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HOCHSCHULE TRIER

Module manual for the courses

Master Electrical Engineering
Master Electrical Engineering (Cooperative Study Programme)

Subject examination regulations 2025

Version 02.00.SoSe2025

24.03.2025

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Abbreviations

BM	Basic module
CEM	Compulsatory elective module
RM	Required module

Explanations

Basic module	In the Master's degree programme in Electrical Engineering, basic modules must be selected and completed in accordance with the respective examination or subject examination regulations.
Compulsatory elective module	Depending on the degree programme, examinations must be taken in one or more compulsory elective modules. The compulsory elective modules must be selected from the current catalogue of compulsory elective modules.
Required module	Compulsory elective modules must be successfully completed to obtain a degree in a degree programme.

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General notes

- The timing of the modules can be found in the annexes of the examination regulations or the subject examination regulations.
- The overall grade is calculated in accordance with the examination regulations or subject examination regulations.
- If several alternative exam performances, depending on the number of participants, are specified for a module, the current exam performance for the semester will be announced at the beginning of the course. These are indicated by additions in brackets with reference to the number of participants. In all other cases in which several exam performances are specified for a module, these must be taken in order to successfully pass the module.
- The requirement for the awarding of ECTS credits is the successful completion of the listed exam and study performances. If a module consists of two courses (e.g. a laboratory with the courses Partial Laboratory 1 and Partial Laboratory 2), the ECTS credits shown in the respective courses are not awarded individually, but the sum of the ECTS credits of the associated courses is only awarded when the complete module is passed.
- The examination regulations or subject examination regulations in the currently valid version are legally binding.

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Course specific notes

Contents

Advanced Cognitive Robotics			
Content	Lecture: - Basic concepts of Industry 4.0, Cyber-Physical Systems (CPS) and robotics - Fundamentals of mobile robotics, Kinematics and actuators - Introduction to the Robot Operating System (ROS) framework - Perception: sensor technology, sensor data processing and fusion; environment perception - Localization and mapping, motion planning and navigation The lecture topics are accompanied by complementary practical applications as laboratory exercises. These will be implemented using Python and ROS.		
Competency goals	Upon successful completion of the module, students will be able to, 1. Identify application fields of the Industry 4.0 and robotics, 2. Describe the basic components, functionalities and interactions of mobile robotics, 3. use the acquired knowledge to gain an understanding of complex systems in mobile robotics and sensing/perception, 4. develop practical applications of robotics in the lab.		
Teaching form	☒ Lecture		
	☐ Exercise		
	☐ Seminar/seminar exercise		
	☒ Laboratory		
	☐ Project		
Recommended Prequesites			
Literature	• Further literature will be announced in lecture • Klein, B. Einfuhrung in Python 3. Hanser Verlag, 2021 (optionally, to refresh Python knowledge). • Thrun; Burgard; Fox. Probabilistic Robotics. MIT Press, 2005. • Siciliano, Khatib. Springer Handbook of Robotics - Second Edition. Springer, 2016 (available on demand in case of further interest) • Siegwart; Nourbakhsh, Scaramuzza. Introduction to Autonomous, Mobile Robots - Second Edition. MIT Press, 2011. • Quigley; Gerkey; Smart. Programming Robots with ROS. O Reilly, 2015. • Thrun; Burgard; Fox. Probabilistic Robotics. MIT Press, 2005. • Siciliano, Khatib. Springer Handbook of Robotics - Second Edition. Springer, 2016 (available on demand in case of further interest) • Siegwart; Nourbakhsh, Scaramuzza. Introduction to Autonomous, Mobile Robots - Second Edition. MIT Press, 2011. • Quigley; Gerkey; Smart. Programming Robots with ROS. O Reilly, 2015.		
Study performance	☐ Exercise performance		
	☒ Laboratory performance		
	☐ Term paper		
	☐ Presentation		
	☐ Certificate		
Exam performance	☒ Written exam (in case of high number of participants)		
	☒ Oral exam (in case of low number of participants)		
	☐ Term paper		
	☐ Project paper		
	☒ Laboratory performance		
	☐ Final thesis and oral exam		
	☐ presentation		
Usability	Master Electrical Engineering (-Cooperative Study Programme) - (FPO 2025)	☒ BM	
	Master Electrical Engineering - (PO 2019)	☒ BM	
	Master Interdisciplinary Engineering - (PO 2021)	☒ CEM	
Offer	☐ Winter semester ☐ Summer semester ☒ Irregular		
Workload	Credit points	Contact time	Self-study
	5	60 hours [4 hours per week]	90 hours

Language	English
Duration of the module	1 Semester
Approved aids for the exam performance	Will be announced in the lecture
Lecturer(s)	Mr. Prof. Dr. Volker Lücken
Responsible(s)	Mr. Prof. Dr. Volker Lücken
Comment	Fundamental prior knowledge of software development with Python is mandatory. The successful participation in the lab sessions is required. This course is the successor of Industrie 4.0 & IoT / Industry 4.0 & IoT. Please note that the course is seat restricted and requires registration in the first week, with a priorization of Electrical Engineering (M.Sc.) students, and also the EE specialization of Interdisciplinary Engineering (M.Sc.).
Change date	12.03.2025

Biomechanical Systems			
Content	The lecture deals with fundamental questions of biomechanics with a focus on the human and cellular mechanical system. Firstly, the basic structure of the human and cellular mechanical system and the physical principles of biomechanics (statics, strength, kinetics) are discussed. Another focus is on the relationship between structure and function. In addition, finite element analysis is used to describe complex biomechanical systems using computer tomography data.		
Competency goals	After successfully completing the module, students will be able to - describe and explain the basic principles of biomechanical systems, - link the physical principles and the biological structure of biomechanical systems, - understand the functional principle of computer tomography and explain its application in biomechanics, - apply finite element analysis to initial examples. As part of the project work, students will also learn how to work with scientific publications and how to deal with more complex issues.		
Teaching form	☒ Lecture		
	☐ Exercise		
	☐ Seminar/seminar exercise		
	☐ Laboratory		
	☒ Project		
Recommended Prequesites	• Classical and Modern Physics • Special Topics in Physics		
Literature	• Richard, Hans Albert, and Kullmer, Gunter. Biomechanik: Anwendungen mechanischer Prinzipien auf den menschlichen Bewegungsapparat. Deutschland, Springer Fachmedien Wiesbaden, 2020. • Winter, David A.. Biomechanics and Motor Control of Human Movement. Wiley, 2009. • Knudson, Duane. Fundamentals of Biomechanics. USA, Springer US, 2013. • Cytoskeletal Mechanics: Models and Measurements in Cell Mechanics. USA, Cambridge University Press, 2006.		
Study performance	☐ Exercise performance		
	☐ Laboratory performance		
	☐ Term paper		
	☐ Presentation		
	☐ Certificate		
Exam performance	☒ Written exam		
	☐ Oral exam		
	☐ Term paper		
	☒ Project paper		
	☐ Laboratory performance		
	☐ Final thesis and oral exam		
	☐ presentation		
Usability	Master Electrical Engineering - (PO 2019)	☒ CEM	
	Master Electrical Engineering (-Cooperative Study Programme) - (FPO 2025)	☒ CEM	
Offer	☐ Winter semester ☒ Summer semester ☐ Irregular		
Workload	Credit points: 5	Contact time: 60 hours [4 hours per week]	Self-study: 90 hours
Language	German and English		
Duration of the module	1 Semester		
Approved aids for the exam performance	Calculator (not programmable)		
Lecturer(s)	Mrs. Dr. Friederike Nolle		
Responsible(s)	Mrs. Dr. Friederike Nolle		
Comment			
Change date	10.03.2025		

Deep Learning			
Content	- Basics of Data Preparation Pipeline - Introduction to deep learning and neural networks - Mathematical foundations of deep learning - Architecture of neural networks - Training neural networks - Convolutional Neural Nets (CNNs) - Recurrent neural networks (RNNs) and LSTM - Reinforcement Learning (RL) - Evolutionary algorithms (EA) - Practical application and frameworks		
Competency goals	After completing the module, students should be able to - Understand and explain basic and advanced concepts of deep learning and related fields (such as RL and EA). - Identify and differentiate between different types of neural networks and their applications. - Design, implement and train neural networks, including CNNs, RNNs, and LSTM networks. - Apply reinforcement learning and evolutionary algorithms in practical application scenarios. - Solve complex problems by applying deep learning techniques. - Develop innovative solutions for challenges in various application areas such as image and speech recognition. - Work efficiently with common deep learning frameworks such as TensorFlow or PyTorch. - Use current software tools and libraries to develop and implement deep learning models.		
Teaching form	☒ Lecture		
	☒ Exercise		
	☐ Seminar/seminar exercise		
	☐ Laboratory		
	☐ Project		
Recommended Prequesites	• Machine Learning		
Literature	• Goodfellow, Bengio & Courville, Deep Learning, MIT Press, 2016 • Ethem Alpaydin, Machine Learning, MIT Press, 2021 • Nikhil Buduma, Fundamentals of Deep Learning, OReilly, 2022 • Kapoor, Gulli, Pal: Deep Learning with TensorFlow and Keras: Build and deploy supervised, unsupervised, deep, and reinforcement learning models, 3rd Edition		
Study performance	☐ Exercise performance		
	☐ Laboratory performance		
	☐ Term paper		
	☐ Presentation		
	☐ Certificate		
Exam performance	☒ Written exam		
	☐ Oral exam		
	☐ Term paper		
	☐ Project paper		
	☐ Laboratory performance		
	☐ Final thesis and oral exam		
	☐ presentation		
Usability	Master Electrical Engineering (-Cooperative Study Programme) - (FPO 2025)		☒ BM
Offer	☒ Winter semester ☐ Summer semester ☐ Irregular		
Workload	Credit points	Contact time	Self-study
	5	60 hours [4 hours per week]	90 hours
Language	English		
Duration of the module	1 Semester		
Approved aids for the exam performance	None		
Lecturer(s)	Mr. Prof. Dr. Ernst Georg Haffner		
Responsible(s)	Mr. Prof. Dr. Ernst Georg Haffner		
Comment	Points for the exam can be earned as part of the exercises		

Change date	09.09.2024

Digital Signal Processing			
Content	Discrete Stochastic Processes Linear Signal Models Nonparametric Specrtal Estimation Optimal Linear Filters Algorithms and Structures for Optimal Filtering Least Squares Filtering Parametric Spectral Estimation Adaptive Filters Array signal processing Radar signal processing, SAR, ISAR System identification		
Competency goals	The students • can explain the differences between classical and stochastic signal processing, • The students are able to select suitable methods and algorithms for various applications in digital signal processing, • can evaluate the different methods in terms of their performance and computational effort, • can develop new systems, forexample, for medical devices, measuring instruments and radar technology devices, • are able to analyze unknown systems and to model		
Teaching form	☒ Lecture		
	☐ Exercise		
	☐ Seminar/seminar exercise		
	☐ Laboratory		
	☐ Project		
Recommended Prequesites			
Literature	• Spectral Analysis of Signals, P.Stoica, R. Moses • Probability, Random Variables and Stochastic Processes, A. Papoulis, S.Unnikrishna Pillai		
Study performance	☐ Exercise performance		
	☐ Laboratory performance		
	☐ Term paper		
	☐ Presentation		
	☐ Certificate		
Exam performance	☒ Written exam		
	☐ Oral exam		
	☐ Term paper		
	☐ Project paper		
	☐ Laboratory performance		
	☐ Final thesis and oral exam		
	☐ presentation		
Usability	Master Electrical Engineering - (PO 2019)	☒ BM	
	Master Electrical Engineering (-Cooperative Study Programme) - (FPO 2025)	☒ BM	
Offer	☐ Winter semester ☒ Summer semester ☐ Irregular		
Workload	Credit points	Contact time	Self-study
	5	60 hours [4 hours per week]	90 hours
Language	German		
Duration of the module	1 Semester		
Approved aids for the exam performance	None		
Lecturer(s)	Mr. Prof. Dr. Elmar Seidenberg		
Responsible(s)	Mr. Prof. Dr. Elmar Seidenberg		
Comment			
Change date	28.11.2024		

Elektromagnetische Wellen_2025			
Content			
Competency goals			
Teaching form	☒ Lecture		
	☒ Exercise		
	☐ Seminar/seminar exercise		
	☐ Laboratory		
	☐ Project		
Recommended Prequesites			
Literature	• Georg: Elektromagnetische Wellen • Pehl: Mikrowellentechnik		
Study performance	☐ Exercise performance		
	☐ Laboratory performance		
	☐ Term paper		
	☐ Presentation		
	☐ Certificate		
Exam performance	☒ Written exam		
	☐ Oral exam		
	☐ Term paper		
	☐ Project paper		
	☐ Laboratory performance		
	☐ Final thesis and oral exam		
	☐ presentation		
Usability	Master Electrical Engineering (-Cooperative Study Programme) - (FPO 2025)		☒ BM
Offer	☐ Winter semester ☒ Summer semester ☐ Irregular		
Workload	Credit points	Contact time	Self-study
	5	60 hours [4 hours per week]	90 hours
Language	German		
Duration of the module	1 Semester		
Approved aids for the exam performance	None		
Lecturer(s)	Mr. Prof. Dr. Andreas R. Diewald		
Responsible(s)	Mr. Prof. Dr. Andreas R. Diewald		
Comment			
Change date	09.08.2024		

Energy-efficient Vehicles (M)			
Content	Expected developments in the global vehicle population, primary energy resources and CO2 emissions are presented. The results are based on a comparison of the current and future climate development, current and future legislation, and fuel costs. Comparison of different efficiency indicators. Influence of the design parameters of a vehicle on energy efficiency. Efficiency and emissions, energy chains: well-to-wheel and future fuel options, trends and potentials in powertrains Efficiency. Battery electric vehicles and hybrid drives, efficiency potential of auxiliary drives. Potentials for minimizing driving resistance and lightweight construction, influences of vehicle operation and driving style, predictive operating strategies and driver assistance systems, presentation and assessment of realized concepts and vehicles.		
Competency goals	Upon successful completion of the module, students will know the importance of energy efficiency as well as reduction of CO2-emissions for future transport. They can evaluate the efficiency of vehicles and can assess the effectiveness of efficiency-improving measures in the different energy conversion processes along the chain from fuel production to driving.		
Teaching form	☒ Lecture		
	☒ Exercise		
	☐ Seminar/seminar exercise		
	☐ Laboratory		
	☐ Project		
Recommended Prequesites			
Literature	• Hybridfahrzeuge - Ein alternatives Antriebssystem für die Zukunft Hofmann, Peter, 2014, Springer-Verlag Wien, ISBN 978-3-7091-1779-8 • Handbuch Lithium-Ionen-Batterien Korthauer, R., Springer-Verlag Berlin Heidelberg 2013, ISBN 978-3-642-30652-5978-3-7091-1779-8 • Vorlesungsskripte mit Bezug auf umfangreiche Fachliteratur		
Study performance	☐ Exercise performance		
	☐ Laboratory performance		
	☐ Term paper		
	☐ Presentation		
	☐ Certificate		
Exam performance	☒ Written exam (in case of high number of participants)		
	☒ Oral exam (in case of low number of participants)		
	☐ Term paper		
	☐ Project paper		
	☐ Laboratory performance		
	☐ Final thesis and oral exam		
	☐ presentation		
Usability	Master Industrial Engineering - (PO 2015)	☒ CEM	
	Master Mechanical Engineering - (PO 2015)	☒ CEM	
	Master Electrical Engineering - (PO 2019)	☒ CEM	
	Master Electrical Engineering (-Cooperative Study Programme) - (FPO 2025)	☒ CEM	
Offer	☐ Winter semester ☒ Summer semester ☐ Irregular		
Workload	Credit points	Contact time	Self-study
	5	60 hours [4 hours per week]	90 hours
Language	German		
Duration of the module	1 Semester		
Approved aids for the exam performance	Calculator (not programmable)		
Lecturer(s)	Mr. Prof. Dr. Florian Dräger		
Responsible(s)	Mr. Prof. Dr. Florian Dräger		
Comment	German		
Change date	08.03.2025		

Engineering Design Master			
Content	The technical contents correspond to the respective specialization. In the module, analyses and designs for systems or subcomponents are created on the basis of problems. The learned knowledge from other modules will be implemented in a design and the results will be discussed with the other groups. Intermediate results will be presented to each other. The contents include: • Elaboration of the requirements from a generally posed problem • Analysis of the correlations • Selection of suitable concepts • Elaboration of a solution according to the given requirements. • Planning and, if necessary, team organization • Documentation • Presentation		
Competency goals	Upon successful completion of the module, students will be able to, -The students are asked to methodically analyze their own development through the completion of qualified development tasks, the content of which is oriented towards the profile of their future professional activity, - to develop solutions independently in the technical-scientific field, -The aim of the project is to compare scientific/technical approaches to solving problems, -The program allows you to analyze, solve and evaluate problems on your own, -technical documentation according to good scientific practice the work carried out.		
Teaching form	☐ Lecture		
	☐ Exercise		
	☐ Seminar/seminar exercise		
	☐ Laboratory		
	☒ Project		
Recommended Prequesites			
Literature	• Literatur ist abhängig von der gewählten Aufgabenstellung		
Study performance	☐ Exercise performance		
	☐ Laboratory performance		
	☐ Term paper		
	☐ Presentation		
	☐ Certificate		
Exam performance	☐ Written exam		
	☐ Oral exam		
	☐ Term paper		
	☒ Project paper		
	☐ Laboratory performance		
	☐ Final thesis and oral exam		
	☐ presentation		
Usability	Master Electrical Engineering - (PO 2019)	☒ CEM	
	Master Electrical Engineering (-Cooperative Study Programme) - (FPO 2025)	☒ CEM	
Offer	☒ Winter semester ☒ Summer semester ☐ Irregular		
Workload	Credit points	Contact time	Self-study
	5	60 hours [4 hours per week]	90 hours
Language	German		
Duration of the module	1 Semester		
Approved aids for the exam performance	None		
Lecturer(s)	Mr. Prof. Dr. Matthias Scherer		
Responsible(s)	Mr. Prof. Dr. Matthias Scherer		
Comment			
Change date	11.03.2025		

Final Thesis			
Content	The content of the master thesis is defined individually. The dual students generally complete their final thesis within the cooperating company, whereby the topic is agreed between the company and the head of the degree programme.		
Competency goals	Upon sucessfull completion of the module, students will be able, • to methodically analyze the students professional development through the completion of qualified developmental tasks, the content of which is oriented towards the profile of the later personal activity, • to develop solutions in the field of technical/medical qualification, • to compare approaches to solutions with scientific/technical working methods, • to analyze and solve problems independently, • to write technical papers on the work carried out. Students will be able to present and discuss theoretical and methodological issues in front of and with experts in the field present and justify their work with sound reasoning. Dual students and students who have completed their work at a company are able to reflect on and solve applied scientific tasks in a company-specific context.		
Teaching form	☐ Lecture		
	☐ Exercise		
	☐ Seminar/seminar exercise		
	☐ Laboratory		
	☒ Project		
Recommended Prequesites			
Literature	• Literatur ist abhängig von der gewählten Aufgabenstellung Michael Schuth Leitlinie für das Anfertigen von Projekt-, Studien-, und Diplomarbeiten im technischen Bereich Shaker Verlag ISBN 3-8265-9052-X		
Study performance	☐ Exercise performance		
	☐ Laboratory performance		
	☐ Term paper		
	☐ Presentation		
	☐ Certificate		
Exam performance	☐ Written exam		
	☐ Oral exam		
	☐ Term paper		
	☐ Project paper		
	☐ Laboratory performance		
	☒ Final thesis and oral exam		
	☐ presentation		
Usability	Master Electrical Engineering - (PO 2019)	☒ RM	
	Master Electrical Engineering (-Cooperative Study Programme) - (FPO 2025)	☒ RM	
Offer	☒ Winter semester ☒ Summer semester ☐ Irregular		
Workload	Credit points: 30	Contact time: 450 hours [30 hours per week]	Self-study: 450 hours
Language	German		
Duration of the module	1 Semester		
Approved aids for the exam performance	None		
Lecturer(s)	Alle Professorinnen und Professoren des Fachbereichs Technik		
Responsible(s)	Alle Professorinnen und Professoren des Fachbereichs Technik		
Comment			
Change date	19.03.2025		

Microsystems for Life Sciences			
Content			
Competency goals			
Teaching form	☒ Lecture		
	☐ Exercise		
	☐ Seminar/seminar exercise		
	☐ Laboratory		
	☐ Project		
Recommended Prequesites			
Literature	• M. Madou: Fundamentals of Microfabrication • Albert Folch: Introduction to BioMEMS		
Study performance	☐ Exercise performance		
	☐ Laboratory performance		
	☐ Term paper		
	☐ Presentation		
	☐ Certificate		
Exam performance	☒ Written exam		
	☐ Oral exam		
	☐ Term paper		
	☐ Project paper		
	☐ Laboratory performance		
	☐ Final thesis and oral exam		
	☐ presentation		
Usability	Master Electrical Engineering (-Cooperative Study Programme) - (FPO 2025)	☒ BM	
Offer	☐ Winter semester ☒ Summer semester ☐ Irregular		
Workload	Credit points	Contact time	Self-study
	5	60 hours [4 hours per week]	90 hours
Language	German		
Duration of the module	1 Semester		
Approved aids for the exam performance	None		
Lecturer(s)	Mr. Prof. Dr.-Ing. Dara Feili		
Responsible(s)	Mr. Prof. Dr.-Ing. Dara Feili		
Comment			
Change date	26.11.2024		

Model-Based Optimal Estimation			
Content	Basics of deterministic observers - Luenberger observer - Nonlinear observers Fundamentals of stochastic processes - Random variables and probability space - Expected values and moments - Bayes' theorem - Correlation and covariance - Power density spectra - Brownian processes Applications - Kalman filter as a stochastic optimal filter method - Extended Kalman filter for non-linear problems - Application examples from practice		
Competency goals	This course enables students to understand important methods of state estimation in theory and practice. The strong connection between theory and application should also enable students to perform transfer work in the very broad field of stochastic signal processing. Students will be able to simulatively analyze individual tasks of optimal state observation from different fields of application (medical technology, automotive engineering, automation, navigation, etc.). They can design optimal state estimation methods for linear and non-linear systems and verify them with simulation. They are able to document and present their results in an appropriate form (good scientific practice).		
Teaching form	☒ Lecture		
	☐ Exercise		
	☐ Seminar/seminar exercise		
	☐ Laboratory		
	☐ Project		
Recommended Prequesites	• Analysis 1 • Analysis 2 • •		
Literature	• "Estimationstheorie I + II", Loffeld • "Stochastic models, estimation, and control I-III", P.S.Maybeck • "Applied optimal Estimation", A.Gelb		
Study performance	☐ Exercise performance		
	☐ Laboratory performance		
	☐ Term paper		
	☐ Presentation		
	☐ Certificate		
Exam performance	☐ Written exam		
	☒ Oral exam		
	☐ Term paper		
	☒ Project paper		
	☐ Laboratory performance		
	☐ Final thesis and oral exam		
	☐ presentation		
Usability	Master Electrical Engineering - (PO 2019)	☒ CEM	
	Master Electrical Engineering (-Cooperative Study Programme) - (FPO 2025)	☒ CEM	
Offer	☐ Winter semester ☒ Summer semester ☐ Irregular		
Workload	Credit points: 5	Contact time: 60 hours [4 hours per week]	Self-study: 90 hours
Language	German and English		
Duration of the module	1 Semester		
Approved aids for the exam performance	None		
Lecturer(s)	Mr. Prof. Dr. Matthias Scherer		

Responsible(s)	Mr. Prof. Dr. Matthias Scherer
Comment	
Change date	28.11.2024

Moderne elektrische Antriebe			
Content	Topics covered: o Dimensioning of transformers and transient processes in transformers o Surge short circuit in synchronous generators o Slot harmonics in the induction machine o Transient behavior of the induction machine o Field-oriented control of the induction machine o Field-oriented control of the permanent magnetized synchronous machine o Calculation of linear drives, including end effects		
Competency goals	After successfully completing the module, students will understand the dynamic properties of electric drives and be able to reproduce various situations with the help of simulation tools. They have knowledge of the basic mathematical methods for analyzing dynamic problems. Furthermore, they will be able to carry out calculations of magnetic circuits for both static and dynamic problems using an FEM program.		
Teaching form	☒ Lecture		
	☒ Exercise		
	☐ Seminar/seminar exercise		
	☐ Laboratory		
	☐ Project		
Recommended Prequesites			
Literature	• Dierk Schröder: Elektrische Antriebstechnik - Regelung von Antriebssystemen • Dieter Gerling: Electrical Machines		
Study performance	☐ Exercise performance		
	☐ Laboratory performance		
	☐ Term paper		
	☐ Presentation		
	☐ Certificate		
Exam performance	☐ Written exam		
	☒ Oral exam		
	☐ Term paper		
	☐ Project paper		
	☐ Laboratory performance		
	☐ Final thesis and oral exam		
	☐ presentation		
Usability	Master Electrical Engineering (-Cooperative Study Programme) - (FPO 2025)		☒ BM
Offer	☐ Winter semester ☒ Summer semester ☐ Irregular		
Workload	Credit points	Contact time	Self-study
	5	60 hours [4 hours per week]	90 hours
Language	German		
Duration of the module	1 Semester		
Approved aids for the exam performance	None		
Lecturer(s)	Mr. Prof. Dr. Nikolaus Reiland		
Responsible(s)	Mr. Prof. Dr. Nikolaus Reiland		
Comment			
Change date	12.03.2025		

Neural Interfaces			
Content	Modeling of electrophysiological processes at the cell membrane, here the electrochemical processes at the cell membrane are discussed in detail. These describe the behavior of the ion channels during the generation of an action potential and the nonlinear behavior for the generation of action potentials. In the field of recording signals, the following topics are dealt with: study of amplifier technology, electrodes, electrophysiology, Modeling of the signal transmission of (amplifier noise, noise coupling, microphonics), Optimization of the measuring equipment (amplifiers, cables, arrangements), fields of application of medical technology: -EKG / EEG (stationary and long-term examinations, wellness) -impedance tomography -Neurodiagnostics - Active implants		
Competency goals	Upon successful completion of the module, students will be able to • describe the origin of electrophysiological signals, • explain the formation of resting potentials and action potentials, • describe the propagation of action potentials on nerve fibers, • Calculate the modeling of electrophysiological signals. The students master the design and selection of measurement amplifiers and are able to select methods for the reduction of disturbances. Furthermore, they are able to implement selected methods in an application-oriented manner in the field of electrodiagnostics. Through the elaboration of technical topics in the context of the module, the students are able, in the sense of lifelong learning, to work out new topics independently (key qualification).		
Teaching form	☒ Lecture		
	☒ Exercise		
	☐ Seminar/seminar exercise		
	☐ Laboratory		
	☐ Project		
Recommended Prequesites			
Literature	• Origin of the Resting Potential; Nassir H. Sabah, IEEE Engineering in medizine and biology.		
Study performance	☐ Exercise performance		
	☐ Laboratory performance		
	☐ Term paper		
	☐ Presentation		
	☐ Certificate		
Exam performance	☐ Written exam		
	☒ Oral exam		
	☒ Term paper		
	☐ Project paper		
	☐ Laboratory performance		
	☐ Final thesis and oral exam		
	☐ presentation		
Usability	Master Electrical Engineering (-Cooperative Study Programme) - (FPO 2025)		☒ BM
Offer	☒ Winter semester ☐ Summer semester ☐ Irregular		
Workload	Credit points	Contact time	Self-study
	5	60 hours [4 hours per week]	90 hours
Language	German and English		
Duration of the module	1 Semester		
Approved aids for the exam performance	None		
Lecturer(s)	Mr. Prof. Dr.-Ing. Klaus Peter Koch		
Responsible(s)	Mr. Prof. Dr.-Ing. Klaus Peter Koch		
Comment	This module replaces the module ”Medical Systems 2” in the Master’s programme.		
Change date	06.03.2025		

Nichtlineare Systeme und Regelungen			
Content	Nonlinear systems - Introduction to the properties of nonlinear systems - Analytical and non-analytical nonlinear systems - Rest positions and stability criteria of nonlinear systems - Analysis of nonlinear systems in the phase diagram Nonlinear controls - Analysis of variable-structure controls - Sliding-mode controllers - Optimal controls - Linearization at the operating point - Gain scheduling - Exact linearization - Flatness-based controls		
Competency goals	Students know the different types of non-linear systems. They are able to differentiate between non-linear properties based on tasks from different fields of application. They are proficient in working with 2D phase diagrams. They will be able to linearize analytical nonlinear systems at the operating point and use gain scheduling techniques. They can use Lie-algebra to linearize input-affine, non-linear systems precisely and design controls. They will be able to simulatively analyze specific practical tasks. They will have mastered formal controller design using the methods presented in the course with professional simulation tools (Matlab/Simulink). They are able to document and present their results in an appropriate form (good scientific practice).		
Teaching form	☒ Lecture		
	☐ Exercise		
	☐ Seminar/seminar exercise		
	☐ Laboratory		
	☐ Project		
Recommended Prequesites	• Analysis 1 • Analysis 2 • Control engineering •		
Literature	• Applied Nonlinear Control, Slotine, Li, • nichtlineare Regelungen, Adamy • Nichtlineare Regelungen I+II, Föllinger		
Study performance	☐ Exercise performance		
	☐ Laboratory performance		
	☐ Term paper		
	☐ Presentation		
	☐ Certificate		
Exam performance	☒ Written exam		
	☐ Oral exam		
	☐ Term paper		
	☐ Project paper		
	☐ Laboratory performance		
	☐ Final thesis and oral exam		
	☐ presentation		
Usability	Master Electrical Engineering (-Cooperative Study Programme) - (FPO 2025)	☒ BM	
Offer	☒ Winter semester ☐ Summer semester ☐ Irregular		
Workload	Credit points	Contact time	Self-study
	5	60 hours [4 hours per week]	90 hours
Language	German		
Duration of the module	1 Semester		
Approved aids for the exam performance	None		
Lecturer(s)	Mr. Prof. Dr. Matthias Scherer		

Responsible(s)	Mr. Prof. Dr. Matthias Scherer
Comment	
Change date	23.11.2024

<table>
<tr><th colspan="4">Project</th></tr>
<tr><td>Content</td><td colspan="3">Technical contents
- Elaboration of requirements from the topic
- Creation of a work and time plan for the project
- Coordination of the work packages
- Research on scientific topics, state of the art, methods
- Research on scientific topics, state of the art, applications
- Analysis of technical correlations (simulation if necessary)
- Development of solutions
- Selection and application of appropriate scientific methods
- Project organization: development of decision templates
- documentation
- Presentation of results

The dual students generally carry out the project work within the cooperating company, whereby the topic is agreed between the company and the head of the degree programme.</td></tr>
<tr><td>Competency goals</td><td colspan="3">This course enables the students to plan and work on a scientific project and finally to present the results. They master methods and tools and are able to analyze systems from
the technical environment. They are able to evaluate new methods and, if necessary, adapt them to the objectives of the project. The students are able to systematically develop and implement solutions according to the task at hand. They are able to make decisions according to objective criteria and to implement the selected solution.
You have taken responsibility for subprojects or other tasks in the overall project. You are able to manage your project according to the rules of good scientific practice to be documented.

Dual study programme students are able to reflect on and solve applied scientific tasks in a company-specific context.</td></tr>
<tr><td rowspan="5">Teaching form</td><td colspan="3">☐ Lecture</td></tr>
<tr><td colspan="3">☐ Exercise</td></tr>
<tr><td colspan="3">☐ Seminar/seminar exercise</td></tr>
<tr><td colspan="3">☐ Laboratory</td></tr>
<tr><td colspan="3">☒ Project</td></tr>
<tr><td>Recommended Prequesites</td><td colspan="3"></td></tr>
<tr><td>Literature</td><td colspan="3">• Abhängig vom gewählten Projekt</td></tr>
<tr><td rowspan="5">Study performance</td><td colspan="3">☐ Exercise performance</td></tr>
<tr><td colspan="3">☐ Laboratory performance</td></tr>
<tr><td colspan="3">☐ Term paper</td></tr>
<tr><td colspan="3">☐ Presentation</td></tr>
<tr><td colspan="3">☐ Certificate</td></tr>
<tr><td rowspan="7">Exam performance</td><td colspan="3">☐ Written exam</td></tr>
<tr><td colspan="3">☐ Oral exam</td></tr>
<tr><td colspan="3">☐ Term paper</td></tr>
<tr><td colspan="3">☒ Project paper</td></tr>
<tr><td colspan="3">☐ Laboratory performance</td></tr>
<tr><td colspan="3">☐ Final thesis and oral exam</td></tr>
<tr><td colspan="3">☐ presentation</td></tr>
<tr><td>Usability</td><td colspan="2">Master Electrical Engineering - (PO 2019)</td><td>☒ RM</td></tr>
<tr><td></td><td colspan="2">Master Electrical Engineering (-Cooperative Study Programme) - (FPO 2025)</td><td>☒ RM</td></tr>
<tr><td>Offer</td><td colspan="3">☒ Winter semester ☒ Summer semester ☐ Irregular</td></tr>
<tr><td>Workload</td><td colspan="3"><table><tr><th>Credit points</th><th>Contact time</th><th>Self-study</th></tr><tr><td>10</td><td>120 hours [8 hours per week]</td><td>180 hours</td></tr></table></td></tr>
<tr><td>Language</td><td colspan="3">German and English</td></tr>
<tr><td>Duration of the module</td><td colspan="3">1 Semester</td></tr>
<tr><td>Approved aids for the exam performance</td><td colspan="3">None</td></tr>
<tr><td>Lecturer(s)</td><td colspan="3">Mr. Prof. Dr. Matthias Scherer</td></tr>
</table>

Responsible(s)	Mr. Prof. Dr. Matthias Scherer
Comment	
Change date	11.03.2025

Seminar			
Content	The topic of the seminar will be announced at the beginning of the semester. The subject matter depends on the chosen task.		
Competency goals	After successfully completing the module, students will be able to - systematically and purposefully identify scientific literature and publications, also in English, using appropriate tools, - analyze and evaluate the content of current, application-oriented and theoretical methods with regard to their relevance to the research topic, - present scientific contexts in a suitable form and layout of a scientific publication. - elaborate and present the core of the content, - prepare professional presentations and present them convincingly, - moderate discussions on scientific topics.		
Teaching form	☐ Lecture		
	☐ Exercise		
	☒ Seminar/seminar exercise		
	☐ Laboratory		
	☐ Project		
Recommended Prequesites	• Seminar (eng.)		
Literature	• Literatur ist abhängig von der gewählten Aufgabenstellung • Literature depends on the selected task		
Study performance	☐ Exercise performance		
	☐ Laboratory performance		
	☐ Term paper		
	☐ Presentation		
	☐ Certificate		
Exam performance	☐ Written exam		
	☐ Oral exam		
	☒ Term paper		
	☐ Project paper		
	☐ Laboratory performance		
	☐ Final thesis and oral exam		
	☒ presentation		
Usability	Master Electrical Engineering - (PO 2019)	☒ RM	
	Master Electrical Engineering (-Cooperative Study Programme) - (FPO 2025)	☒ RM	
Offer	☒ Winter semester ☐ Summer semester ☐ Irregular		
Workload	Credit points	Contact time	Self-study
	5	60 hours [4 hours per week]	90 hours
Language	German		
Duration of the module	1 Semester		
Approved aids for the exam performance	None		
Lecturer(s)	Mr. Prof. Dr. Matthias Scherer		
Responsible(s)	Mr. Prof. Dr. Matthias Scherer		
Comment			
Change date	11.03.2025		

Smart Grids			
Content	Vision and strategy for the electrical grids of the future Development and operation of transmission and distribution grids Requirements for stable grid operation Smart generation and distribution of electrical energy Innovations in energy distribution Integration of electromobility into the energy grid (attention: Module held in German language)		
Competency goals	Students separate between the problems and challenges associated with future electricity grids. They understand advantages and possible applications and analyze various problems arising under use of power grid, e.g. data protection problems, and learn about different technologies for generating and distributing energy. The skills acquired form the basis for innovative and sustainable grid expansion. (attention: Module held in German language)		
Teaching form	☒ Lecture		
	☐ Exercise		
	☐ Seminar/seminar exercise		
	☐ Laboratory		
	☐ Project		
Recommended Prequesites	• Grid Infrastructure • Electrical Safety • Power Quality		
Literature	• Smart Grids: Grundlagen und Technologien der elektrischen Netze der Zukunft B. Buchholz und Z. Styczynski VDE-Verlag, 2019. Fundamentals of Smart Grids M. Kamran Academic Predss, 2022. • Smart Grids: Grundlagen und Technologien der elektrischen Netze der Zukunft B. Buchholz und Z. Styczynski VDE-Verlag, 2019. Fundamentals of Smart Grids M. Kamran Academic Predss, 2022.		
Study performance	☐ Exercise performance		
	☐ Laboratory performance		
	☐ Term paper		
	☐ Presentation		
	☐ Certificate		
Exam performance	☒ Written exam (in case of high number of participants)		
	☒ Oral exam (in case of low number of participants)		
	☐ Term paper		
	☐ Project paper		
	☐ Laboratory performance		
	☐ Final thesis and oral exam		
	☐ presentation		
Usability	Master Electrical Engineering (-Cooperative Study Programme) - (FPO 2025)	☒ BM	
	Master Electrical Engineering - (PO 2019)	☒ BM	
Offer	☒ Winter semester ☐ Summer semester ☐ Irregular		
Workload	Credit points	Contact time	Self-study
	5	60 hours [4 hours per week]	90 hours
Language	German		
Duration of the module	1 Semester		
Approved aids for the exam performance	None		

Lecturer(s)	Mr. Prof. Dr. Dirk Brechtken
Responsible(s)	Mr. Prof. Dr. Dirk Brechtken
Comment	
Change date	28.11.2024

Systems Engineering			
Content			
Competency goals			
Teaching form	☒ Lecture		
	☐ Exercise		
	☐ Seminar/seminar exercise		
	☐ Laboratory		
	☐ Project		
Recommended Prequesites			
Literature	• R. Haberfellener u.a.: SystemsEngineering.Verlag Orel-Füssli, A, Kossiakoff: Systems Engineering. Wiley-Verlag,		
Study performance	☐ Exercise performance		
	☐ Laboratory performance		
	☐ Term paper		
	☐ Presentation		
	☐ Certificate		
Exam performance	☒ Written exam		
	☐ Oral exam		
	☐ Term paper		
	☐ Project paper		
	☐ Laboratory performance		
	☐ Final thesis and oral exam		
	☐ presentation		
Usability	Master Electrical Engineering (-Cooperative Study Programme) - (FPO 2025)	☒ BM	
Offer	☐ Winter semester ☐ Summer semester ☒ Irregular		
Workload	Credit points	Contact time	Self-study
	5	60 hours [4 hours per week]	90 hours
Language	German		
Duration of the module	1 Semester		
Approved aids for the exam performance	None		
Lecturer(s)	Mr. Prof. Dr. Volker Lücken		
Responsible(s)	Mr. Prof. Dr. Volker Lücken		
Comment			
Change date	25.09.2024		

Team Project			
Content	Technical contents • Development of requirements from the topic • Preparation of a work plan and time schedule for the project • Coordination of work packages within the team, integration of team members • Research on scientific topics, state of the art, methods, etc. • Research on scientific topics, state of the art, applications • Analysis of technical correlations (simulation if necessary) • Development of solutions • Selection and application of appropriate scientific methods • Planning and team organization • Project organization: preparation and moderation of team meetings, preparation of decision papers • Documentation • Presentation of the results		
Competency goals	This course enables the students to plan and work on a scientific project with several collaborators and finally to present the results. The students have learned to takeresponsibility in a team and to coordinate subtasks.They master methods and tools and are able to analyze systems from the electrotechnical environment. They are able to evaluate new methods and, if necessary, adapt them to the objectives of the project. The students are able to systematically develop and implement solutions according to the task at hand. They are able to make decisions according to objective criteria and to implement the selected solution. You have taken responsibility for subprojects or other tasks in the overall project. You are able to manage your project according to the rules of good scientific practice to be documented.		
Teaching form	☐ Lecture		
	☐ Exercise		
	☐ Seminar/seminar exercise		
	☐ Laboratory		
	☒ Project		
Recommended Prequesites			
Literature	• Abhängig vom gewählten Thema des Teamprojekts		
Study performance	☐ Exercise performance		
	☐ Laboratory performance		
	☐ Term paper		
	☐ Presentation		
	☐ Certificate		
Exam performance	☐ Written exam		
	☐ Oral exam		
	☐ Term paper		
	☒ Project paper		
	☐ Laboratory performance		
	☐ Final thesis and oral exam		
	☐ presentation		
Usability	Master Electrical Engineering - (PO 2019)	☒ RM	
	Master Electrical Engineering (-Cooperative Study Programme) - (FPO 2025)	☒ RM	
Offer	☒ Winter semester ☒ Summer semester ☐ Irregular		
Workload	Credit points: 10	Contact time: 120 hours [8 hours per week]	Self-study: 180 hours
Language	German		
Duration of the module	1 Semester		
Approved aids for the exam performance	None		
Lecturer(s)	Mr. Prof. Dr. Matthias Scherer		
Responsible(s)	Mr. Prof. Dr. Matthias Scherer		
Comment			

Change date	25.11.2024

Vibration Technology (M)			
Content	- Consolidation of selected chapters of dynamics - Development of differential equations to describe the motion in vibrational mechanical systems - Development and solution of the differential equations in time and frequency domain - Practical implementation of the theory with the simulation tool SDT-DynaSim		
Competency goals	The module Vibration Engineering imparts students with fundamental knowledge and skills in the field of vibration analysis, calculation, and damping. Its aim is to enable students to recognize, analyze, and develop suitable solutions for vibration-related issues in technical systems.		
Teaching form	☒ Lecture		
	☐ Exercise		
	☐ Seminar/seminar exercise		
	☒ Laboratory		
	☐ Project		
Recommended Prequesites			
Literature	• Michael Wahle ”Grundlagen der Maschinen- und Strukturdynamik” Wissenschaftsverlag Mainz - Aachen • Horst Irretier ”Grundlagen der Schwingungstechnik 2” Vieweg Verlag • Vorlesungsumdruck • Horst Irretier ”Grundlagen der Schwingungstechnik 1” Vieweg Verlag		
Study performance	☐ Exercise performance		
	☐ Laboratory performance		
	☐ Term paper		
	☐ Presentation		
	☐ Certificate		
Exam performance	☒ Written exam		
	☐ Oral exam		
	☐ Term paper		
	☐ Project paper		
	☐ Laboratory performance		
	☐ Final thesis and oral exam		
	☐ presentation		
Usability	Master Industrial Engineering - (PO 2015)	☒ RM	
	Master Mechanical Engineering - (PO 2015)	☒ RM	
	Master Electrical Engineering (-Cooperative Study Programme) - (FPO 2025)	☒ CEM	
Offer	☒ Winter semester ☐ Summer semester ☐ Irregular		
Workload	Credit points	Contact time	Self-study
	5	60 hours [4 hours per week]	90 hours
Language	German		
Duration of the module	1 Semester		
Approved aids for the exam performance	None		
Lecturer(s)	Mr. Prof. Dr. Alexander Wohlers		
Responsible(s)	Mr. Prof. Dr. Alexander Wohlers		
Comment	None None		
Change date	28.11.2024		