentice Hall. Oppenheim, A. V., Schafer, R. W.: Discrete-Time Signal Processing. Prentice Hall.

Embedded Systems Design (ESD / 5917 / 11658)

Course name:	**Embedded Systems Design**	Abbr.: ESD MNR: 5917 / 11658
Frequency of offer:	Summer term	
Responsible lecturer:	Prof. Dr.-Ing. Jürgen Jasperneite	
Lecturer:	N.N.	
Language:	English	Last update: 03.12.2024
Use of the module in the programs/ Semester of study:	Elektrotechnik (M. Sc.): Second semester; compulsory optional module Information Technology (M. Sc.): Full-time study: second semester; part time-study: second or fourth semester; compulsory optional module	
Form of teaching/ Hours per week:	Lecture / 2 hours per week Exercise / 2 hours per week	
Contact hours/ Self-study:	60 hours confrontation time (lectures, exercises, and labs) plus 90 hours additional student individual work/homework time	
Credit points / Workload:	5 CR / 150 h	
Prerequisites:	**Formal requirements:** / **Content requirements:** /	
Learning objectives, competencies:	**Knowledge:** Students gain knowledge in the field of embedded systems. This in- cludes generic system design aspects, sensors and actuators, micro- processor basics, HDL design, components of embedded systems, testing of embedded systems, FPGA basics, embedded software inte- gration, and hardware-based acceleration approaches. **Comprehension:** Students gain competencies in the design of embedded systems with focus on real-time issues. They are able to specify embedded sys- tems and explore the design space according to applicational re- quirements as well as to implement and test embedded systems. According to the wide range of the covered topics, the students are able to understand the correlation between the different aspects of embedded system design. **Application:** The students are able to apply their knowledge in order to design practical embedded systems based on FPGA technologies.	

Contents:	**Lecture:** 1. Introduction to embedded systems: What are embedded systems, requirements for embedded systems, and communication approaches? 2. System theory and technologies: Signal processing chain, embedded processor basics, bus systems, memory concepts, external interfaces, multi- and coprocessor concepts 3. Software concepts: code development, tool-chains, operating sys- tems for embedded systems 4. Application examples from the domain of industrial automation **Lab:** 1. Exercises related to lectures 2. Fundamentals of FPGA design 3. Embedded FPGA-based system design including embedded CPUs 4. Exemplary implementation of embedded software for industrial usage
Examination	Written examination, duration 90 minutes. The grade equals the grade for the module.
Literature:	P. Marwedel: Embedded System Design. Springer, 2018. Hennessy, J. L.: Computer Architecture. A Quantitative Approach. Morgan Kaufmann, 2017. Thomas, D., Moorby, Philip: The Verilog® Hardware Description Language. Springer, 2008.

Industrial Software Engineering (ISE / 5923 / 11780)

Course name:	**Industrial Software Engineering** Abbr.: ISE MNR: 5923 / 11780
Frequency of offer:	Summer term
Responsible lecturer:	Prof.'in Dr. Jessica Rubart
Lecturer:	Prof.'in Dr. Jessica Rubart, Prof. Dr. Robert Mertens
Language:	English Last update: 14.11.2024
Use of the module in the programs/ Semester of study:	Information Technology (M. Sc.): Full-time study: second semester, part- time study: second or fourth semester; compulsory optional module
Form of teaching/ Hours per week:	Lecture / 2 hours per week, Exercises / 2 hours per week
Contact hours/ Self-study:	60 hours confrontation time (lectures, exercises, and labs) plus 90 hours additional student individual work/homework time
Credit points / Workload:	5 CR / 150 h
Prerequisites:	**Formal requirements:** / **Content requirements:** /
Learning objectives, competencies:	Students acquire the skills needed to manage software development projects. This includes the definition of an optimal software development method for a given project, identifying agile or disciplined practices suited for the project's specific needs. Students learn how to manage the resources needed to complete projects that meet business objectives. In addition, requirements engineering, risk management, knowledge management, and process improvement are important competence fields targeted by this course.
Contents:	Industrial software development process frameworks, such as the Rational Unified Process and the agile change management approach Scrum Principles of Lean Software Development *Process improvement with Six Sigma* Designing software for and with reuse Software architecture
Examination	Written examination. The grade equals the grade for the module.
Literature:	Herzum, P., Sims, O.: Business Component Factory: A Comprehensive Overview of Component-Based Development for the Enterprise. OMG / John Wiley, 2000. Poppendieck, M. and T.: Implementing Lean Software Development, Addision-Wesley, 2007. Pyzdek, T., Keller, P. A.: The Six Sigma Handbook. 3rd ed. New York: McGraw-Hill, 2009. Sommerville, I.: Software Engineering. Ninth edition. Pearson, 2010. Schwaber, K.: Agile Project Management with Scrum. Microsoft Press, 2004. Yacoub, S. M., Ammar, H. H.: Pattern-Oriented Analysis and Design: Composing Patterns to Design Software Systems. Addision-Wesley, 2003.

Information Fusion (IFU / 5919 / 11828)

Course name:	**Information Fusion** Abbr.: IFU MNR: 5919 / 11828
Frequency of offer:	Summer term
Responsible lecturer:	Prof. Dr.-Ing. Volker Lohweg
Lecturer:	Prof. Dr.-Ing. Volker Lohweg, M.Sc. Christoph-Alexander Holst
Language:	English Last update: 09.12.2024
Use of the module in the programs/ Semester of study:	Elektrotechnik (M. Sc.): Second semester; compulsory optional module Information Technology (M. Sc.): Full-time study: second semester, part-time study: second or fourth semester; compulsory optional module
Form of teaching/ Hours per week:	Lecture / 3 hours per week, Lab / 1 hour
Contact hours/ Self-study:	60 hours confrontation time (lectures, exercises, and labs) plus 90 hours additional student individual work/homework time
Credit points / Workload:	5 CR / 150 h
Prerequisites:	**Formal requirements:** / **Content requirements:** Mathematics for undergraduates, Statistics, Signals and Systems or System Modeling and Analysis, Image Analysis or Digital Image Processing
Learning objectives, competencies:	**Analyse:** The students are able to discuss sensor and information fusion concepts as well as methodologies. **Evaluate:** Furthermore, they are able to operationalize mathematical models in information fusion. **Create:** Students are also able to apply these concepts to real life scenarios, like machine conditioning.
Contents:	Information Fusion identifies the concept of combining data from different information sources, such as sensors or human experts. The conceptual strategy is based on obtaining new or more certain information by data combination. In numerous applications it is not possible to capture all necessary information or features by a single sensor source. In such cases more sensors and additive experts' know-how can generate more precise data regarding different real world systems, e.g. robots, machines and equipment, data experts systems, cognitive systems and so on. The following topics are highlighted: sensory signal representation fusion methods fusion models / multi-sensor fusion human-centric models probability theory incl. Bayes decision trees Dempster-Shafer theory Fuzzy set theory possibility theory, real world examples
Examination	Written exam, duration 120 minutes or Programming project with presentation, duration 30 minutes, The grade equals the grade for the module.

Literature:	Solaiman, B; Bossé, É: Possibility Theory for the Design of Information Fusion Systems, Springer 2019. Bossé, É; Rogova, G. L.: Information Quality in Information Fusion and Decision Making (Information Fusion and Data Science), April 2019, Springer. Bosse, É.: Concepts, Models, and Tools for Information Fusion. Artech, 2007. Campos, F.: Decision Making in Uncertain Situations. An Extension to the Mathematical Theory of Evidence. Diss. Boca Raton, 2006. Shafer, G.: A Mathematical Theory of Evidence. Princeton University Press, 1976. Thomas, C. (Ed.): Sensor Fusion. Foundation and Applications. InTech, 2011. Thomas, C. (Ed.): Sensor Fusion and Its Applications. Sciyo, 2010. Additional literature sources with current references (books, papers and online sources) will be announced in the respective lecture or exercise unit.

Innovation and Development Strategies (IDS / 5912 / 11763)

Course name:	**Innovation and Development Strategies** Abbr.: IDS MNR: 5912 / 11763
Frequency of offer:	Summer term
Responsible lecturer:	Prof. Dr.-Ing. Volker Lohweg
Lecturer:	Prof. Dr.- Ing. Volker Lohweg, Prof. Dr. phil. Reinhard Doleschal, Dr. Christian Helmig, Dipl.-Ing. ETH Johannes Schaede, Prof. Dr. rer. pol. Andreas Welling, M.Sc. Saurav Borborah
Language:	English Last update: 09.12.2024
Use of the module in the programs/ Semester of study:	Elektrotechnik (M. Sc.), Mechatronische Systeme (M. Sc.): second semester; compulsory module Information Technology (M. Sc.): Full-time study: second semester, part-time study: second or fourth semester; compulsory module
Form of teaching/ Hours per week:	Lecture / 2 hours per week Seminar / 2 hours per week
Contact hours/ Self-study:	60 hours confrontation time (lectures, exercises, and labs) plus 90 hours additional student individual work/homework time and/or group work time, depending on selection of themes
Credit points / Workload:	5 CR / 150 h
Prerequisites:	**Formal requirements:** / **Content requirements:** Elementary management skills
Learning objectives, competencies:	**Analyse:** The students are able to understand and discuss about fundamental principles and methods for innovation and development processes based on intercultural R&D strategies, knowledge management, portfolio analysis, risk management, and patent strategies for international companies. **Evaluate:** Students are able to evaluate e.g. patent applications and patents. **Create:** Furthermore, they are able to operationalize concepts e.g. on building international teams.
Contents:	Intercultural management: What is culture? Cultural behavior, International R&D teams Knowledge management: What is company knowledge? How to handle knowledge? Knowledge distribution strategies Development processes: Portfolio analysis, risk analysis, FMEA, processes for mass products, processes for single products Patent management: What are patents, patents applications, trademarks? How to read patents? Patent processing
Examination	Engineering Project (homework) with presentation, duration approx.15 minutes and written exam, duration 60 minutes. The grade consists equally of both parts. Or written exam 120 minutes (special case).

Literature:	Basis: Davenport, T. H., Prusak, L: Working Knowledge. How Organizations Manage What They Know. Harvard, 1997. Eversheim, W. (Ed.): Innovation Management for Technical Products. RWTH Edition. Springer, 2008. Jacob, N.: Intercultural Management. MBA Masterclass. Kogan Page, 2003. Nonaka, I., Takeuchi, H.: The Knowledge-Creating Company. How Japanese Companies Create the Dynamics of Innovation. Oxford University Press, 1995. Rapaille, C.: The Culture Code. Random House, 2006. Stim, R.: Patent, Copyright and Trademark. A Desk Reference to Intellectual Property Law. Nolo, 2009. Vose, D.: Risk Analysis. A Quantitative Guide. 3rd ed. Wiley, 2008. Additional literature sources with current references (books, papers and online sources) will be announced in the respective lecture or exercise unit.

Intelligent Technical Systems (ITS / 5922 / 11563)

Course name:	**Intelligent Technical Systems** Abbr.: ITS MNR: 5922 / 11563
Frequency of offer:	Summer term
Responsible lecturer:	N.N.
Lecturer:	N.N.
Language:	English Last update: 14.11.2024
Use of the module in the programs/ Semester of study:	Elektrotechnik (M. Sc.): Second semester; compulsory optional module Information Technology (M. Sc.): Full-time study: second semester; part-time study: second or fourth semester; compulsory optional module
Form of teaching/ Hours per week:	Lecture / 2 hours per week, Exercises / 2 hours
Contact hours/ Self-study:	60 hours confrontation time (lectures, exercises, and labs) plus 90 hours additional student individual work/homework time
Credit points / Workload:	5 CR / 150 h
Prerequisites:	**Formal requirements:** / **Content requirements:** Basic knowledge of algorithms and programming.
Learning objectives, competencies:	The students are able to understand and implement algorithms from the field of artificial intelligence. These algorithms are applied to the intelligent planning, configuration, diagnosis and optimization of technical systems. The main application area is industrial automation.
Contents:	Block I: System Analysis: Models for diagnosis, finite state machine, discrete models, ODE-based models, physical, DAE-based and hybrid models (e.g. Modelica), simulation of these models Block II: System Diagnosis: Algorithms for anomaly detection and diagnosis Block III: System Configuration and Planning: Propositional logic, predicate logic, temporal logic, probabilistic logic, ontologies block, algorithms for configuration and planning
Examination	Written examination. The grade equals the grade for the module.
Literature:	Cellier, F; Kofman, E: Continuous System Simulation. Springer, 2010. Russel, S.; Norvig, P.: Artificial Intelligence. A Modern Approach. Prentice Hall, 2009. Tan, P. N.; Steinbach, M; Kumar, V.: Introduction to Data Mining. Pearson, 2013.

Management Skills and Business Administration (MBA / 5906 / 11849)

Course name:	**Management Skills and Business Administration** Abbr.: MBA MNR: 5906 / 11849
Frequency of offer:	Winter term
Responsible lecturer:	Prof. Dr.-Ing. habil. Ulrich Büker
Lecturer:	Prof. Dr.-Ing. habil. Ulrich Büker, Prof. Dr. rer. pol. Andreas Welling, M.A. Tosca Albrecht, Saurav Borborah
Language:	English Last update: 14.11.2024
Use of the module in the programs/ Semester of study:	Elektrotechnik (M. Sc.), Mechatronische Systeme (M. Sc.): first semester; compulsory module Information Technology (M. Sc.): Full-time study: first semester, part-time study: first or third semester; compulsory module
Form of teaching/ Hours per week:	Seminar / 4 hours per week
Contact hours/ Self-study:	65 hours confrontation time (lectures, exercises, and labs) plus 85 hours additional student individual work/homework time
Credit points / Workload:	5 CR / 150 h
Prerequisites:	**Formal requirements:** / **Content requirements:** /
Learning objectives, competencies:	The students • are familiar with various company structures • understand team structures and how to manage and lead teams • understand strategies and models of internationalization and globalization • know the basics of project management and have already done projects themselves • are familiar with financing and accounting models of medium-sized enterprises and know the meaning of outside financing • know methods and instruments of business management, human resource management, marketing and KPI-based controlling • are familiar with means and methods of strategic business management • are able to handle modern media and have gained experience in presentations
Contents:	Accounting, financing, balanced scorecard, marketing and research, strategic business management, leadership, internationalization, communication skills, presentation skills, rhetorical skills, intercultural studies, teamwork, creativity, how to deal with conflicts, how to lead a discussion, organization of projects, time management
Examination	Presentation with a length of 30 minutes and a processing time of 6 weeks. The grade equals the grade for the module.
Literature:	Robbins, S.R., Coulter, M.: Management. Pearson Education, 2021. Whittingtonb, R., Regner, P., Angwin, D. Johnson, G., Scholes, K.: Exploring Strategy, Pearson International, 2019. Lynch, R. L.: Strategic Management. Pearson, 2012. Kaplan, R. S., Norton, D. P.: The Balanced Scorecard. Harvard, 1996. Kotter,

	J. P.: Leading Change. Harvard, 1996 Further literature will be announced during the course.

Master's Thesis (MAT / -)

Course name:	**Master's Thesis** Abbr.: MAT MNR: ---
Frequency of offer:	No restriction
Responsible lecturer:	The initial examiner
Lecturer:	---
Language:	English Last update: 15.07.2019
Use of the module in the programs/ Semester of study:	Information Technology (M. Sc.): Full-time study: fourth semester; part- time study: seventh or eighth semester; compusory module
Form of teaching/ Hours per week:	Independent processing of a practice-relevant task with a new scien- tific value
Contact hours/ Self-study:	900 h
Credit points / Workload:	30 CR
Prerequisites:	All compulsory modules, Research Project
Learning objectives, competencies:	The aim of the Master's Thesis is the interdisciplinary application of in-depth individual knowledge and skills using scientific methods. Thus, practical experience is gained and the methodical and profes- sional competence in the field of scientific application is extended, especially with regard to the defined tasks.
Contents:	Depends on the respective engineering project
Examination	Written report, graded. The grade equals the grade for the module.
Literature:	Depends on the subject of the Master's Thesis.

Network Security (NWS / 5920 / 11678)

Course name:	**Network Security**	Abbr.: NWS MNR: 5920 / 11678
Frequency of offer:	Summer term	
Responsible lecturer:	Prof. Dr. Henning Trsek	
Lecturer:	Prof. Dr. Henning Trsek	
Language:	English	Last update: 14.11.2024
Use of the module in the programs/ Semester of study:	Elektrotechnik (M. Sc.): Second semester; compulsory optional module Information Technology: Full-time study: second semester; part-time study: second or fourth semester; compulsory optional module	
Form of teaching/ Hours per week:	Lecture / 2 hours per week Lab / 2 hour per week	
Contact hours/ Self-study:	60 hours confrontation time (lectures, exercises, and labs) plus 90 hours additional student individual work (homework and project work)	
Credit points / Workload:	5 CR / 150 h	
Prerequisites:	**Formal requirements:** / **Content requirements:** Basic knowledge of networking and IP-related protocols	
Learning objectives, competencies:	The students acquire solid knowledge about threats to security and privacy in networked and distributed systems. Different security mechanisms specified in current network protocols are known and can be rated with respect to their applicability. The students are familiar with the most important aspects of information security management and they are able to apply them to both, Information Technology (IT) and Operational Technology (OT) environments. The students carry out a detailed study of some selected security- related protocol or recently published attack (project work).	
Contents:	Networking applications and protocols and their vulnerabilities, IT security (aims, threats, secure programming), applied cryptography (basic mechanisms, selected algorithms and their applications), public key infrastructures (PKI), security and privacy in networked and distributed systems, transport layer security protocol (TLS), information security governance (according to ISO 27001), industrial security (IEC 62443).	
Examination	Written examination, duration 120 minutes. The grade equals the grade for the module.	
Literature:	Anderson, R.: Security Engineering. Wiley, 2008. Campbell, T.: Practical Information Security Management. Springer, 2016. Kaufman, C., Perlman, R. Speciner, M.: Network Security. Prentice Hall, 2002. Paar, C., Pelzl, J.: Understanding cryptography: A textbook for stu- dents and practitioners. Springer, 2010. Risitc, I.: Bulletproof SSL and TLS. Feisty Duck, 2014. Stallings, W.: Cryptography and Network Security. Principles and Practice. Pearson, 2016.	

Probability and Statistics (PAS / 5913 / 11866)

Course name:	**Probability and Statistics** Abbr.: PAS MNR: 5913 / 11866
Frequency of offer:	Winter term
Responsible lecturer:	Prof. Dr. rer. nat. Stefan Heiss
Lecturer:	Prof. Dr. rer. nat. Stefan Heiss
Language:	English Last update: 14.11.2024
Use of the module in the programs/ Semester of study:	Elektrotechnik (M. Sc.) and Smart Health Sciences (M.Sc.): First semester; compulsory module Information Technology (M. Sc.): Full-time study: first semester; part-time study: first or third semester; compulsory module
Form of teaching/ Hours per week:	Lectures / 3 hours per week Exercises / 1 hour per week
Contact hours/ Self-study:	60 hours confrontation time (lectures and exercises) plus 90 hours additional student individual work/homework time
Credit points / Workload:	5 CR / 150 h
Prerequisites:	**Formal requirements:** / **Content requirements:** Knowledge of mathematics from a Bachelor of Science program.
Learning objectives, competencies:	The students acquire solid knowledge about fundamental definitions and theorems from the fields of probability theory and statistics. Upon completion of the course, students shall be able to perform statistical parameter estimations and hypothesis testing of samples and to trans- fer these techniques e. g. to applications in the field of quality control.
Contents:	- Basics of probability theory (sample space, event, probability, conditional probability, random variable, expectation, variance) - Special distributions, central limit theorem - Sampling, parameter estimation, hypothesis testing - Regression and analysis of variance - Goodness of fit and nonparametric testing - Quality control, product and system reliability
Examination	Written examination (E-Exam), duration 120 minutes. The grade equals the grade for the module.
Literature:	DeGroot, M. H.; Schervish, M. J.: Probability and Statistics. Pearson, 2010. Gubner, J. A.: Probability and Random Processes for Electrical and Computer Engineers. Cambridge University Press, 2006. Ross, S. M.: Introduction to Probability and Statistics for Engineers and Scientists. Academic Press, 2009.

Research Project (RES / 5925 / 11729)

Course name:	**Research Project**	Abbr.: RES MNR: 5925 / 11729
Frequency of offer:	No restriction	
Responsible lecturer:	The examiner	
Lecturer:	---	
Language:	English	Last update: 14.11.2024
Use of the module in the programs/ Semester of study:	Information Technology (M. Sc.)	
Form of teaching/ Hours per week:	Independent processing of a research-oriented task	
Contact hours/ Self-study:	900 h	
Credit points / Workload:	30 CR	
Prerequisites:	Technical and methodical knowledge from the modules of the preceding semesters of the Master's program	
Learning objectives, competencies:	The students get acquainted with the procedural steps in the processing of research projects, from the preparation of the application to the final documentation. For this they are involved in the pro- cessing of subtasks of current research projects. The acquired com- petences prepare for the subsequent Master's Thesis.	
Contents:	The technical content depends on the specific research-oriented task. Variant 1: The students work on a subtask from a larger research project alone or in a team of two. Variant 2: The students work on several subtasks from different research projects alone or in a team of two.	
Examination	Composition with Colloquium, graded, The grade corresponds to the grade for the course.	
Literature:	Depends on the specific project	

Scientific Methods and Writing (SMW / 5911 / 11656)

Course name:	**Scientific Methods and Writing** Abbr.: SMW MNR: 5911 / 11656
Frequency of offer:	Winter term
Responsible lecturer:	Prof. Dr.-Ing. Dr. phil. Dr. rer. soc. habil. Carsten Röcker
Lecturer:	Prof. Dr.-Ing. Dr. phil. Dr. rer. soc. habil. Carsten Röcker
Language:	English Last update: 14.11.2024
Use of the module in the programs/ Semester of study:	Elektrotechnik (M.Sc.): First semester, compulsory module Mechatronische Systeme (M.Sc.): First semester, compulsory module Smart Health Sciences (M.Sc.): First semester, compulsory module Information Technology (M. Sc.): Full-time study: first semester; part-time study: first or third semester, compulsory module Maschinenbau (M.Sc.): First semester, compulsory optional module
Form of teaching/ Hours per week:	Lecture / 2 hours per week Exercise / 2 hours per week
Contact hours/ Self-study:	60 hours confrontation time (lectures, exercises) plus 90 hours additional student individual work/homework time
Credit points / Workload:	5 CR / 150 h
Prerequisites:	**Formal requirements:** / **Content requirements:** /
Learning objectives, competencies:	Students acquire basic knowledge about scientific writing and presenting. They understand typical structures of scientific papers and typical presentation styles. At the level of personality development, they gain problem-solving skills. In the practical part of the course, students gain hands-on experience in drafting, organizing and revising a scientific paper. The course is targeted at non-native English speakers with intermediate language abilities.
Contents:	The course provides an introduction to and application of key principles of effective and efficient scientific writing. It provides key techniques, guidelines and suggestions to improve scientific writing skills. This includes a basic understanding of the writing strategy (research, planning, summarizing), the organization of the document (structure, argumentation) and the writing process (avoidance of plagiarism, proper referencing, proof-reading).
Examination	Project work including a composition and a colloqium. The composition comprises 4 pages with a processing time of 8 weeks. The associated colloquium has a length of 20 minutes per examinee.
Literature:	Turabian, K. L. (2013). A Manual for Writers of Research Papers, Theses, and Dissertations. The University of Chicago Press, Chicago, IL, USA. Sword, H. (2012). Stylish Academic Writing. Harvard University Press, Cambridge, MA, USA. Murray, R. (2005). Writing for Academic Journals. Open University Press, Maidenhead, Berkshire, UK. Strunk, W., White, E. B. (2000). The Elements of Style. Allyn & Bacon, Boston, MA, USA.

	Rocco, T. S., Hatcher, T. G., Creswell, J. W. (2011). The Handbook of Scholarly Writing and Publishing. John Wiley & Sons, Hoboken, NJ, USA. Schimel J. (2012). Writing Science: How to Write Papers that Get Cited and Proposals that Get Funded. Oxford University Press, Oxford, UK. Heard, S. (2016). The Scientist's Guide to Writing: How to Write More Easily and Effectively Throughout Your Scientific Career. Princeton University Press, Princeton, NJ, USA. Derntl, M. (2014). Basics of Research Paper Writing and Publishing. In: International Journal of Technology Enhanced Learning, Vol. 6, No. 2, pp. 105-123.

Special Topics in Information Technology (STI / 5926 / 11684)

Course name:	**Special Topics in Information Technology**	Abbr.: STI MNR: 5926 / 11684
Frequency of offer:	Summer term	
Responsible lecturer:	NN	
Lecturer:	NN	
Language:	English	Last update: 14.11.2024
Use of the module in the programs/ Semester of study:	Information Technology (M. Sc.): Full-time study: second semester; part-time study: second or fourth semester, compulsory optional module	
Form of teaching/ Hours per week:	5 CR / 150 h	
Contact hours/ Self-study:	60 hours confrontation time (lectures and exercises) plus 90 hours additional student individual work / homework time	
Credit points / Workload:	5 CR / 150 h	
Prerequisites:	tbd.	
Learning objectives, competencies:	This compulsory optional module serves as a placeholder if a compulsory optional module with topics from the field of information technology can be offered. The module description is then specified.	
Contents:	Lecture: tbd. Exerciseg: tbd. Lab: tbd.	
Examination	Type of exam graded. The exam grade is the grade for the module.	
Literature:	tbd.	

Usability Engineering (UEN / 5916 / 11706)

Course name:	**Usability Engineering** Abbr.: UEN MNR: 5916 / 11706
Frequency of offer:	Winter term
Responsible lecturer:	Prof. Dr.-Ing. Dr. phil. Dr. rer. soc. habil. Carsten Röcker
Lecturer:	Prof. Dr.-Ing. Dr. phil. Dr. rer. soc. habil. Carsten Röcker
Language:	English Last update14.11.2024
Use of the module in the programs/ Semester of study:	Information Technology (M. Sc.): Full-time study: first semester; part-time study: first or third semester; compulsory module
Form of teaching/ Hours per week:	Lecture / 2 hours per week, Exercises / 2 hours per week
Contact hours/ Self-study:	60 hours confrontation time (lectures, exercises, and labs) plus 90 hours additional student individual work/homework time
Credit points / Workload:	5 CR / 150 h
Prerequisites:	**Formal requirements:** / **Content requirements:** /
Learning objectives, competencies:	Students gain theoretical and practical knowledge of the most important user-centered design techniques and their alignment in the development process. They are able to assess the individual strengths and weaknesses of different approaches for evaluating the usability of various types of information technologies. This includes the ability to plan and execute user studies for evaluating the usability of specific information technologies. In the practical part of the course, the students acquire experience in applying the various methods and techniques to a design task.
Contents:	Today, the success of information technologies is largely influenced by its usability and user-friendly design has become an essential requirement for most systems. In this context, usability is defined as the extent to which a system can be used by a specific user to achieve a specific goal in a specific context with effectiveness, efficiency and satisfaction. In order to reach this goal, this course provides basic principles of usability engineering methods for the design and evaluation of information technologies. This includes basic concepts of human-computer interaction, user interface design strategies, software development and evaluation methods as well as practical guidelines and standards.
Examination	Composition with Colloquium. The composition comprises 15 pages with a processing time of 8 weeks. The associated colloquium has a length of 20 minutes per examinee.
Literature:	Richter, M., Flückiger, M. (2014). User-Centred Engineering. Creating Products for Humans. Springer, Heidelberg. Bill Albert, Tom Tullis (2013). Measuring the User Experience: Collecting, Analyzing, and Presenting Usability Metrics. Morgan Kaufmann. Morgan Kaufmann, Burlington, MA, USA.

	Carol M. Barnum (2010). Usability Testing Essentials: Ready, Set...Test! Morgan Kaufmann, Burlington, MA, USA. Philip Kortum (2016). Usability Assessment: How to Measure the Usability of Products, Services, and Systems: User's Guides to Human Factors and Ergonomics Methods. Human Factors and Ergonomics Society. David C. C. Evans (2017). Bottlenecks: Aligning UX Design with User Psychology. Apress, New York, NY, USA.