

**Modulhandbuch für den Studiengang /
Module manual of the study programme:
Master Electrical Engineering**

Fachbereich Technik, Fachrichtung Elektrotechnik /Department of
Engineering, subject area Electrical Engineering

Hochschule Trier
Trier University of Applied Sciences

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Anlage 1: Masterstudiengang Elektrotechnik²

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	SWS	LP(ECTS)	SWS	LP(ECTS)	SWS	LP(ECTS)	SWS	LP(ECTS)
Basismodule (5 Module sind zu wählen)								
Powersystems			4	5			4	5
Theorie der Antriebstechnik	4	5					4	5
Medizinische Systeme 1	4	5					4	5
Medizinische Systeme 2			4	5			4	5
Regelungstechnik			4	5			4	5
Signalverarbeitung	4	5					4	5
Lernende Systeme			4	5			4	5
Elektromagnetische Felder	4	5					4	5
Internet of Things / Industrie 4.0	4	5					4	5
Projektmanagement			4	5			4	5
Summe								25
Wahlpflichtmodule (Beispielkatalog) (2 Module sind zu wählen)								
Energieeffiziente Fahrzeuge	4	5					4	5
Ethik und Compliance			4	5			4	5
Programmierung von ERP-Systemen am Beispiel von SAP-ERP	4	5					4	5
Medizinische Mustererkennung			4	6			4	6
Verlässliche Echtzeitsysteme	4	6					4	6
Summe								10
Module mit studierendenzentrierten Lehrformen								
Projekt		10						10
Teamprojekt				10				10
Fachseminar			4	5			4	5
Summe		10		15				25
Master-Abschlussarbeit								
Abschlussarbeit						30		30
Summe						30		30
Summe ges.								90

² Für einen Aufenthalt an einer anderen Hochschule eignet sich insbesondere das 2. Fachsemester.

Hinweise und Anmerkungen zu den Modulbeschreibungen

Das Modulhandbuch basiert auf den derzeit aktuellen Prüfungsordnungen.

1. **Lehrveranstaltung:** Eine Lehrveranstaltung kann verschiedene Lehrformen, z.B. Vorlesungen (V), Übungen (Ü), Laborübungen (L), Seminare (S) usw. enthalten.
2. **Modul:** Falls mehrere Lehrveranstaltungen zum gleichen Modul gehören, tragen sie gemeinsame Modulbezeichnungen.
3. **Modulverantwortlicher:** Angaben zum Modulverantwortlichen
4. **Lehrende/Prüfende:** Falls eine Lehrveranstaltung von mehreren Lehrenden/Prüfenden angeboten wird, ist für jeden weiteren Lehrenden/Prüfenden eine eigene Zeile anzufügen.
5. **Semester:** Bezieht sich auf Studienbeginn im Wintersemester. Sommersemesterbeginner sehen bitte in das Curriculum für Sommersemesterbeginner in der zugehörigen Fachprüfungsordnung.
6. **Qualifizierungsziele:** kompakte Beschreibung
7. **Aufbauend auf:** Hier werden Module bezeichnet, die zur Belegung des Moduls empfohlen werden, jedoch nicht formal vorausgesetzt werden.
8. **Formale Voraussetzungen:** Voraussetzung für die Vergabe von ECTS-Punkten ist das erfolgreiche Bestehen der aufgeführten Prüfungs- und Studienleistungen. Für Studierende der Bachelor-Studiengänge Maschinenbau, Wirtschaftsingenieurwesen, Sicherheitsingenieurwesen und der Dualen Bachelor-Studiengänge Maschinenbau (dual) und Wirtschaftsingenieurwesen (dual) gilt: Bezüglich der Zulassung zu Prüfungsleistungen ab dem 3. Semester ist die zugehörige Prüfungsordnung zu beachten.
9. **Prüfungsleistung:** Unter Prüfungsleistung sind die Prüfungsformen aufgeführt.
10. **Studienleistung:** Eine Studienleistung ist eine von einer/einem Prüfenden bewertete individuelle Leistung.
11. **SWS aufgeschlüsselt:** SWS nach Lehrform(en); (s. 1)
12. **ECTS:** European Credit Transfer System, 1 ECTS = 30 Arbeitsstunden
13. **Stellenwert der Note:** Als Stellenwert bezeichnet man den Anteil, mit dem die Note des Moduls in die Gesamtnote des Abschlusses eingeht.
14. **Selbststudium:** Zeit, die außerhalb der Präsenzveranstaltungen aufzubringen ist
15. **Kommentare:** bei Bedarf
16. **Bemerkungen:** bei Bedarf

ECTS-Punkte: Messen den Zeitaufwand der Studierenden einschließlich der häuslichen Arbeit für eine Lehrveranstaltung bzw. ein Modul im Gegensatz zu den üblichen SWS („contact hours“, die ein Maß für die Belastung der Lehrenden sind). Normale Semesterleistung: 30 ECTS-Punkte; unterstellte Arbeitsleistung bis zu 900 Std. pro Semester: 1 ECTS-Punkt entspricht also etwa 30 Stunden mittlerer Arbeitsaufwand eines Studierenden.

Hinweis zu Modulen anderer Fachbereiche: Bei den Modulen der Bachelorstudiengänge Medizintechnik, Elektromobilität und Sport- & Rehathechnik, die nicht in diesem Modulhandbuch aufgeführt sind, handelt es sich um Module aus anderen Fachbereichen. Die Information zu fast allen diesen Modulen sind auf der Website des Fachbereichs Informatik zu finden. Informationen zum Modul ‚Brennstoffzellen- und Batterietechnik‘ sind auf der Website des Fachbereichs Umweltplanung/Umwelttechnik vermerkt.

Notes and comments on the module descriptions

The module manual is based on the current examination regulations.

1. **Course:** A course can contain different forms of teaching, e.g. lectures (V), exercises (Ü), laboratory performances (L), seminars (S), and so on.
2. **Module:** If several courses belong to the same module, they have common module names.
3. **Module coordinator:** Details of the person responsible for the module.
4. **Lecturer/Examiner:** If a course is offered by more than one lecturers/examiners, a separate line must be added for each additional lecturer/examiner.
5. **Course is given in semester:** Refers to the start of studies in the winter semester. Summer semester beginners please see the curriculum for summer semester beginners in the corresponding examination regulations.
6. **Objectives:** compact description
7. **Based on:** Modules are designated here that are recommended for taking the module but are not formally required.
8. **Formal Prerequisites:** Prerequisite for the award of ECTS credits is the successful completion of the listed exam and study performances. For students of the bachelor programmes Mechanical Engineering, Industrial Engineering, Safety Engineering and the cooperative study programmes Mechanical Engineering (dual) and Industrial Engineering (dual) the following applies: Regarding the admission to examinations from the 3rd semester on, the respective examination regulations have to be observed.
9. **Exam performance:** The forms of examination are listed under exam performance.
10. **Study performance:** A study performance is an individual performance evaluated by an examiner.
11. **SWS categorisation of semester load:** SWS by teaching form(s); (s. 1)
12. **ECTS:** European Credit Transfer System, 1 ECTS = 30 working hours
13. **Final mark ration:** The ration value is the proportion with which the grade of the module is included in the overall grade of the degree.
14. **Self-study:** Time to be spent outside of the face-to-face studies.
15. **Comments:** if required
16. **Remarks:** if required

ECTS points: Measure the amount of time students spend on a course or module, including the work they do at home, in contrast to the usual SWS (“contact hours”, which are a measure for the load of the teachers). Normal semester performance: 30 ECTS points - assumed workload of up to 900 hours per semester. 1 ECTS point thus corresponds to about 30 hours of average workload of a student.

The modules from the Bachelor’s degree programmes in Medical Engineering, Electromobility and Sports and Rehabilitation Technologies that are not listed in this module manual are modules from other departments. Information about almost all of these modules can be found on the website of the Department of Computer Science. Information on the ‚Brennstoffzellen- und Batterietechnik‘ module is available on the website of the Department of Environmental Planning/Environmental Technology.

Lehrveranstaltung ¹ / Course	Control engineering			
Modul ² /Module	Control engineering			
Fachbereich/ Department	Technik, Fachrichtung Elektrotechnik /Department of Engineering, subject area Electrical Engineering			
Studiengang/ Degree Programme	Master Electrical Engineering [basic module]			
Sprache/ Language	Deutsch und Englisch / German and English			
Modulverantwortliche/r ³ / Module Coordinator	Anrede address	Titel title	Vorname First name	Nachname Last name
	Herr / Mr.	Prof. Dr.	Matthias	Scherer
Lehrende/r ³ / Lecturer	Anrede address	Titel title	Vorname First name	Nachname Last name
	Herr / Mr.	Prof. Dr.	Matthias	Scherer
Stoffinhalt/Contents	<p>Lecture</p> <p>Nonlinear systems</p> <ul style="list-style-type: none"> - Linearization method - Decoupling method - Harmonious balance - Structural variable regulations <p>System identification procedure</p> <ul style="list-style-type: none"> - parametric and non-parametric estimation methods. - LS procedure <p>Homework/Laboratory</p> <ul style="list-style-type: none"> - Simulation of selected mechatronic systems - Design and layout of sensors and actuators - Controller design process - Animation of the simulation with 3D animation from Matlab 			
Lern- und Qualifizierungsziele ⁷ / Objectives	<p>Students are familiar with the interaction of mechanics and electronics/software of mechatronic systems. They are able to model nonlinear controlled systems and to differentiate and evaluate them with respect to their properties. They are able to apply selected methods for the design of controllers for nonlinear systems for practical problems and to evaluate the result.</p> <p>The students understand the relevant methods for system identification. They can apply the methods with the help of Matlab on simple examples and evaluate the result.</p> <p>Students understand the development process of mechatronic systems.</p> <p>After successful completion of the laboratory exercises and homework, they have the application competence for the process steps:</p> <ul style="list-style-type: none"> - Specification - System simulation - Design of sensors and actuators - Controller design 			
Aufbauend auf ⁸ / Based on	Keine/none			
Formale Voraussetzungen ⁹ / Formal prerequisites	Voraussetzung für die Vergabe von ECTS-Punkten ist das erfolgreiche Bestehen der aufgeführten Prüfungs- und Studienleistungen. / The prerequisite for the award of ECTS credits is the successful completion of the listed exam and study performances.			

Prüfungsleistung ¹⁰ / Exam performance	Projektarbeit und mündliche Prüfung / project paper and oral exam
Studienleistung ¹¹ / Study performance	keine / none Voraussetzung zum Ablegen der Prüfungsleistung: nein Prerequisite for taking the exam performance: no
Zugelassene Hilfsmittel zur Erbringung der Prüfungsleistung / Approved aids for the exam performance	None
Literatur/Literature	<ul style="list-style-type: none"> • • Isidori, "Nonlinear Control Systems" • Follinger, Nichtlineare Regelungen I+II • Dorf, Bishop, Modern Control Systems • Schwarz, "Einführung in nichtlineare Regelsysteme" • Isermann, "Systemidentifikation I + II"
SWS gesamt/ Total semester load	4
SWS aufgeschlüsselt ¹² / Categorization of semester load	3 SWS Vorlesung, 1 SWS Labor
ECTS-Punkte ¹³ / ECTS-credits, Workload	5 ECTS, 150 Stunden/hours
Stellenwert der Note ¹⁴ / Final mark ration	Berechnung der Gesamtnote gemäß Prüfungsordnung. Calculation of the overall grade according to the examination regulations.
Selbststudium ¹⁵ / Self-study	90 Stunden/hours
Angeboten im / Offered in	Sommersemester / summer semester
Turnus / Rhythm	jährlich / annually
Dauer des Moduls / Duration of module	
Kommentare ¹⁶ / Comments	Keine/none
Bemerkungen ¹⁷ / Comments	Keine/none

Lehrveranstaltung ¹ / Course	Design master			
Modul ² /Module	Design master			
Fachbereich/ Department	Technik, Fachrichtung Elektrotechnik /Department of Engineering, subject area Electrical Engineering			
Studiengang/ Degree Programme	Master Electrical Engineering [compulsory elective module]			
Sprache/ Language	Deutsch / German			
Modulverantwortliche/r ³ / Module Coordinator	Anrede address	Titel title	Vorname First name	Nachname Last name
	Herr / Mr.	Prof. Dr.	Matthias	Scherer
Lehrende/r ³ / Lecturer	Anrede address	Titel title	Vorname First name	Nachname Last name
	Herr / Mr.	Prof. Dr.	Matthias	Scherer
Stoffinhalt/Contents	<p>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.</p> <p>The contents include:</p> <ul style="list-style-type: none"> • 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 			
Lern- und Qualifizierungsziele ⁷ / Objectives	<p>Upon successful completion of the module, students will be able to,</p> <ul style="list-style-type: none"> -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. 			
Aufbauend auf ⁸ / Based on	Keine/none			
Formale Voraussetzungen ⁹ / Formal prerequisites	Voraussetzung für die Vergabe von ECTS-Punkten ist das erfolgreiche Bestehen der aufgeführten Prüfungs- und Studienleistungen. / The prerequisite for the award of ECTS credits is the successful completion of the listed exam and study performances.			
Prüfungsleistung ¹⁰ / Exam performance	Projektarbeit / project paper			
Studienleistung ¹¹ / Study performance	keine / none Voraussetzung zum Ablegen der Prüfungsleistung: nein Prerequisite for taking the exam performance: no			

Zugelassene Hilfsmittel zur Erbringung der Prüfungsleistung / Approved aids for the exam performance	all
Literatur/Literature	<ul style="list-style-type: none"> • • Literature is dependent on the chosen task.
SWS gesamt/ Total semester load	0
SWS aufgeschlüsselt ¹² / Categorization of semester load	
ECTS-Punkte ¹³ / ECTS-credits, Workload	5 ECTS, 150 Stunden/hours
Stellenwert der Note ¹⁴ / Final mark ration	Berechnung der Gesamtnote gemäß Prüfungsordnung. Calculation of the overall grade according to the examination regulations.
Selbststudium ¹⁵ / Self-study	150 Stunden/hours
Angeboten im / Offered in	Winter- und Sommersemester / winter and summer semester
Turnus / Rhythm	jedes Semester / each semester
Dauer des Moduls Duration of module	
Kommentare ¹⁶ / Comments	Keine/none
Bemerkungen ¹⁷ / Comments	Keine/none

Lehrveranstaltung ¹ / Course	Electromagnetic fields			
Modul ² /Module	Electromagnetic fields			
Fachbereich/ Department	Technik, Fachrichtung Elektrotechnik /Department of Engineering, subject area Electrical Engineering			
Studiengang/ Degree Programme	Master Electrical Engineering [basic module]			
Sprache/ Language	Deutsch / German			
Modulverantwortliche/r ³ / Module Coordinator	Anrede address	Titel title	Vorname First name	Nachname Last name
	Herr / Mr.	Prof. Dr.	Andreas R.	Diewald
Lehrende/r ³ / Lecturer	Anrede address	Titel title	Vorname First name	Nachname Last name
	Herr / Mr.	Prof. Dr.	Andreas R.	Diewald
Stoffinhalt/Contents	Transition of conducted to free electromagnetic waves. 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 dipole, introduction to antennas, parasitic effects, Waveguide: waveguide, cutoff frequency			
Lern- und Qualifizierungsziele ⁷ / Objectives	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. 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. For this purpose, students master the specification of subject-specific The students will be able to solve specific computational problems, to compare computational methods, and to select the optimal method. method as well as the application of basic techniques in practice.			
Aufbauend auf ⁸ / Based on	Keine/none			
Formale Voraussetzungen ⁹ / Formal prerequisites	Voraussetzung für die Vergabe von ECTS-Punkten ist das erfolgreiche Bestehen der aufgeführten Prüfungs- und Studienleistungen. / The prerequisite for the award of ECTS credits is the successful completion of the listed exam and study performances.			
Prüfungleistung ¹⁰ / Exam performance	Klausur / written exam			
Studienleistung ¹¹ / Study performance	keine / none			
	Voraussetzung zum Ablegen der Prüfungsleistung: nein Prerequisite for taking the exam performance: no			
Zugelassene Hilfsmittel zur Erbringung der Prüfungsleistung / Approved aids for the exam performance	Non-programmable, simple calculator no text memory function, no radio communication interface. One sheet DIN A4 handwritten formulary			

Literatur/Literature	<ul style="list-style-type: none"> • • Georg: Elektromagnetische Wellen • Pehl: Mikrowellentechnik • Herter, Lörcher: Nachrichtentechnik • Freyer: Nachrichten-Übertragungstechnik
SWS gesamt/ Total semester load	4
SWS aufgeschlüsselt ¹² / Categorization of semester load	3 SWS Vorlesung, 1 SWS Übung
ECTS-Punkte ¹³ / ECTS-credits, Workload	5 ECTS, 150 Stunden/hours
Stellenwert der Note ¹⁴ / Final mark ration	Berechnung der Gesamtnote gemäß Prüfungsordnung. Calculation of the overall grade according to the examination regulations.
Selbststudium ¹⁵ / Self-study	90 Stunden/hours
Angeboten im / Offered in	Sommersemester / summer semester
Turnus / Rhythm	jährlich / annually
Dauer des Moduls Duration of module	
Kommentare ¹⁶ / Comments	Electromagnetic Waves
Bemerkungen ¹⁷ / Comments	Keine/none

Lehrveranstaltung ¹ / Course	Energy-efficient vehicles (M)			
Modul ² /Module	Energy-efficient vehicles (M)			
Fachbereich/ Department	Technik, Fachrichtung Maschinenbau /Department of Engineering, subject area Mechanical Engineering			
Studiengang/ Degree Programme	Master Electrical Engineering [compulsory elective module] Master Industrial Engineering [compulsory elective module] Master Mechanical Engineering [compulsory elective module] Master Mechanical Engineering AMB [compulsory elective module] Master Mechanical Engineering FZT [compulsory elective module]			
Sprache/ Language	Deutsch / German			
Modulverantwortliche/r ³ / Module Coordinator	Anrede address	Titel title	Vorname First name	Nachname Last name
	Herr / Mr.	Prof. Dr.-Ing.	Hartmut	Zoppke
	Herr / Mr.	Prof. Dr.-Ing.	Christoph	Heinrich
Lehrende/r ³ / Lecturer	Anrede address	Titel title	Vorname First name	Nachname Last name
	Herr / Mr.	Prof. Dr.-Ing.	Hartmut	Zoppke
	Herr / Mr.	Prof. Dr.	Hellmut	Hupe
Stoffinhalt/Contents	<p>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.</p> <p>Comparison of different efficiency indicators. Influence of the design parameters of a vehicle on energy efficiency.</p> <p>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.</p>			
Lern- und Qualifizierungsziele ⁷ / Objectives	<p>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.</p>			
Aufbauend auf ⁸ / Based on	Keine/none			
Formale Voraussetzungen ⁹ / Formal prerequisites	<p>Voraussetzung für die Vergabe von ECTS-Punkten ist das erfolgreiche Bestehen der aufgeführten Prüfungs- und Studienleistungen. / The prerequisite for the award of ECTS credits is the successful completion of the listed exam and study performances.</p>			
Prüfungsleistung ¹⁰ / Exam performance	Klausur / written exam			
Studienleistung ¹¹ / Study performance	keine / none Voraussetzung zum Ablegen der Prüfungsleistung: nein Prerequisite for taking the exam performance: no			

Zugelassene Hilfsmittel zur Erbringung der Prüfungsleistung / Approved aids for the exam performance	None
Literatur/Literature	<ul style="list-style-type: none"> • • Lecture notes with reference to extensive technical 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 978-3-642-30652-5/978-3-7091-1779-8
SWS gesamt/ Total semester load	4
SWS aufgeschlüsselt ¹² / Categorization of semester load	4 SWS Vorlesung
ECTS-Punkte ¹³ / ECTS-credits, Workload	5 ECTS, 150 Stunden/hours
Stellenwert der Note ¹⁴ / Final mark ration	Berechnung der Gesamtnote gemäß Prüfungsordnung. Calculation of the overall grade according to the examination regulations.
Selbststudium ¹⁵ / Self-study	90 Stunden/hours
Angeboten im / Offered in	Sommersemester / summer semester
Turnus / Rhythm	jährlich / annually
Dauer des Moduls / Duration of module	1 Semester / semester
Kommentare ¹⁶ / Comments	None
Bemerkungen ¹⁷ / Comments	None

Lehrveranstaltung ¹ / Course	Internet of Things / Industry 4.0			
Modul ² /Module	Internet of Things / Industry 4.0			
Fachbereich/ Department	Technik, Fachrichtung Elektrotechnik /Department of Engineering, subject area Electrical Engineering			
Studiengang/ Degree Programme	Master Electrical Engineering [basic module]			
Sprache/ Language	Deutsch und Englisch / German and English			
Modulverantwortliche/r ³ / Module Coordinator	Anrede address	Titel title	Vorname First name	Nachname Last name
	Herr / Mr.	Prof. Dr.	Volker	Lücken
Lehrende/r ³ / Lecturer	Anrede address	Titel title	Vorname First name	Nachname Last name
	Herr / Mr.	Prof. Dr.	Volker	Lücken
Stoffinhalt/Contents	<p>(Please note the changed focus of the lecture on advanced cognitive and mobile robotics)</p> <ul style="list-style-type: none"> - Basic concepts of Industry 4.0, Cyber-Physical Systems (CPS) and cognitive robotics - Fundamentals of stationary and 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, navigation and control <p>The theoretical foundations from lecture and tutorial sessions as well as additional online content will be applied in the lab (participation is mandatory) during the semester, where a complete mobile robot system stack, based on the Turtlebot 3 robot, will be developed in groups of two.</p>			
Lern- und Qualifizierungsziele ⁷ / Objectives	Upon successful completion of the module, students will be able to, <ol style="list-style-type: none"> 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. 			
Aufbauend auf ⁸ / Based on	None			
Formale Voraussetzungen ⁹ / Formal prerequisites	Voraussetzung für die Vergabe von ECTS-Punkten ist das erfolgreiche Bestehen der aufgeführten Prüfungs- und Studienleistungen. / The prerequisite for the award of ECTS credits is the successful completion of the listed exam and study performances.			
Prüfungsleistung ¹⁰ / Exam performance	Klausur und Hausarbeit / written exam and term paper			
Studienleistung ¹¹ / Study performance	keine / none Voraussetzung zum Ablegen der Prüfungsleistung: nein Prerequisite for taking the exam performance: no			

Zugelassene Hilfsmittel zur Erbringung der Prüfungsleistung / Approved aids for the exam performance	As announced in lecture.
Literatur/Literature	<ul style="list-style-type: none"> • King, A. Programming the Internet of Things. O Reilly, 2021. • Quigley; Gerkey; Smart. Programming Robots with ROS. O Reilly, 2015. • Siegwart; Nourbakhsh, Scaramuzza. Introduction to Autonomous, Mobile Robots - Second Edition. MIT Press, 2011. • Siciliano, Khatib. Springer Handbook of Robotics - Second Edition. Springer, 2016 (available on demand in case of further interest) • Thrun; Burgard; Fox. Probabilistic Robotics. MIT Press, 2005. • Klein, B. Einführung in Python 3. Hanser Verlag, 2021 (optionally, to refresh Python knowledge).
SWS gesamt/ Total semester load	4
SWS aufgeschlüsselt ¹² / Categorization of semester load	2 SWS Vorlesung, 2 SWS Labor
ECTS-Punkte ¹³ / ECTS-credits, Workload	5 ECTS, 150 Stunden/hours
Stellenwert der Note ¹⁴ / Final mark ration	Berechnung der Gesamtnote gemäß Prüfungsordnung. Calculation of the overall grade according to the examination regulations.
Selbststudium ¹⁵ / Self-study	90 Stunden/hours
Angeboten im / Offered in	Sommersemester / summer semester
Turnus / Rhythm	jährlich / annually
Dauer des Moduls / Duration of module	
Kommentare ¹⁶ / Comments	<p>Prior knowledge of software development with Python is mandatory.</p> <p>The successful participation in the lab sessions is required. The lab is part of the grading, therefore, registering for the lab will require the final examination. More details will follow in the first lecture.</p> <p>This course, titled Advanced Cognitive Robotics, is the successor of the Industrie 4.0 & IoT / Industry 4.0 & IoT course.</p>
Bemerkungen ¹⁷ / Comments	None

Lehrveranstaltung ¹ / Course	Learning Systems			
Modul ² /Module	Learning Systems			
Fachbereich/ Department	Technik, Fachrichtung Elektrotechnik /Department of Engineering, subject area Electrical Engineering			
Studiengang/ Degree Programme	Master Electrical Engineering [basic module]			
Sprache/ Language	Englisch / English			
Modulverantwortliche/r ³ / Module Coordinator	Anrede address	Titel title	Vorname First name	Nachname Last name
	Herr / Mr.	Prof. Dr.	Ernst-Georg	Haffner
Lehrende/r ³ / Lecturer	Anrede address	Titel title	Vorname First name	Nachname Last name
	Herr / Mr.	Prof. Dr.	Ernst-Georg	Haffner
Stoffinhalt/Contents	Introduction and classification of learning systems, Learning Systems Overview, History of Learning Systems, Fundamentals 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			
Lern- und Qualifizierungsziele ⁷ / Objectives	Upon successful completion of the module, students will be able to, <ul style="list-style-type: none"> • Understand the basic concepts and classifications of learning systems. • Gain an overview of different learning systems and appreciate their historical context. • Comprehend the fundamentals of Neural Networks • Develop an understanding of the architecture and functioning of Multilayer Perceptrons (MLPs). • Analyze the structure and applications of Convolutional Neural Networks (CNNs). • Examine the design and use-cases of Recurrent Neural Networks (RNNs). • Grasp the workings and implications of Long Short-Term Memory Networks (LSTMs). • Gain insights into generative models and autoencoders, and their relevance in machine learning. • Explore the mechanics and application of Q-Learning and Deep Q-Network (DQN). • Examine the principles and real-world applications of evolutionary algorithms. 			
Aufbauend auf ⁸ / Based on	None			
Formale Voraussetzungen ⁹ / Formal prerequisites	Voraussetzung für die Vergabe von ECTS-Punkten ist das erfolgreiche Bestehen der aufgeführten Prüfungs- und Studienleistungen. / The prerequisite for the award of ECTS credits is the successful completion of the listed exam and study performances.			
Prüfungsleistung ¹⁰ / Exam performance	Klausur / written exam			
Studienleistung ¹¹ / Study performance	Voraussetzung zum Ablegen der Prüfungsleistung: nein Prerequisite for taking the exam performance: no			

Zugelassene Hilfsmittel zur Erbringung der Prüfungsleistung / Approved aids for the exam performance	None
Literatur/Literature	<ul style="list-style-type: none"> • Ethem Alpaydin, Machine Learning, MIT Press, 2021 • Aurélien Géron, Hands-On Machine Learning with Scikit-Learn & TensorFlow, OReilly, 3rd ed. 2022 • Goodfellow, Bengio & Courville, Deep Learning, MIT Press, 2016 • Nikhil Buduma, Fundamentals of Deep Learning, OReilly, 2022 • Josh Patterson & Adam Gibson, Deep Learning, OReilly, 1. Auflage 2017
SWS gesamt/ Total semester load	4
SWS aufgeschlüsselt ¹² / Categorization of semester load	2 SWS Vorlesung, 2 SWS Labor
ECTS-Punkte ¹³ / ECTS-credits, Workload	5 ECTS, 150 Stunden/hours
Stellenwert der Note ¹⁴ / Final mark ration	Berechnung der Gesamtnote gemäß Prüfungsordnung. Calculation of the overall grade according to the examination regulations.
Selbststudium ¹⁵ / Self-study	90 Stunden/hours
Angeboten im / Offered in	Wintersemester / winter semester
Turnus / Rhythm	jährlich / annually
Dauer des Moduls Duration of module	
Kommentare ¹⁶ / Comments	None
Bemerkungen ¹⁷ / Comments	None

Lehrveranstaltung ¹ / Course	Medical systems 1			
Modul ² /Module	Medical systems 1			
Fachbereich/ Department	Technik, Fachrichtung Elektrotechnik /Department of Engineering, subject area Electrical Engineering			
Studiengang/ Degree Programme	Master Electrical Engineering [basic module]			
Sprache/ Language	Deutsch / German			
Modulverantwortliche/r ³ / Module Coordinator	Anrede address	Titel title	Vorname First name	Nachname Last name
	Herr / Mr.	Prof. Dr.-Ing.	Dara	Feili
Lehrende/r ³ / Lecturer	Anrede address	Titel title	Vorname First name	Nachname Last name
	Herr / Mr.	Prof. Dr.-Ing.	Dara	Feili
Stoffinhalt/Contents	Introduction: Fluid, Colloid, Solutions Electrokinetics: electroosmosis, electrophoresis, electrowetting Principles of microactuators: electrostatics, magnetics, piezoelectrics, shape-memory alloys. Lab on Chip: Microfluidic Devices, Micromixers, Microarrays, Tissue Engineering, Plasma Medicine, Inertial sensors, navigation, satellite navigation, Introduction to RF-MEMS and MOEMS			
Lern- und Qualifizierungsziele ⁷ / Objectives	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. 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.			
Aufbauend auf ⁸ / Based on	Keine/none			
Formale Voraussetzungen ⁹ / Formal prerequisites	Voraussetzung für die Vergabe von ECTS-Punkten ist das erfolgreiche Bestehen der aufgeführten Prüfungs- und Studienleistungen. / The prerequisite for the award of ECTS credits is the successful completion of the listed exam and study performances.			
Prüfungsleistung ¹⁰ / Exam performance	Hausarbeit und mündliche Prüfung / term paper and oral exam			
Studienleistung ¹¹ / Study performance	Voraussetzung zum Ablegen der Prüfungsleistung: nein Prerequisite for taking the exam performance: no			
Zugelassene Hilfsmittel zur Erbringung der Prüfungsleistung / Approved aids for the exam performance	for the term paper: all; for the oral examination: term paper			

Literatur/Literature	<ul style="list-style-type: none"> • • Mescheder, Ulrich: Mikrosystemtechnik - Konzepte und Anwendungen • Buttgenbach, Stephanus: Mikromechanik - Einführung in Technologie und Anwendungen • Gerlach, G.; Dötzel, W.: Grundlagen der Mikrosystemtechnik • Menz, Wolfgang; Mohr, Jurgen: Mikrosystemtechnik für Ingenieure • M. Madou: Fundamentals of Microfabrication
SWS gesamt/ Total semester load	4
SWS aufgeschlüsselt ¹² / Categorization of semester load	4 SWS Vorlesung
ECTS-Punkte ¹³ / ECTS-credits, Workload	5 ECTS, 150 Stunden/hours
Stellenwert der Note ¹⁴ / Final mark ration	Berechnung der Gesamtnote gemäß Prüfungsordnung. Calculation of the overall grade according to the examination regulations.
Selbststudium ¹⁵ / Self-study	90 Stunden/hours
Angeboten im / Offered in	Sommersemester / summer semester
Turnus / Rhythm	jährlich / annually
Dauer des Moduls Duration of module	
Kommentare ¹⁶ / Comments	Keine/none
Bemerkungen ¹⁷ / Comments	Keine/none

Lehrveranstaltung ¹ / Course	Medical systems 2			
Modul ² /Module	Medical systems 2			
Fachbereich/ Department	Technik, Fachrichtung Elektrotechnik /Department of Engineering, subject area Electrical Engineering			
Studiengang/ Degree Programme	Master Electrical Engineering [basic module]			
Sprache/ Language	Deutsch und Englisch / German and English			
Modulverantwortliche/r ³ / Module Coordinator	Anrede address	Titel title	Vorname First name	Nachname Last name
	Herr / Mr.	Prof. Dr.-Ing.	Klaus Peter	Koch
Lehrende/r ³ / Lecturer	Anrede address	Titel title	Vorname First name	Nachname Last name
	Herr / Mr.	Prof. Dr.-Ing.	Klaus Peter	Koch
Stoffinhalt/Contents	<p>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.</p> <p>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:</p> <ul style="list-style-type: none"> -EKG / EEG (stationär and long-term examinations, wellness) -impedance tomography -Neurodiagnostics - Active implants 			
Lern- und Qualifizierungsziele ⁷ / Objectives	<p>Upon successful completion of the module, students will be able to</p> <ul style="list-style-type: none"> • 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. <p>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).</p>			
Aufbauend auf ⁸ / Based on	Keine/none			
Formale Voraussetzungen ⁹ / Formal prerequisites	Voraussetzung für die Vergabe von ECTS-Punkten ist das erfolgreiche Bestehen der aufgeführten Prüfungs- und Studienleistungen. / The prerequisite for the award of ECTS credits is the successful completion of the listed exam and study performances.			
Prüfungleistung ¹⁰ / Exam performance	Hausarbeit und mündliche Prüfung / term paper and oral exam			
Studienleistung ¹¹ / Study performance	Voraussetzung zum Ablegen der Prüfungsleistung: nein Prerequisite for taking the exam performance: no			

Zugelassene Hilfsmittel zur Erbringung der Prüfungsleistung / Approved aids for the exam performance	for the term paper: all; for the oral examination: term paper
Literatur/Literature	<ul style="list-style-type: none"> • Origin of the Resting Potential; Nassir H. Sabah, IEEE Engineering in medicine and biology
SWS gesamt/ Total semester load	4
SWS aufgeschlüsselt ¹² / Categorization of semester load	2 SWS Vorlesung, 2 SWS Übung
ECTS-Punkte ¹³ / ECTS-credits, Workload	5 ECTS, 150 Stunden/hours
Stellenwert der Note ¹⁴ / Final mark ration	Berechnung der Gesamtnote gemäß Prüfungsordnung. Calculation of the overall grade according to the examination regulations.
Selbststudium ¹⁵ / Self-study	90 Stunden/hours
Angeboten im / Offered in	Wintersemester / winter semester
Turnus / Rhythm	jährlich / annually
Dauer des Moduls Duration of module	
Kommentare ¹⁶ / Comments	Keine/none
Bemerkungen ¹⁷ / Comments	Keine/none

Lehrveranstaltung ¹ / Course	Methods of systematic problem solving			
Modul ² /Module	Methods of systematic problem solving			
Fachbereich/ Department	Technik, Fachrichtung Elektrotechnik /Department of Engineering, subject area Electrical Engineering			
Studiengang/ Degree Programme	Master Electrical Engineering [compulsory elective module]			
Sprache/ Language	Deutsch / German			
Modulverantwortliche/r ³ / Module Coordinator	Anrede address	Titel title	Vorname First name	Nachname Last name
	Herr / Mr.	Prof. Dr.	Walter	Jakoby
	Herr / Mr.	Prof. Dr.	Volker	Lücken
Lehrende/r ³ / Lecturer	Anrede address	Titel title	Vorname First name	Nachname Last name
	Herr / Mr.	Prof. Dr.	Walter	Jakoby
Stoffinhalt/Contents	Part 1: - Terms and definitions - Analysis of initial and target state - Synthesis of solution variants - Evaluation and decision - Solution realization as a project Part 2: -Outline of scientific papers -Literature search (literature databases, patents, Internet) -Verification of the sources (boundary conditions, quality). -Revision of the question -Selection and presentation of methods (FMEA, risk analysis) -Display of results -Interpretation and discussion of the results -types of documentation (theses, development documentations, journal articles, patents, congress reports)			
Lern- und Qualifizierungsziele ⁷ / Objectives	After completing the course, students are capable of, • the difference between tasks, problems and processes. explain, • to apply the different strategies for search problems, • explain the importance of systems and processes in problem solving using examples, • analyze problematic issues, • to create operational target systems out of abstruse target concepts, • To use creativity techniques to search for solution ideas, • Use decision procedures for the selection of optimal solutions.			
Aufbauend auf ⁸ / Based on	Keine/none			
Formale Voraussetzungen ⁹ / Formal prerequisites	Voraussetzung für die Vergabe von ECTS-Punkten ist das erfolgreiche Bestehen der aufgeführten Prüfungs- und Studienleistungen. / The prerequisite for the award of ECTS credits is the successful completion of the listed exam and study performances.			
Prüfungleistung ¹⁰ / Exam performance	Klausur / written exam			

Studienleistung ¹¹ / Study performance	keine / none Voraussetzung zum Ablegen der Prüfungsleistung: nein Prerequisite for taking the exam performance: no
Zugelassene Hilfsmittel zur Erbringung der Prüfungsleistung / Approved aids for the exam performance	
Literatur/Literature	<ul style="list-style-type: none"> • Lecture slides
SWS gesamt/ Total semester load	4
SWS aufgeschlüsselt ¹² / Categorization of semester load	3 SWS Vorlesung, 1 SWS Übung
ECTS-Punkte ¹³ / ECTS-credits, Workload	5 ECTS, 150 Stunden/hours
Stellenwert der Note ¹⁴ / Final mark ration	Berechnung der Gesamtnote gemäß Prüfungsordnung. Calculation of the overall grade according to the examination regulations.
Selbststudium ¹⁵ / Self-study	90 Stunden/hours
Angeboten im / Offered in	Sommersemester / summer semester
Turnus / Rhythm	jährlich / annually
Dauer des Moduls / Duration of module	1 Semester / semester
Kommentare ¹⁶ / Comments	Keine/none
Bemerkungen ¹⁷ / Comments	Keine/none

Lehrveranstaltung ¹ / Course	Powersystems-E			
Modul ² /Module	Powersystems			
Fachbereich/ Department	Technik, Fachrichtung Elektrotechnik /Department of Engineering, subject area Electrical Engineering			
Studiengang/ Degree Programme	Master Electrical Engineering [basic module]			
Sprache/ Language	Deutsch / German			
Modulverantwortliche/r ³ / Module Coordinator	Anrede address	Titel title	Vorname First name	Nachname Last name
	Herr / Mr.	Prof. Dr.	Dirk	Brechtken
Lehrende/r ³ / Lecturer	Anrede address	Titel title	Vorname First name	Nachname Last name
	Herr / Mr.	Prof. Dr.	Dirk	Brechtken
Stoffinhalt/Contents	1) Faults in electrical networks 2) Protection and selectivity in electrical networks 3) Grounding in electrical networks 4) Requirements and their normative mapping for grounding 5) Investigations on demonstrators 6) Design and dimensioning of grounding systems 7) Network feedback, network analysis and evaluation			
Lern- und Qualifizierungsziele ⁷ / Objectives	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. 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. 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.			
Aufbauend auf ⁸ / Based on	Keine/none			
Formale Voraussetzungen ⁹ / Formal prerequisites	Voraussetzung für die Vergabe von ECTS-Punkten ist das erfolgreiche Bestehen der aufgeführten Prüfungs- und Studienleistungen. / The prerequisite for the award of ECTS credits is the successful completion of the listed exam and study performances.			
Prüfungsleistung ¹⁰ / Exam performance	nur Studienleistung / study performance only			
Studienleistung ¹¹ / Study performance	Voraussetzung zum Ablegen der Prüfungsleistung: nein Prerequisite for taking the exam performance: no			
Zugelassene Hilfsmittel zur Erbringung der Prüfungsleistung / Approved aids for the exam performance				

Literatur/Literature	<ul style="list-style-type: none"> • DIN 18015, Erdungsanlagen BVS-Standpunkt Fundamente der, 2019
SWS gesamt/ Total semester load	4
SWS aufgeschlüsselt ¹² / Categorization of semester load	2 SWS Vorlesung, 1 SWS Übung, 1 SWS Labor
ECTS-Punkte ¹³ / ECTS-credits, Workload	5 ECTS, 150 Stunden/hours
Stellenwert der Note ¹⁴ / Final mark ration	Berechnung der Gesamtnote gemäß Prüfungsordnung. Calculation of the overall grade according to the examination regulations.
Selbststudium ¹⁵ / Self-study	90 Stunden/hours
Angeboten im / Offered in	Wintersemester / winter semester
Turnus / Rhythm	jährlich / annually
Dauer des Moduls Duration of module	
Kommentare ¹⁶ / Comments	Modul wird letztmalig im WS 23/24 gelesen!
Bemerkungen ¹⁷ / Comments	Keine/none

Lehrveranstaltung ¹ / Course	Professional seminar			
Modul ² /Module	Professional seminar			
Fachbereich/ Department	Technik, Fachrichtung Elektrotechnik /Department of Engineering, subject area Electrical Engineering			
Studiengang/ Degree Programme	Master Electrical Engineering [required module]			
Sprache/ Language	Deutsch / German			
Modulverantwortliche/r ³ / Module Coordinator	Anrede address	Titel title	Vorname First name	Nachname Last name
	Herr / Mr.	Prof. Dr.	Matthias	Scherer
Lehrende/r ³ / Lecturer	Anrede address	Titel title	Vorname First name	Nachname Last name
	Herr / Mr.	Prof. Dr.	Matthias	Scherer
Stoffinhalt/Contents	<p>The subject of the seminar will be announced at the beginning of the semester.</p> <p>The content of the material depends on the selected task. The content of the material depends on the chosen task.</p>			
Lern- und Qualifizierungsziele ⁷ / Objectives	<p>Upon successful completion of the module, students will be able to,</p> <ul style="list-style-type: none"> • systematically and purposefully identify scientific literature and publications, including those in English, by appropriate means, • Analyze and evaluate the contents of current, application-oriented and theoretical methods with regard to their relevance to the research question, • to elaborate and present the core of the content, • prepare professional presentations and present them in a convincing manner, • Facilitate discussions on scientific topics. 			
Aufbauend auf ⁸ / Based on	None			
Formale Voraussetzungen ⁹ / Formal prerequisites	Voraussetzung für die Vergabe von ECTS-Punkten ist das erfolgreiche Bestehen der aufgeführten Prüfungs- und Studienleistungen. / The prerequisite for the award of ECTS credits is the successful completion of the listed exam and study performances.			
Prüfungleistung ¹⁰ / Exam performance	Präsentation / presentation			
Studienleistung ¹¹ / Study performance	keine / none			
	Voraussetzung zum Ablegen der Prüfungsleistung: nein Prerequisite for taking the exam performance: no			
Zugelassene Hilfsmittel zur Erbringung der Prüfungleistung / Ap- proved aids for the exam performance	all			
Literatur/Literature	<ul style="list-style-type: none"> • • Literature is dependent on the chosen task. 			
SWS gesamt/ Total semester load	4			

SWS aufgeschlüsselt ¹² / Categorization of semester load	4 SWS Seminar
ECTS-Punkte ¹³ / ECTS-credits, Workload	5 ECTS, 150 Stunden/hours
Stellenwert der Note ¹⁴ / Final mark ration	Berechnung der Gesamtnote gemäß Prüfungsordnung. Calculation of the overall grade according to the examination regulations.
Selbststudium ¹⁵ / Self-study	90 Stunden/hours
Angeboten im / Offered in	Wintersemester / winter semester
Turnus / Rhythm	jährlich / annually
Dauer des Moduls Duration of module	
Kommentare ¹⁶ / Comments	None
Bemerkungen ¹⁷ / Comments	None

Lehrveranstaltung ¹ / Course	Programming of ERP systems using SAP®-S 4HANA®			
Modul ² /Module	Programming of ERP systems using SAP®-S/4HANA®			
Fachbereich/ Department	Technik, Fachrichtung Elektrotechnik /Department of Engineering, subject area Electrical Engineering			
Studiengang/ Degree Programme	Master Electrical Engineering [compulsory elective module] Master Industrial Engineering [compulsory elective module] Master Mechanical Engineering [compulsory elective module] Master Mechanical Engineering AMB [compulsory elective module] Master Mechanical Engineering FZT [compulsory elective module]			
Sprache/ Language	Deutsch / German			
Modulverantwortliche/r ³ / Module Coordinator	Anrede address	Titel title	Vorname First name	Nachname Last name
	Herr / Mr.	Prof. Dr.	Fritz Nikolai	Rudolph
Lehrende/r ³ / Lecturer	Anrede address	Titel title	Vorname First name	Nachname Last name
	Herr / Mr.	Prof. Dr.	Fritz Nikolai	Rudolph
Stoffinhalt/Contents	- Quick start SAP-ERP MM and PP - The programming language ABAP, screens, internal tables, Open SQL©, data modeler, function blocks			
Lern- und Qualifizierungsziele ⁷ / Objectives	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.			
Aufbauend auf ⁸ / Based on	None			
Formale Voraussetzungen ⁹ / Formal prerequisites	Voraussetzung für die Vergabe von ECTS-Punkten ist das erfolgreiche Bestehen der aufgeführten Prüfungs- und Studienleistungen. / The prerequisite for the award of ECTS credits is the successful completion of the listed exam and study performances.			
Prüfungsleistung ¹⁰ / Exam performance	Seminararbeit und Referat / seminar paper and presentation			
Studienleistung ¹¹ / Study performance	Hausarbeit / term paper			
	Voraussetzung zum Ablegen der Prüfungsleistung: nein Prerequisite for taking the exam performance: no			
Zugelassene Hilfsmittel zur Erbringung der Prüfungsleistung / Approved aids for the exam performance				
Literatur/Literature	<ul style="list-style-type: none"> • • Karl-Heinz Kühnhauser, Thorsten Franz; Einstieg in ABAP • Horst Keller, Sascha Krüger; ABAP Objects; ISBN 978-3-89842- 358-8 • Andreas Blumenthal, Horst Keller; ABAP - Fortgeschrittene Techniken und Tools, Band 2; ISBN 978-3-8362-2072-9 • Horst Keller, Wolf Hagen Thümmel; ABAP- Programmierrichtlinien; ISBN 978-3-8362-2090-3 			

SWS gesamt/ Total semester load	4
SWS aufgeschlüsselt ¹² / Categorization of semester load	4 SWS Vorlesung
ECTS-Punkte ¹³ / ECTS-credits, Workload	5 ECTS, 150 Stunden/hours
Stellenwert der Note ¹⁴ / Final mark ration	Berechnung der Gesamtnote gemäß Prüfungsordnung. Calculation of the overall grade according to the examination regulations.
Selbststudium ¹⁵ / Self-study	90 Stunden/hours
Angeboten im / Offered in	Sommersemester / summer semester
Turnus / Rhythm	jährlich / annually
Dauer des Moduls / Duration of module	1 Semester / semester
Kommentare ¹⁶ / Comments	None
Bemerkungen ¹⁷ / Comments	None

Lehrveranstaltung ¹ / Course	Project			
Modul ² /Module	Project			
Fachbereich/ Department	Technik, Fachrichtung Elektrotechnik /Department of Engineering, subject area Electrical Engineering			
Studiengang/ Degree Programme	Master Electrical Engineering [required module]			
Sprache/ Language	Deutsch / German			
Modulverantwortliche/r ³ / Module Coordinator	Anrede address	Titel title	Vorname First name	Nachname Last name
	Herr / Mr.	Prof. Dr.	Matthias	Scherer
Lehrende/r ³ / Lecturer	Anrede address	Titel title	Vorname First name	Nachname Last name
	Herr / Mr.	Prof. Dr.	Matthias	Scherer
Stoffinhalt/Contents	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			
Lern- und Qualifizierungsziele ⁷ / Objectives	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.			
Aufbauend auf ⁸ / Based on	Keine/none			
Formale Voraussetzungen ⁹ / Formal prerequisites	Voraussetzung für die Vergabe von ECTS-Punkten ist das erfolgreiche Bestehen der aufgeführten Prüfungs- und Studienleistungen. / The prerequisite for the award of ECTS credits is the successful completion of the listed exam and study performances.			
Prüfungsleistung ¹⁰ / Exam performance	Projektarbeit / project paper			
Studienleistung ¹¹ / Study performance	keine / none Voraussetzung zum Ablegen der Prüfungsleistung: nein Prerequisite for taking the exam performance: no			

Zugelassene Hilfsmittel zur Erbringung der Prüfungsleistung / Approved aids for the exam performance	all
Literatur/Literature	<ul style="list-style-type: none"> • Depending on the selected project
SWS gesamt/ Total semester load	0
SWS aufgeschlüsselt ¹² / Categorization of semester load	
ECTS-Punkte ¹³ / ECTS-credits, Workload	10 ECTS, 300 Stunden/hours
Stellenwert der Note ¹⁴ / Final mark ration	Berechnung der Gesamtnote gemäß Prüfungsordnung. Calculation of the overall grade according to the examination regulations.
Selbststudium ¹⁵ / Self-study	300 Stunden/hours
Angeboten im / Offered in	Winter- und Sommersemester / winter and summer semester
Turnus / Rhythm	jedes Semester / each semester
Dauer des Moduls Duration of module	
Kommentare ¹⁶ / Comments	Keine/none
Bemerkungen ¹⁷ / Comments	Keine/none

Lehrveranstaltung ¹ / Course	Project management			
Modul ² /Module	Project management			
Fachbereich/ Department	Technik, Fachrichtung Elektrotechnik /Department of Engineering, subject area Electrical Engineering			
Studiengang/ Degree Programme	Master Electrical Engineering [basic module]			
Sprache/ Language	Deutsch / German			
Modulverantwortliche/r ³ / Module Coordinator	Anrede address	Titel title	Vorname First name	Nachname Last name
	Herr / Mr.	Prof. Dr.	Walter	Jakoby
	Herr / Mr.	Prof. Dr.	Volker	Lücken
Lehrende/r ³ / Lecturer	Anrede address	Titel title	Vorname First name	Nachname Last name
	Herr / Mr.	Prof. Dr.	Walter	Jakoby
Stoffinhalt/Contents	1. Introduction: terms, definition, classification and delimitation 2. Project organization: process, structure and information organization 3. Project planning: preparation of project, process, cost and schedule plans, risk management. 4. Project management: progress control, change management, and Project completion 5. Tools: practical use			
Lern- und Qualifizierungsziele ⁷ / Objectives	Upon successful completion of the module, students will be able to plan and manage projects by (1.) Decide whether a project is a project and which project management processes are required, . . . (2.) lay the groundwork for the goal-oriented execution of a project by creating an assignment, . . . (3.) Organize the structure of the project team, the basic structure of the project process and the handling of information in the project, . . . (4.) Structure the composition of the project result and the subdivision of the project activities in a hierarchical form, . . . (5.) the statements of work required in a project. The information available allows us to estimate the duration and cost of the project, . . . (6.) Determine the sequence of the work and plan the deadlines with the help of the allocation of resources, . . . (7.) Identify the risk factors in the project and take measures to reduce them, . . . (8.) Plan and monitor the progress of the project in order to be able to react to deviations by means of controlling measures, . . . (9.) Computerized tools for the planning and control of the Use projects.			
Aufbauend auf ⁸ / Based on	Keine/none			
Formale Voraussetzungen ⁹ / Formal prerequisites	Voraussetzung für die Vergabe von ECTS-Punkten ist das erfolgreiche Bestehen der aufgeführten Prüfungs- und Studienleistungen. / The prerequisite for the award of ECTS credits is the successful completion of the listed exam and study performances.			
Prüfungsleistung ¹⁰ / Exam performance	Klausur / written exam			

Studienleistung ¹¹ / Study performance	Voraussetzung zum Ablegen der Prüfungsleistung: nein Prerequisite for taking the exam performance: no
Zugelassene Hilfsmittel zur Erbringung der Prüfungsleistung / Approved aids for the exam performance	None
Literatur/Literature	<ul style="list-style-type: none"> • W. Jakoby: Projektmanagement für Ingenieure, Springer Vieweg, 5. Aufl. 2021. • W, Jakoby: Intensivtraining Projektmanagement, Springer Vieweg, 3. Aufl. 2021
SWS gesamt/ Total semester load	5
SWS aufgeschlüsselt ¹² / Categorization of semester load	4 SWS Vorlesung, 1 SWS Übung
ECTS-Punkte ¹³ / ECTS-credits, Workload	5 ECTS, 150 Stunden/hours
Stellenwert der Note ¹⁴ / Final mark ration	Berechnung der Gesamtnote gemäß Prüfungsordnung. Calculation of the overall grade according to the examination regulations.
Selbststudium ¹⁵ / Self-study	75 Stunden/hours
Angeboten im / Offered in	Wintersemester / winter semester
Turnus / Rhythm	jährlich / annually
Dauer des Moduls / Duration of module	
Kommentare ¹⁶ / Comments	Keine/none
Bemerkungen ¹⁷ / Comments	Keine/none

Lehrveranstaltung ¹ / Course	Signal processing			
Modul ² /Module	Signal processing			
Fachbereich/ Department	Technik, Fachrichtung Elektrotechnik /Department of Engineering, subject area Electrical Engineering			
Studiengang/ Degree Programme	Master Electrical Engineering [basic module]			
Sprache/ Language	Deutsch / German			
Modulverantwortliche/r ³ / Module Coordinator	Anrede address	Titel title	Vorname First name	Nachname Last name
	Herr / Mr.	Prof. Dr.	Elmar	Seidenberg
Lehrende/r ³ / Lecturer	Anrede address	Titel title	Vorname First name	Nachname Last name
	Herr / Mr.	Prof. Dr.	Elmar	Seidenberg
Stoffinhalt/Contents	Discrete Stochastic Processes Linear Signal Models Nonparametric Spectral 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			
Lern- und Qualifizierungsziele ⁷ / Objectives	The students <ul style="list-style-type: none"> • 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, foreexample, for medical devices, measuring instruments and radar technology devices, • are able to analyze unknown systems and to model 			
Aufbauend auf ⁸ / Based on	Keine/none			
Formale Voraussetzungen ⁹ / Formal prerequisites	Voraussetzung für die Vergabe von ECTS-Punkten ist das erfolgreiche Bestehen der aufgeführten Prüfungs- und Studienleistungen. / The prerequisite for the award of ECTS credits is the successful completion of the listed exam and study performances.			
Prüfungleistung ¹⁰ / Exam performance	Klausur / written exam			
Studienleistung ¹¹ / Study performance	keine / none			
	Voraussetzung zum Ablegen der Prüfungsleistung: nein Prerequisite for taking the exam performance: no			
Zugelassene Hilfsmittel zur Erbringung der Prüfungsleistung / Approved aids for the exam performance	None			

Literatur/Literature	<ul style="list-style-type: none"> • Spectral Analysis of Signals, P.Stoica, R. Moses • Probability, Random Variables and Stochastic Processes, A. Papoulis, S.Unnikrishna Pillai
SWS gesamt/ Total semester load	4
SWS aufgeschlüsselt ¹² / Categorization of semester load	4 SWS Vorlesung
ECTS-Punkte ¹³ / ECTS-credits, Workload	5 ECTS, 150 Stunden/hours
Stellenwert der Note ¹⁴ / Final mark ration	Berechnung der Gesamtnote gemäß Prüfungsordnung. Calculation of the overall grade according to the examination regulations.
Selbststudium ¹⁵ / Self-study	90 Stunden/hours
Angeboten im / Offered in	Sommersemester / summer semester
Turnus / Rhythm	jährlich / annually
Dauer des Moduls / Duration of module	1 Semester / semester
Kommentare ¹⁶ / Comments	Keine/none
Bemerkungen ¹⁷ / Comments	Keine/none

Lehrveranstaltung ¹ / Course	Team project			
Modul ² /Module	Team project			
Fachbereich/ Department	Technik, Fachrichtung Elektrotechnik /Department of Engineering, subject area Electrical Engineering			
Studiengang/ Degree Programme	Master Electrical Engineering [required module]			
Sprache/ Language	Deutsch / German			
Modulverantwortliche/r ³ / Module Coordinator	Anrede address	Titel title	Vorname First name	Nachname Last name
	Herr / Mr.	Prof. Dr.	Matthias	Scherer
Lehrende/r ³ / Lecturer	Anrede address	Titel title	Vorname First name	Nachname Last name
	Herr / Mr.	Prof. Dr.	Matthias	Scherer
Stoffinhalt/Contents	Technical contents <ul style="list-style-type: none"> • 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 			
Lern- und Qualifizierungsziele ⁷ / Objectives	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 take responsibility 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.			
Aufbauend auf ⁸ / Based on	Keine/none			
Formale Voraussetzungen ⁹ / Formal prerequisites	Voraussetzung für die Vergabe von ECTS-Punkten ist das erfolgreiche Bestehen der aufgeführten Prüfungs- und Studienleistungen. / The prerequisite for the award of ECTS credits is the successful completion of the listed exam and study performances.			
Prüfungleistung ¹⁰ / Exam performance	Projektarbeit / project paper			

Studienleistung ¹¹ / Study performance	keine / none Voraussetzung zum Ablegen der Prüfungsleistung: nein Prerequisite for taking the exam performance: no
Zugelassene Hilfsmittel zur Erbringung der Prüfungsleistung / Approved aids for the exam performance	
Literatur/Literature	<ul style="list-style-type: none"> • Depending on the chosen topic of the team project.
SWS gesamt/ Total semester load	0
SWS aufgeschlüsselt ¹² / Categorization of semester load	
ECTS-Punkte ¹³ / ECTS-credits, Workload	10 ECTS, 300 Stunden/hours
Stellenwert der Note ¹⁴ / Final mark ration	Berechnung der Gesamtnote gemäß Prüfungsordnung. Calculation of the overall grade according to the examination regulations.
Selbststudium ¹⁵ / Self-study	300 Stunden/hours
Angeboten im / Offered in	Winter- und Sommersemester / winter and summer semester
Turnus / Rhythm	jedes Semester / each semester
Dauer des Moduls / Duration of module	
Kommentare ¹⁶ / Comments	Keine/none
Bemerkungen ¹⁷ / Comments	Keine/none