Technik
Hauptcampus

HOCHSCHULE TRIER

# Module manual for the course Master Electrical Engineering

## Examination regulations 2019

Version 01.00.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.

# Contents

| **Advanced Cognitive Robotics** | | | |
|---|---|---|---|
| **Content** | Lecture:<br>- Basic concepts of Industry 4.0, Cyber-Physical Systems (CPS) and robotics<br>- Fundamentals of mobile robotics, Kinematics and actuators<br>- Introduction to the Robot Operating System (ROS) framework<br>- Perception: sensor technology, sensor data processing and fusion; environment perception<br>- Localization and mapping, motion planning and navigation<br><br>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,<br>1. Identify application fields of the Industry 4.0 and robotics,<br>2. Describe the basic components, functionalities and interactions of mobile robotics,<br>3. use the acquired knowledge to gain an understanding of complex systems in mobile robotics and sensing/perception,<br>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<br>• Klein, B. Einfuhrung in Python 3. Hanser Verlag, 2021 (optionally, to refresh Python knowledge).<br>• Thrun; Burgard; Fox. Probabilistic Robotics. MIT Press, 2005.<br>• Siciliano, Khatib. Springer Handbook of Robotics - Second Edition. Springer, 2016 (available on demand in case of further interest)<br>• Siegwart; Nourbakhsh, Scaramuzza. Introduction to Autonomous, Mobile Robots - Second Edition. MIT Press, 2011.<br>• Quigley; Gerkey; Smart. Programming Robots with ROS. O Reilly, 2015.<br>• Thrun; Burgard; Fox. Probabilistic Robotics. MIT Press, 2005.<br>• Siciliano, Khatib. Springer Handbook of Robotics - Second Edition. Springer, 2016 (available on demand in case of further interest)<br>• Siegwart; Nourbakhsh, Scaramuzza. Introduction to Autonomous, Mobile Robots - Second Edition. MIT Press, 2011.<br>• 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 |

| **Automatic Control** | |
|---|---|
| **Content** | Lecture<br><br>Nonlinear systems<br>- Linearization methods<br>- Decoupling method<br>- Stability criteria according to Lyapunov<br>- Structure-variable controls (sliding mode)<br><br>Analytical nonlinear systems and controls<br>- Exact linearization<br>- Zero dynamics<br>- Simulation examples<br><br>System identification<br>- LS method<br>- Maximum Likelihood method<br><br>Homework/Laboratory<br>- Simulation of selected nonlinear systems<br>- Simulation of structure-variable control methods<br>- Simulation of control loops with exact linearization |
| **Competency goals** | Students are familiar with the special properties and challenges of non-linear systems. They are able to model non-linear controlled systems and differentiate and evaluate their properties. They can apply selected methods for the design of controllers for non-linear systems to practical problems and evaluate the results.<br><br>Students understand the relevant methods for system identification. They can apply the methods to simple examples using Matlab and evaluate the results.<br><br>Students understand the development process of mechatronic systems.<br>After successfully completing the laboratory exercises and homework, they will have the application skills for the process steps:<br><br>- specification<br>- system simulation<br>- Design of sensors and actuators<br>- Controller design |
| **Teaching form** | ☒ Lecture |
| | ☐ Exercise |
| | ☐ Seminar/seminar exercise |
| | ☒ Laboratory |
| | ☐ Project |
| **Recommended Prequesites** | • Analysis 1<br>• Analysis 2<br>•<br>• Classical and Modern Physics<br>• Control engineering<br>• |
| **Literature** | • Isidori, “Nonlinear Control Systems”<br>• Föllinger „Nichtlineare Regelungen I+II“<br>• Dorf, Bishop „Modern Control Systems“<br>• Schwarz, “Einführung in nichtlineare Regelsysteme”<br>• Isermann, “Systemidentifikation I + II” |
| **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 |
| **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** | 28.11.2024 | | |

| **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<br>- describe and explain the basic principles of biomechanical systems,<br>- link the physical principles and the biological structure of biomechanical systems,<br>- understand the functional principle of computer tomography and explain its application in biomechanics,<br>- apply finite element analysis to initial examples.<br><br>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<br>• Special Topics in Physics | | |
| **Literature** | • Richard, Hans Albert, and Kullmer, Gunter. Biomechanik: Anwendungen mechanischer Prinzipien auf den menschlichen Bewegungsapparat. Deutschland, Springer Fachmedien Wiesbaden, 2020.<br>• Winter, David A.. Biomechanics and Motor Control of Human Movement. Wiley, 2009.<br>• Knudson, Duane. Fundamentals of Biomechanics. USA, Springer US, 2013.<br>• 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 | 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** | Calculator (not programmable) | | |
| **Lecturer(s)** | Mrs. Dr. Friederike Nolle | | |
| **Responsible(s)** | Mrs. Dr. Friederike Nolle | | |
| **Comment** | | | |
| **Change date** | 10.03.2025 | | |

| **Digital Signal Processing** | | | |
|---|---|---|---|
| **Content** | Discrete Stochastic Processes Linear<br>Signal Models Nonparametric Specrtal<br>Estimation Optimal Linear Filters<br>Algorithms and Structures for Optimal Filtering<br>Least Squares Filtering<br>Parametric Spectral Estimation<br>Adaptive Filters<br>Array signal processing Radar signal processing, SAR, ISAR<br>System identification | | |
| **Competency goals** | The students<br>• can explain the differences between classical and stochastic signal processing,<br>• The students are able to select suitable methods and algorithms for various applications in digital signal processing,<br>• can evaluate the different methods in terms of their performance and computational effort,<br>• can develop new systems, forexample, for medical devices, measuring instruments and radar technology devices,<br>• 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<br>• 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 | | |

| **Electromagnetic Fields** | | | |
|---|---|---|---|
| **Content** | Transition of conducted to free electromagnetic waves.<br>Basis: Maxwell equations in integral and differential form. Frequency ranges and applications. (Complex) Maxwell equations in the high frequency range. (Time-averaged) Poynting vector and lei- stuation. High frequency effects in materials and devices, skin effect field characteristic impedance, phase and group delay, Polarization, reflection and transmission at boundaries, Hertzian<br>dipole, introduction to antennas, parasitic effects,<br>Waveguide: waveguide, cutoff frequency | | |
| **Competency goals** | After successful completion of the module, the students will be able to evaluate transmission systems for different fields of application with regard to reasonable combinations of medium, bit rate/bandwidth and modulation and multiplexing methods.<br>They are able to evaluate low and high frequency systems for different applications on the basis of the nominal behavior, the parasitic effects and the electromagnetic compatibility.<br>For this purpose, students master the specification of subject-specific<br>The students will be able to solve specific computational problems, to compare computational methods, and to select the optimal method.<br>method as well as the application of basic techniques in practice. | | |
| **Teaching form** | ☒ Lecture | | |
| | ☒ Exercise | | |
| | ☐ Seminar/seminar exercise | | |
| | ☐ Laboratory | | |
| | ☐ Project | | |
| **Recommended Prequesites** | | | |
| **Literature** | • Pehl: Mikrowellentechnik<br>• Herter, Lörcher: Nachrichtentechnik<br>• Herter, Lörcher: Nachrichtentechnik<br>• Freyer: Nachrichten-Übertragungstechnik<br>• Georg: Elektromagnetische Wellen<br>• Herter, Lörcher: Nachrichtentechnik<br>• Freyer: Nachrichten-Übertragungstechnik<br>• Freyer: Nachrichten-Übertragungstechnik<br>• Freyer: Nachrichten-Übertragungstechnik<br>• Pehl: Mikrowellentechnik<br>• Freyer: Nachrichten-Übertragungstechnik<br>• Freyer: Nachrichten-Übertragungstechnik<br>• Freyer: Nachrichten-Übertragungstechnik<br>• Herter, Lörcher: Nachrichtentechnik<br>• Freyer: Nachrichten-Übertragungstechnik<br>• Freyer: Nachrichten-Übertragungstechnik<br>• Freyer: Nachrichten-Übertragungstechnik | | |
| **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 |
| **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 | | |

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| **Approved aids for the exam performance** | |
| **Lecturer(s)** | Mr. Prof. Dr. Andreas R. Diewald |
| **Responsible(s)** | Mr. Prof. Dr. Andreas R. Diewald |
| **Comment** | Electromagnetic Waves |
| **Change date** | 14.11.2024 |

| **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.<br>Comparison of different efficiency indicators. Influence of the design parameters of a vehicle on energy efficiency.<br>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<br>Hofmann, Peter, 2014, Springer-Verlag Wien, ISBN 978-3-7091-1779-8<br>• Handbuch Lithium-Ionen-Batterien<br>Korthauer, R., Springer-Verlag Berlin Heidelberg 2013, ISBN 978-3-642-30652-5978-3-7091-1779-8<br>• 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.<br>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.<br>The contents include:<br>• Elaboration of the requirements from a generally posed problem<br>• Analysis of the correlations<br>• Selection of suitable concepts<br>• Elaboration of a solution according to the given requirements.<br>• Planning and, if necessary, team organization<br>• Documentation<br>• Presentation | | |
| **Competency goals** | Upon successful completion of the module, students will be able to,<br>-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<br>professional activity,<br>- to develop solutions independently in the technical-scientific field,<br>-The aim of the project is to compare scientific/technical approaches to solving problems,<br>-The program allows you to analyze, solve and evaluate problems on your own,<br>-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.<br>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,<br>• 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,<br>• to develop solutions in the field of technical/medical qualification,<br>• to compare approaches to solutions with scientific/technical working methods,<br>• to analyze and solve problems independently,<br>• to write technical papers on the work carried out.<br>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.<br><br>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<br>Michael Schuth<br>Leitlinie für das Anfertigen von Projekt-, Studien-, und Diplomarbeiten im technischen Bereich<br>Shaker Verlag<br>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 | | |

| **Internet of Things / Industrie 4.0** | | | |
|---|---|---|---|
| **Content** | The course will be offered in English from summer semester 2024 under the title 'Internet of Things / Industry 4.0' or the title 'Advanced Cognitive Robotics' according to the new examination regulations. From summer semester 2025, the course will only be offered under the title 'Advanced Cognitive Robotics'. | | |
| **Competency goals** | See referenced course. | | |
| **Teaching form** | ☒ Lecture | | |
| | ☐ Exercise | | |
| | ☐ Seminar/seminar exercise | | |
| | ☒ Laboratory | | |
| | ☐ Project | | |
| **Recommended Prequesites** | | | |
| **Literature** | • Siehe referenzierte Veranstaltung | | |
| **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 | |
| **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. Volker Lücken | | |
| **Responsible(s)** | Mr. Prof. Dr. Volker Lücken | | |
| **Comment** | See referenced course. Examination and laboratory conditions after announcement. | | |
| **Change date** | 07.11.2024 | | |

| **Learning Systems** | | | |
|---|---|---|---|
| **Content** | Introduction and classification of learning systems, overview of learning systems, history of learning systems, basics of neural networks, multilayer perceptrons (MLPs), convolutional neural networks (CNNs), recurrent neural networks (RNNs), Long Short-Term Memory Networks (LSTMs), generative models and autoencoders, natural language processing (NLP), reinforcement learning, Q-learning and Deep Q-Network (DQN), policy gradient methods, evolutionary algorithms | | |
| **Competency goals** | After successfully completing the module, students will be able to<br>• understand the basic concepts and classifications of learning systems.<br>• gain an overview of different learning systems and understand their historical context<br>• understand the basics of neural networks<br>• develop an understanding of the architecture and functioning of multilayer perceptrons (MLPs).<br>• analyze the structure and applications of convolutional neural networks (CNNs)<br>• examine the structure and use cases of recurrent neural networks (RNNs)<br>• understand the functionality and effects of LSTMs<br>• gain insights into generative models and autoencoders and their importance for machine learning<br>• explore mechanisms and application of Q-learning and Deep Q-Network (DQN)<br>• investigate principles and real-world applications of evolutionary algorithms | | |
| **Teaching form** | ☒ Lecture | | |
| | ☐ Exercise | | |
| | ☐ Seminar/seminar exercise | | |
| | ☒ Laboratory | | |
| | ☐ Project | | |
| **Recommended Prequesites** | | | |
| **Literature** | • Ethem Alpaydin, Machine Learning, MIT Press, 2021<br>• Aurélien Géron, Hands-On Machine Learning with Scikit-Learn & TensorFlow, OReilly, 3. Auflage 2022<br>• Goodfellow, Bengio & Courville, Deep Learning, MIT Press, 2016<br>• Nikhil Buduma, Fundamentals of Deep Learning, OReilly, 2022<br>• Josh Patterson & Adam Gibson, Deep Learning, OReilly, 1. Auflage 2017 | | |
| **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 |
| **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** | | | |
| **Change date** | 28.11.2024 | | |

| **Medical Systems 1** | | | |
|---|---|---|---|
| **Content** | Introduction: Fluid, Colloid, Solutions<br>Electrokinetics: electroosmosis, electrophoresis, electrowetting<br>Principles of microactuators: electrostatics, magnetics, piezoelectrics, shape-memory alloys.<br>Lab on Chip: Microfluidic Devices, Micromixers, Microarrays, Tissue Engineering, Plasma Medicine, Inertial sensors, navigation, satellite navigation, Introduction to RF-MEMS and MOEMS | | |
| **Competency goals** | After successful completion of the module, the students possess basic knowledge as well as in-depth knowledge of complex manufacturing technologies of microsystem and microfluidic devices and are able to implement selected processes in an application-oriented manner in the field of System-on-chip technologies. They have an extended knowledge of the theoretical basics in "Tissue Engineering (TE)" and are familiar with the Methods of technology of plasma for medical applications. Furthermore, they have basic knowledge in complex application areas of microsystems technology in the field of microactuators and microsensors and are able to describe, explain and analytically calculate the resulting devices.<br>After successful completion, the graduates of the module will be able to provide meaningful, competent and solution-oriented professional topics in the field of System on Chip components. | | |
| **Teaching form** | ☒ Lecture | | |
| | ☐ Exercise | | |
| | ☐ Seminar/seminar exercise | | |
| | ☐ Laboratory | | |
| | ☐ Project | | |
| **Recommended Prequesites** | | | |
| **Literature** | • Mescheder, Ulrich: Mikrosystemtechnik - Konzepte und Anwendungen<br>• Büttgenbach, Stephanus: Mikromechanik - Einführung in Technologie und Anwendungen<br>• Gerlach, G.; Dötzel, W.: Grundlagen der Mikrosystemtechnik<br>• Menz, Wolfgang; Mohr, Jürgen: Mikrosystemtechnik für Ingenieure<br>• M. Madou: Fundamentals of Microfabrication | | |
| **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 | |
| **Offer** | ☐ Winter semester ☒ Summer semester ☐ Irregular | | |
| **Workload** | Credit points: 5 | Contact time: 60 hours [4 hours per week] | Self-study: 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** | 28.11.2024 | | |

| **Medical Systems 2** | | | |
|---|---|---|---|
| **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.<br>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:<br>-EKG / EEG (stationary and long-term examinations, wellness)<br>-impedance tomography<br>-Neurodiagnostics<br>- Active implants | | |
| **Competency goals** | Upon successful completion of the module, students will be able to<br>• describe the origin of electrophysiological signals,<br>• explain the formation of resting potentials and action potentials,<br>• describe the propagation of action potentials on nerve fibers,<br>• Calculate the modeling of electrophysiological signals.<br>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<br>in an application-oriented manner in the field of electrodiagnostics.<br>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 - (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 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 will be replaced by the module ‘Neural Interfaces’ from winter semester 2024-25. | | |
| **Change date** | 10.03.2025 | | |

| **Methods of systematic Problem solving** | | | |
|---|---|---|---|
| **Content** | Part 1:<br>- Terms and definitions<br>- Analysis of initial and target state<br>- Synthesis of solution variants<br>- Evaluation and decision<br>- Solution realization as a project<br>Part 2:<br>-Outline of scientific papers<br>-Literature search (literature databases, patents, Internet)<br>-Verification of the sources (boundary conditions, quality).<br>-Revision of the question<br>-Selection and presentation of methods (FMEA, risk analysis)<br>-Display of results<br>-Interpretation and discussion of the results<br>-types of documentation (theses, development documentations, journal articles, patents, congress reports) | | |
| **Competency goals** | After completing the course, students are capable of,<br>• the difference between tasks, problems and processes.<br>explain,<br>• to apply the different strategies for search problems,<br>• explain the importance of systems and processes in problem solving using examples,<br>• analyze problematic issues,<br>• to create operational target systems out of abstruse target concepts,<br>• To use creativity techniques to search for solution ideas,<br>• Use decision procedures for the selection of optimal solutions. | | |
| **Teaching form** | ☒ Lecture | | |
| | ☒ Exercise | | |
| | ☐ Seminar/seminar exercise | | |
| | ☐ Laboratory | | |
| | ☐ Project | | |
| **Recommended Prequesites** | | | |
| **Literature** | • Vorlesungsfolien | | |
| **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 |
| **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** | 25.10.2024 | | |

| **Model-Based Optimal Estimation** | | | |
|---|---|---|---|
| **Content** | Basics of deterministic observers<br>- Luenberger observer<br>- Nonlinear observers<br>Fundamentals of stochastic processes<br>- Random variables and probability space<br>- Expected values and moments<br>- Bayes' theorem<br>- Correlation and covariance<br>- Power density spectra<br>- Brownian processes<br>Applications<br>- Kalman filter as a stochastic optimal filter method<br>- Extended Kalman filter for non-linear problems<br>- 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<br>• Analysis 2<br>•<br>• | | |
| **Literature** | • "Estimationstheorie I + II", Loffeld<br>• "Stochastic models, estimation, and control I-III", P.S.Maybeck<br>• "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 |

| **Powersystems** | | | |
|---|---|---|---|
| **Content** | 1) Faults in electrical networks<br>2) Protection and selectivity in electrical networks<br>3) Grounding in electrical networks<br>4) Requirements and their normative mapping for grounding<br>5) Investigations on demonstrators<br>6) Design and dimensioning of grounding systems<br>7) Network feedback, network analysis and evaluation | | |
| **Competency goals** | After successful completion of the module, the participants know the different faults in electrical networks. They know the requirements for grounding systems and their importance for electrical power distribution. Based on the technical requirements, a comparison is made with the applicable standards. The students recognize that a standard does not necessarily have to be correct in itself, but should also be critically examined. Existing deviations are discussed critically.<br>Joint network analyses and their evaluation as well as the execution of measurements complete this complex of topics. The students are sensitized to these network parameters and their effects.<br>The students have a theoretical background with reference to application technology and are competent in carrying out the following tasks complex analyses in electricity networks. | | |
| **Teaching form** | ☒ Lecture | | |
| | ☒ Exercise | | |
| | ☐ Seminar/seminar exercise | | |
| | ☒ Laboratory | | |
| | ☐ Project | | |
| **Recommended Prequesites** | | | |
| **Literature** | • Schutz und Selektivität in Niederspannungsanlagen, VDE-Verlag, 2022.<br>• DIN 18015, Erdungsanlagen BVS-Standpunkt Fundamenterder, 2019. | | |
| **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 | |
| **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** | The module will be held for the last time in WS 23/24.<br>It will be replaced by the module 'Smart Grids'. | | |
| **Change date** | 14.11.2024 | | |

| **Programming of ERP Systems Using the Example of SAP®-S/4HANA®** | | | |
|---|---|---|---|
| **Content** | - Quick start SAP-ERP MM and PP<br>- The programming language ABAP, screens, internal tables, Open SQL©, data modeler, function blocks | | |
| **Competency goals** | After successful completion of the module, students will be able to operate the GUI. They have knowledge of object-oriented programming in ABAP Objects©, GUI programming, database programming and recursive programming. They can structure relational data models. | | |
| **Teaching form** | ☒ Lecture | | |
| | ☐ Exercise | | |
| | ☐ Seminar/seminar exercise | | |
| | ☐ Laboratory | | |
| | ☐ Project | | |
| **Recommended Prequesites** | | | |
| **Literature** | • Karl-Heinz Kühnhauser, Thorsten Franz; Einstieg in ABAP<br>• Horst Keller, Sascha Krüger; ABAP Objects; ISBN 978-3-89842-358-8<br>• Andreas Blumenthal, Horst Keller; ABAP - Fortgeschrittene Techniken und Tools, Band 2; ISBN 978-3-8362-2072-9<br>• Horst Keller, Wolf Hagen Thümmel; ABAP-Programmierrichtlinien; ISBN 978-3-8362-2090-3 | | |
| **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 Industrial Engineering - (PO 2015) | ☒ CEM | |
| | Master Mechanical Engineering - (PO 2015) | ☒ CEM | |
| | 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** | German and English | | |
| **Duration of the module** | 1 Semester | | |
| **Approved aids for the exam performance** | None | | |
| **Lecturer(s)** | Mr. Prof. Dr. Fritz Nikolai Rudolph | | |
| **Responsible(s)** | Mr. Prof. Dr. Fritz Nikolai Rudolph | | |
| **Comment** | None<br>None | | |
| **Change date** | 18.02.2025 | | |

| **Project** | | |
|---|---|---|
| **Content** | Technical contents<br>- Elaboration of requirements from the topic<br>- Creation of a work and time plan for the project<br>- Coordination of the work packages<br>- Research on scientific topics, state of the art, methods<br>- Research on scientific topics, state of the art, applications<br>- Analysis of technical correlations (simulation if necessary)<br>- Development of solutions<br>- Selection and application of appropriate scientific methods<br>- Project organization: development of decision templates<br>- documentation<br>- Presentation of results<br><br>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. | |
| **Competency goals** | 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<br>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.<br>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.<br><br>Dual study programme students 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** | • Abhängig vom gewählten Projekt | |
| **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 |
|---|---|---|
| 10 | 120 hours [8 hours per week] | 180 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** | 11.03.2025 |

| **Project Management** | | | |
|---|---|---|---|
| **Content** | 1. Introduction: terms, definition, classification and delimitation<br>2. Project organization: process, structure and information organization<br>3. Project planning: preparation of project, process, cost and schedule plans, risk management.<br>4. Project management: progress control, change management, and Project completion<br>5. Tools: practical use | | |
| **Competency goals** | Upon successful completion of the module, students will be able to plan and manage projects by . . .<br>. . . (1.) Decide whether a project is a project and which project management processes are required,<br>. . . (2.) lay the groundwork for the goal-oriented execution of a project by creating an assignment,<br>. . . (3.) Organize the structure of the project team, the basic structure of the project process and the handling of information in the project,<br>. . . (4.) Structure the composition of the project result and the subdivision of the project activities in a hierarchical form,<br>. . . (5.) the statements of work required in a project. The information available allows us to estimate the duration and cost of the project,<br>. . . (6.) Determine the sequence of the work and plan the deadlines with the help of the allocation of resources,<br>. . . (7.) Identify the risk factors in the project and take measures to reduce them,<br>. . . (8.) Plan and monitorhe progress of the project in order to be able to react to deviations by means of controlling measures,<br>. . . (9.) Computerized tools for the planning and control of the Use projects. | | |
| **Teaching form** | ☒ Lecture | | |
| | ☒ Exercise | | |
| | ☐ Seminar/seminar exercise | | |
| | ☐ Laboratory | | |
| | ☐ Project | | |
| **Recommended Prequesites** | | | |
| **Literature** | • W, Jakoby: Intensivtraining Projektmanagement, Springer Vieweg, 2015.<br>• W. Jakoby: Projektmanagement für Ingenieure, Springer Vieweg, 3. Aufl. 2015. | | |
| **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 |
| **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** | 20.11.2024 | | |

| **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<br>- systematically and purposefully identify scientific literature and publications, also in English, using appropriate tools,<br>- analyze and evaluate the content of current, application-oriented and theoretical methods with regard to their relevance to the research topic,<br>- present scientific contexts in a suitable form and layout of a scientific publication.<br>- elaborate and present the core of the content,<br>- prepare professional presentations and present them convincingly,<br>- 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<br>• 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<br>Development and operation of transmission and distribution grids<br>Requirements for stable grid operation<br>Smart generation and distribution of electrical energy<br>Innovations in energy distribution<br>Integration of electromobility into the energy grid<br>(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.<br>The skills acquired form the basis for innovative and sustainable grid expansion.<br>(attention: Module held in German language) | | |
| **Teaching form** | ☒ Lecture | | |
| | ☐ Exercise | | |
| | ☐ Seminar/seminar exercise | | |
| | ☐ Laboratory | | |
| | ☐ Project | | |
| **Recommended Prequesites** | • Grid Infrastructure<br>• Electrical Safety<br>• Power Quality | | |
| **Literature** | • Smart Grids: Grundlagen und Technologien der elektrischen Netze der Zukunft<br>B. Buchholz und Z. Styczynski<br>VDE-Verlag, 2019.<br><br>Fundamentals of Smart Grids<br>M. Kamran<br>Academic Predss, 2022.<br>• Smart Grids: Grundlagen und Technologien der elektrischen Netze der Zukunft<br>B. Buchholz und Z. Styczynski<br>VDE-Verlag, 2019.<br><br>Fundamentals of Smart Grids<br>M. Kamran<br>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 | | |

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

| **Team Project** | | | |
|---|---|---|---|
| **Content** | Technical contents<br>• Development of requirements from the topic<br>• Preparation of a work plan and time schedule for the project<br>• Coordination of work packages within the team, integration of team members<br>• Research on scientific topics, state of the art, methods, etc.<br>• Research on scientific topics, state of the art, applications<br>• Analysis of technical correlations (simulation if necessary)<br>• Development of solutions<br>• Selection and application of appropriate scientific methods<br>• Planning and team organization<br>• Project organization: preparation and moderation of team meetings, preparation of decision papers<br>• Documentation<br>• 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<br>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<br>solutions according to the task at hand. They are able to make decisions according to objective criteria and to implement the selected solution.<br>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** | | | |

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|---|---|
| **Change date** | 25.11.2024 |

| **Theory of Drive Technology** | | | |
|---|---|---|---|
| **Content** | Topics covered:<br>o Dimensioning of transformers and transient processes in transformers.<br>o Surge short circuit for synchronous generators<br>o Slot harmonics in the asynchronous machine<br>o Transient behavior of the asynchronous machine<br>o Field-oriented control of the asynchronous machine<br>o Field-oriented control of the permanently excited synchronous machine<br>o Calculation of linear drives taking into account the end-effecte | | |
| **Competency goals** | After successful completion of the module, students will understand the dynamic properties of electric drives and will be able to reproduce various situations with the help of simulation tools. They have knowledge of the basic mathematical procedures for the analysis of dynamic problems. Furthermore, they are able to perform calculations for static as well as for dynamic problems magnetic circuits with the aid of an FEM program. | | |
| **Teaching form** | ☒ Lecture | | |
| | ☒ Exercise | | |
| | ☐ Seminar/seminar exercise | | |
| | ☐ Laboratory | | |
| | ☐ Project | | |
| **Recommended Prequesites** | | | |
| **Literature** | | | |
| **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 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** | 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** | Module language: German | | |
| **Change date** | 13.03.2025 | | |