



**TECHNISCHE HOCHSCHULE  
OSTWESTFALEN-LIPPE  
UNIVERSITY OF  
APPLIED SCIENCES  
AND ARTS**

## **Fachbereiche**

**Elektrotechnik und Technische Informatik**

**Life Science Technologies**

**Maschinenbau und Mechatronik**

**Modulhandbuch für die Masterstudiengänge**

**Elektrotechnik (M.Sc.)**

**Information Technology (M.Sc.)**

**Mechatronische Systeme (M.Sc.)**

**Smart Health Sciences (M.Sc.)**



**TECHNISCHE HOCHSCHULE  
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AND ARTS**

**Departments of**  
**Electrical Engineering and Computer Science**  
**Life Science Technologies**  
**Mechanical Engineering and Mechatronics**

**Course Handbook for the Master Degree Programs**

**Elektrotechnik (M.Sc.)**  
**Information Technology (M.Sc.)**  
**Mechatronische Systeme (M.Sc.)**  
**Smart Health Sciences (M.Sc.)**

## Content Management

Version	Datum / Date	Geändert von / Revised by	Änderung / Revision
1.0	27 July 2020	Rübner	Merging the handbook for Elektrotechnik, Information Technology and Mechatronische Systeme (Version 3.1) in accordance with the respective examination regulations as of 2019 with the handbook for Smart Health Sciences (Version 1.2)
1.1	13 Jan 2021	Rübner	MSE / 6632: Update of the lecturer's academic title ("Prof. Dr.-Ing. Guido Stollt" instead of "Dr.-Ing. Guido Stollt")
1.2	5 May 2021	Rübner	STG / 5930, SAN / 5933, SMW / 5911: Update of the category 'objectives'.
1.3	15 Jul 2021	Rübner	Correction of module number for "Individualisierte Arzneimittel" (IAM): 4578 instead of 4544
1.4	1 Mar 2022	Rübner	ATA / 5915: Update of module responsibility SAN / 5933, STG / 5930: Update of the list of lecturers
1.5	04 Nov 2022	Rübner	Module 4578: Course name "Individualisierte Arzneimittel" replaced by "Individualisierte Therapien". KIN / 5929: Update of the list of lecturers
1.6	21 Sep 2023	Rübner	MBA / 5906, NWS / 5920, HMM / 4577: Update of module responsibility and the (list of) lecturer(s) SAN / 5933 and STG / 5930: Update of the list of lecturers
1.7	9 Nov 2023	Rübner	Module description of 'Autonomous vehicles' (AUV / 5636) added to this course handbook.
1.8	7 Dec 2023	Rübner	AGM / 5612, AML / 5924, AUT / 5928, DRT / 5602, IDS / 5912, IFU / 5919, ITO / 5635, KIN / 5929, MBA / 5906, MFE / 6640, MSE / 6632, PQM / 6637, REE / 5631, ROB / 6639, RTS / 5627, SMW / 5911, SST / 5621, UEN / 5916: Update of module description
2.0	14 Nov 2024	Rübner	Addition of new module numbers
2.1	3 Dec 2024	Rübner	IDS / 5912 / 11763, KIN / 5929 / 11766: Update of category 'Form of teaching', HMM / 4577 / 11540: Update of module responsibility and lecturer, 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'
2.3	30 July 2025	Rübner	ATA / 5915 / 11952, MBA / 5906 / 11849, WLC / 5904 / 11938: Update of the category 'Lecturers', ISE: change of status from 'compulsory optional module' to 'compulsory module' for students enrolled in the 2025 examination regulations of Master Information Technology (MPO-IT-25)

2.4	18 Sep 2025	Rübner	SMW 5911 / 11656, UEN 5916 / 11706: Update of the categories 'Contents' and 'Examination',
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## Advanced Topics in Algorithms (ATA / 5915 / 11952)

Course name:	<b>Advanced Topics in Algorithms</b>	Abbr.: ATA MNR: 5915 / 11952
Frequency of offer:	Winter term	
Responsible lecturer:	Prof. Dr. rer. nat. Helene Dörksen	
Lecturer:	Dr. Niels Grüttemeier, Dr. Klaus Heeger	
Language:	English	Last update: 30.07.2025
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:	<b>Formal requirements:</b> / <b>Content requirements:</b> 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 algorithms. They are able to implement algorithms in an object-oriented programming language.	
Contents:	Complexity and benchmarking of algorithms, optimization of algorithms, 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 theory 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 Algorithms. MIT Press, 2nd edition, 2001. <small>[SEP]</small> Dasgupta, S./Papadimitriou, C., Vazirani, U.: Algorithms. Higher Education. McGrawHill, 1st edition, 2008. <small>[SEP]</small> 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. <small>[SEP]</small>	

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

Course name:	<b>Advanced Topics in Machine Learning</b>	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:	<b>Formal requirements:</b> / <b>Content requirements:</b> 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:	<b>Authentication</b>	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:	<b>Formal requirements:</b> / <b>Content requirements:</b> 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:	<p>Lecture: The lecture introduces theoretical topics with relevance to authentication; i.e.:</p> <ul style="list-style-type: none"> <li>• methods of non-linear signal and image processing,</li> <li>• multivariate data analysis,</li> <li>• feature engineering,</li> <li>• classification optimization and</li> <li>• automation methods for authentication systems.</li> </ul> <p>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:</p> <ul style="list-style-type: none"> <li>• banknote authentication,</li> <li>• error identification in the monitoring of textile manufacturing processes,</li> <li>• authentication of geometric structures in digital spaces.</li> </ul> <p>Exercise / Lab: The lecture contents are deepened on the basis of appropriate tasks. For particular tasks, Matlab is used.</p>	
Examination	Preparation of Term Paper (length: 20 pages, preparation time period: 8 weeks). The grade equals the grade for the module.	
Literature:	<p>Guyon, I.M., Gunn, S.R., Nikraves, M. and Zadeh, L. (eds.) (2006): Feature Extraction, Foundations and Applications, Springer</p> <p>Ethem Alpaydin (2014): Introduction to Machine Learning (3rd ed.). The MIT Press.</p> <p>Alice Zheng, Amanda Casari (2018): Feature Engineering for Machine Learning: Principles and Techniques for Data Scientists, O'Reilly Media</p> <p>Maimon, Oded, Rokach, Lior. (2010). Data Mining and Knowledge Discovery Handbook, 2nd ed., Springer</p> <p>Esther M. Arkin, L. Paul Chew, Daniel P. Hüttenlocher, Klara Kedem, Joseph S. B. Mitchell (1991): An Efficiently Computable Metric for Comparing</p>	

	<p>Polygonal Shapes. IEEE Trans. Pattern Anal. Mach. Intell. 13(3): 209-216</p> <p>Isabelle Debled-Rennesson, Jean-Luc Rémy, Jocelyne Rouyer-Degli (2000): Detection of the Discrete Convexity of Polyominoes. DGCI, 491-504</p> <p>L. J. Latecki and R. Lakämper (2000): Shape Similarity Measure Based on Correspondence of Visual Parts. IEEE Trans. Pattern Analysis and Machine Intelligence (PAMI) 22 (10)</p>
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## Autonomous Vehicles (AUV / 5636 / 15152)

Course name:	<b>Autonomous Vehicles</b>	Abbr.: AUV MNR: 5636 / 15152
Frequency of offer:	Summer term	
Responsible lecturer:	Prof. Dr.-Ing. habil. Ulrich Bükér	
Lecturer:	Prof. Dr.-Ing. habil. Ulrich Bükér	
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:	<b>Formal requirements: /</b> <b>Content requirements: /</b>	
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: <ul style="list-style-type: none"> <li>• Sensor technologies used for assisted and autonomous vehicles e.g. ultrasonic, camera, lidar, radar</li> <li>• Feature functions like intelligent cruise control, automatic emergency break, lane keeping, assisted and autonomous parking</li> <li>• Systems engineering for AVs</li> <li>• Functional safety of autonomous vehicles</li> <li>• Test and validation of AVs</li> <li>• Legal and ethical aspects of autonomous driving</li> </ul>	
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:	<b>Communication for Distributed Systems</b> 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:	<b>Formal requirements:</b> / <b>Content requirements:</b> /
Learning objectives, competencies:	<b>Knowledge:</b> 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. <b>Comprehension:</b> The students are able to explain in detail the needed steps for a credible performance evaluation of communication systems. They are able to describe the approach of discrete event simulation for performance evaluation. <b>Application:</b> The students are able to apply their knowledge to a practical case study using the DES tool omnet++.
Contents:	<b>Lecture:</b> 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. <b>Lab:</b> 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:	<b>Discrete Signals and Systems</b>	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: 30.07.2025
Use of the module in the programs/ Semester of study:	<p>Elektrotechnik (M. Sc.) / Examination Regulations of 2019 (MPO-ET-19): First semester; compulsory module</p> <p>Information Technology (M. Sc.) / Examination Regulations of 2019 (MPO-IT-19): Full-time study: first semester; part-time study: first or third semester; compulsory module</p> <p>Please note: The module was part of the lecture period for the last time in Winter Semester 2025/26!</p>	
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:	<b>Formal requirements:</b> / <b>Content requirements:</b> Continuous signals and linear systems: complex notation, FOURIER series and transformation	
Learning objectives, competencies:	<p>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</p> <ul style="list-style-type: none"> <li>- describe sampling and reconstruction of signals,</li> <li>- use appropriate transform methods,</li> <li>- understand filtering with window functions,</li> <li>- design frequency-selective filters,</li> <li>- use simulation software for signal processing.</li> </ul> <p>After completion of the course, students are able to critically analyze signal processing problems and create appropriate solutions.</p>	
Contents:	<p>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, filtering with window functions, frequency-selective filters).</p> <p>Time-discrete signals (sampling theorem, discrete and fast FOURIER transform)</p> <p>Time-discrete systems (z-transform, filtering with window functions, frequency-selective filters)</p>	
Examination	Written examination, duration 120 minutes. The grade equals the grade for the module.	
Literature:	<p>Script with exercise problems for downloading.</p> <p>Hayes, M. H.: Schaum's Outlines. Digital Signal Processing. McGraw Hill.</p> <p>Oppenheim, A. V, Willsky, A. S.: Signals and Systems. Prentice Hall.</p> <p>Oppenheim, A. V., Schafer, R. W.: Discrete-Time Signal Processing. Prentice Hall.</p>	

## Embedded Systems Design (ESD / 5917 / 11658)

Course name:	<b>Embedded Systems Design</b>	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:	<b>Formal requirements:</b> / <b>Content requirements:</b> /	
Learning objectives, competencies:	<p><b>Knowledge:</b> Students gain knowledge in the field of embedded systems. This includes generic system design aspects, sensors and actuators, micro-processor basics, HDL design, components of embedded systems, testing of embedded systems, FPGA basics, embedded software integration, and hardware-based acceleration approaches.</p> <p><b>Comprehension:</b> Students gain competencies in the design of embedded systems with focus on real-time issues. They are able to specify embedded systems and explore the design space according to applicational requirements 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.</p> <p><b>Application:</b> The students are able to apply their knowledge in order to design practical embedded systems based on FPGA technologies.</p>	

<p>Contents:</p>	<p><b>Lecture:</b></p> <ol style="list-style-type: none"> <li>1. Introduction to embedded systems: What are embedded systems, requirements for embedded systems, and communication approaches?</li> <li>2. System theory and technologies: Signal processing chain, embedded processor basics, bus systems, memory concepts, external interfaces, multi- and coprocessor concepts</li> <li>3. Software concepts: code development, tool-chains, operating systems for embedded systems</li> <li>4. Application examples from the domain of industrial automation</li> </ol> <p><b>Lab:</b></p> <ol style="list-style-type: none"> <li>1. Exercises related to lectures</li> <li>2. Fundamentals of FPGA design</li> <li>3. Embedded FPGA-based system design including embedded CPUs</li> <li>4. Exemplary implementation of embedded software for industrial usage</li> </ol>
<p>Examination</p>	<p>Written examination, duration 90 minutes. The grade equals the grade for the module.</p>
<p>Literature:</p>	<p>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.</p>

## Industrial Software Engineering (ISE / 5923 / 11780)

Course name:	<b>Industrial Software Engineering</b>	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: 30.07.2025
Use of the module in the programs/ Semester of study:	Information Technology (M. Sc.) / Examination Regulations of 2025 (MPO-IT-25): 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:	<b>Formal requirements: /</b> <b>Content requirements: /</b>	
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 <i>Process improvement with Six Sigma</i> 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, Addison-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. <a href="#">Schwaber, K.</a> : Agile Project Management with Scrum. <a href="#">Microsoft Press</a> , 2004. Yacoub, S. M., Ammar, H. H.: Pattern-Oriented Analysis and Design: Composing Patterns to Design Software Systems. Addison-Wesley, 2003.	

## Information Fusion (IFU / 5919 / 11828)

Course name:	<b>Information Fusion</b>	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:	<b>Formal requirements:</b> / <b>Content requirements:</b> Mathematics for undergraduates, Statistics, Signals and Systems or System Modeling and Analysis, Image Analysis or Digital Image Processing	
Learning objectives, competencies:	<b>Analyse:</b> The students are able to discuss sensor and information fusion concepts as well as methodologies. <b>Evaluate:</b> Furthermore, they are able to operationalize mathematical models in information fusion. <b>Create:</b> 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:	<p>Solaiman, B; Bossé, É: Possibility Theory for the Design of Information Fusion Systems, Springer 2019.</p> <p>Bossé, É; Rogova, G. L.: Information Quality in Information Fusion and Decision Making (Information Fusion and Data Science), April 2019, Springer.</p> <p>Bosse, É.: Concepts, Models, and Tools for Information Fusion. Artech, 2007.</p> <p>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.</p> <p>Thomas, C. (Ed.): Sensor Fusion. Foundation and Applications. InTech, 2011.</p> <p>Thomas, C. (Ed.): Sensor Fusion and Its Applications. Sciyo, 2010.</p> <p>Additional literature sources with current references (books, papers and online sources) will be announced in the respective lecture or exercise unit.</p>
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## Innovation and Development Strategies (IDS / 5912 / 11763)

Course name:	<b>Innovation and Development Strategies</b>	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:	<b>Formal requirements:</b> / <b>Content requirements:</b> Elementary management skills	
Learning objectives, competencies:	<b>Analyse:</b> 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. <b>Evaluate:</b> Students are able to evaluate e.g. patent applications and patents. <b>Create:</b> 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:	<p>Basis: Davenport, T. H., Prusak, L: Working Knowledge. How Organizations Manage What They Know. Harvard, 1997.</p> <p>Eversheim, W. (Ed.): Innovation Management for Technical Products. RWTH Edition. Springer, 2008.</p> <p>Jacob, N.: Intercultural Management. MBA Masterclass. Kogan Page, 2003.</p> <p>Nonaka, I., Takeuchi, H.: The Knowledge-Creating Company. How Japanese Companies Create the Dynamics of Innovation. Oxford University Press, 1995.</p> <p>Rapaille, C.: The Culture Code. Random House, 2006.</p> <p>Stim, R.: Patent, Copyright and Trademark. A Desk Reference to Intellectual Property Law. Nolo, 2009.</p> <p>Vose, D.: Risk Analysis. A Quantitative Guide. 3rd ed. Wiley, 2008.</p> <p>Additional literature sources with current references (books, papers and online sources) will be announced in the respective lecture or exercise unit.</p>
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## Intelligent Technical Systems (ITS / 5922 / 11563)

Course name:	<b>Intelligent Technical Systems</b>	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:	<b>Formal requirements:</b> / <b>Content requirements:</b> 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 <sup>[1]</sup> 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 <sup>[1]</sup> 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:	<b>Management Skills and Business Administration</b>	Abbr.: MBA MNR: 5906 / 11849
Frequency of offer:	Winter term	
Responsible lecturer:	Prof. Dr.-Ing. habil. Ulrich Bükler	
Lecturer:	Prof. Dr.-Ing. habil. Ulrich Bükler	
Language:	English	Last update: 30.07.2025
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:	<b>Formal requirements: /</b> <b>Content requirements: /</b>	
Learning objectives, competencies:	<p>The students</p> <ul style="list-style-type: none"> <li>• are familiar with various company structures</li> <li>• understand team structures and how to manage and lead teams</li> <li>• understand strategies and models of internationalization and globalization</li> <li>• know the basics of project management and have already done projects themselves</li> <li>• are familiar with financing and accounting models of medium-sized enterprises and know the meaning of outside financing</li> <li>• know methods and instruments of business management, human resource management, marketing and KPI-based controlling</li> <li>• are familiar with means and methods of strategic business management</li> <li>• are able to handle modern media and have gained experience in presentations</li> </ul>	
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.
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## Master's Thesis (MAT / -)

Course name:	<b>Master's Thesis</b>	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; compulsory module	
Form of teaching/ Hours per week:	Independent processing of a practice-relevant task with a new scientific 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 professional 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:	<b>Network Security</b>	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:	<b>Formal requirements:</b> / <b>Content requirements:</b> 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 students 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:	<b>Probability and Statistics</b>	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:	<b>Formal requirements:</b> / <b>Content requirements:</b> 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 transfer these techniques e. g. to applications in the field of quality control.	
Contents:	<ul style="list-style-type: none"> <li>- Basics of probability theory (sample space, event, probability, conditional probability, random variable, expectation, variance)</li> <li>- Special distributions, central limit theorem</li> <li>- Sampling, parameter estimation, hypothesis testing</li> <li>- Regression and analysis of variance</li> <li>- Goodness of fit and nonparametric testing</li> <li>- Quality control, product and system reliability</li> </ul>	
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:	<b>Research Project</b>	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 processing of subtasks of current research projects. The acquired competences 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:	<b>Scientific Methods and Writing</b>	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: 18.09.2025
Use of the module in the programs/ Semester of study:	<ul style="list-style-type: none"> <li>• Elektrotechnik (M.Sc.): First semester, compulsory module</li> <li>• Mechatronische Systeme (M.Sc.): First semester, compulsory module</li> <li>• Smart Health Sciences (M.Sc.): First semester, compulsory module</li> <li>• Information Technology (M. Sc.): Full-time study: first semester; parttime study: first or third semester, compulsory module</li> <li>• Maschinenbau (M.Sc.): First semester, compulsory optional module</li> </ul>	
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 / 150h	
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 how to design, perform and analyze scientific studies. 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). Further, the students gain insights into a selection of research methodologies.	
Examination	Exam of a duration of 90 minutes	
Literature:	<p>Turabian, K. L. (2018). A Manual for Writers of Research Papers, Theses, and Dissertations. The University of Chicago Press, Chicago, IL, USA.</p> <p>Sword, H. (2012). Stylish Academic Writing. Harvard University Press, Cambridge, MA, USA.</p> <p>Murray, R. (2013). Writing for Academic Journals. Open University Press, Maidenhead, Berkshire, UK.</p> <p>White, E. B., Strunk, W. (2023). The Elements of Style. Allyn &amp; Bacon, Boston, MA, USA.</p> <p>Rocco, T. S., Hatcher, T. G., Creswell, J. W. (2011). The Handbook of Scholarly Writing and Publishing. John Wiley &amp; Sons, Hoboken, NJ, USA.</p> <p>Schimmel J. (2012). Writing Science: How to Write Papers that Get Cited and Proposals that Get Funded. Oxford University Press, Oxford, UK.</p> <p>Heard, S. (2022). The Scientist's Guide to Writing: How to Write More Easily and Effectively Throughout Your Scientific Career. Princeton University Press, Princeton, NJ, USA.</p>	

	Derntl, M. (2014). Basics of Research Paper Writing and Publishing. In: International Journal of Technology Enhanced Learning, Vol. 6, No. 2, pp. 105-123.
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## Special Topics in Information Technology (STI / 5926 / 11684)

Course name:	<b>Special Topics in Information Technology</b>	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. Exercises: 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:	<b>Scientific Methods and Writing</b>	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: 18.09.2025
Use of the module in the programs/ Semester of study:	<ul style="list-style-type: none"> <li>• Elektrotechnik (M.Sc.): First semester, compulsory module</li> <li>• Mechatronische Systeme (M.Sc.): First semester, compulsory module</li> <li>• Smart Health Sciences (M.Sc.): First semester, compulsory module</li> <li>• Information Technology (M. Sc.): Full-time study: first semester; parttime study: first or third semester, compulsory module</li> <li>• Maschinenbau (M.Sc.): First semester, compulsory optional module</li> </ul>	
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 / 150h	
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 how to design, perform and analyze scientific studies. 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). Further, the students gain insights into a selection of research methodologies.	
Examination	Exam of a duration of 90 minutes	
Literature:	<p>Turabian, K. L. (2018). A Manual for Writers of Research Papers, Theses, and Dissertations. The University of Chicago Press, Chicago, IL, USA.</p> <p>Sword, H. (2012). Stylish Academic Writing. Harvard University Press, Cambridge, MA, USA.</p> <p>Murray, R. (2013). Writing for Academic Journals. Open University Press, Maidenhead, Berkshire, UK.</p> <p>White, E. B., Strunk, W. (2023). The Elements of Style. Allyn &amp; Bacon, Boston, MA, USA.</p> <p>Rocco, T. S., Hatcher, T. G., Creswell, J. W. (2011). The Handbook of Scholarly Writing and Publishing. John Wiley &amp; Sons, Hoboken, NJ, USA.</p> <p>Schimmel J. (2012). Writing Science: How to Write Papers that Get Cited and Proposals that Get Funded. Oxford University Press, Oxford, UK.</p> <p>Heard, S. (2022). The Scientist's Guide to Writing: How to Write More Easily and Effectively Throughout Your Scientific Career. Princeton University Press, Princeton, NJ, USA.</p>	

	Derntl, M. (2014). Basics of Research Paper Writing and Publishing. In: International Journal of Technology Enhanced Learning, Vol. 6, No. 2, pp. 105-123.
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## Wireless Communications (WLC / 5904 / 11938)

Course name:	<b>Wireless Communications</b>	Abbr.: WLC MNR: 5904 / 11938
Frequency of offer:	Summer term	
Responsible lecturer:	N.N.	
Lecturer:	N.N.	
Language:	English	Last update: 30.07.2025
Use of the module in the programs/ Semester of study:	Elektrotechnik (M. Sc.): Second semester; compulsory optional module	
Form of teaching/ Hours per week:	Lecture / 3 hours per week, Exercise or lab / 1 hour 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: Signals and linear systems, basics of modulation, basics of random processes	
Learning objectives, competencies:	<p>Students acquire system-theoretical knowledge of the physical and MAC layer of modern radio systems. They are able to determine and to model real propagation channel characteristics. They can assess the performance limits of wireless systems including modulation and channel coding. They learn how to use appropriate simulation and network planning tools in order to predict the quality and the limitations of wireless radio systems.</p> <p>After completion of the course, students are able to critically analyze wireless system problems and create appropriate solutions.</p>	
Contents:	<p>Mobile radio channels (multipath propagation, Doppler effects, Bessel functions, channel measurements and characterization, channel modeling)</p> <p>Advanced modulation methods (theoretical limitations, spread spectrum systems, multicarrier systems, ultra-wide band radio)</p> <p>Channel coding including space-time codes, MIMO (multiple input - multiple output) systems</p> <p>Further topics: Software-defined radio (SDR), cognitive radio systems, coexistence management</p>	
Examination	Oral examination, duration 30 minutes.	
Literature:	<p>Script, exercise problems and lab tasks for downloading Haykin, Simon, and Michael Moher: Modern Wireless Communications. Pearson-Prentice Hall.</p> <p>Pahlavan, K., and A.H. Levesque: Wireless Information Networks. Wiley.</p> <p>Paulraj, A., R. Nabar, and D. Gore: Introduction to Space-Time Wireless</p>	

	Communications. Cambridge UP. Rappaport, T. S.: Wireless Communications, Principles and Practice. Prentice Hall.
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