Hochschule Ravensburg-Weingarten Postfach 30 22, 88216 Weingarten

Modulhandbuch Electrical Engineering and Embedded Systems (Master)

Bei der Gestaltung eines Studiengangs wird zusätzlich zu Studien- und Prüfungsordnungen ein Modulhandbuch erstellt, das eine inhaltliche Beschreibung der Module und die zu erwerbenden Kompetenzen enthält. Module können verpflichtend oder Teil des Wahlbereiches sein. Jedes Modul wird mit einer Modulabschlussprüfung abgeschlossen und mit einer bestimmten Anzahl an Kreditpunkten versehen. Studiengänge und damit auch Module sind konsequent von den zu erreichenden Qualifikationszielen (Learning Outcomes) her konzipiert.
In den Feldern
- Wissen und Verstehen,
- Einsatz, Anwendung und Erzeugung von Wissen,
- Wissenschaftliches Selbstverständnis/Professionalität und
- Kommunikation und Kooperation

werden Kompetenzen im Verlauf des Studiums im jeweiligen fachspezifischen Kontext erworben. Dabei werden nicht alle Kompetenzen oder deren Ausprägungen in jedem Modul erworben; relevant ist, dass am Ende des Studiums die Studierenden alle Kompetenzen erworben haben.
Basis hierfür ist der Qualifikationsrahmen für Deutsche Hochschulabschlüsse (HQR) und die Musterrechtsverordnung gemäß Artikel 4 Absätze 1 – 4 des Studienakkreditierungsstaatsvertrag der Kultusministerkonferenz.

Studiengangsziele

Im Studiengangsbericht wurden keine Studiengangsziele eingegeben

Inhalt

Modul: Mathematics

Studiengang:	EMM
Abschlussgrad:	Master of Science (M.Sc.)
Modulnummer:	01
Modultitel:	Mathematics
Modulverantwortliche/r:	Professor Dr. rer. nat. Wolfgang Ertel
Art des Moduls:	Pflicht
Inhalt des Moduls:	1 Linear Algebra (Repetition) - Video Lectures (Gilbert Strang) 2 Computer Algebra - Gnuplot, a professional Plotting Software - Short Introduction to GNU Octave / MATLAB, Python 3 Calculus - Selected Topics (Repetition) - Sequences and Convergence; - Series; - Continuity - Taylor Series - Differential Calculus in many Variables 4 Statistics and Probability (Repetition) - Statistical Parameters - Probability Theory - Distributions - Random Numbers - Principal Component Analysis - Estimators 5 Numerical Mathematics Fundamentals - Arithmetics on the Computer - Numerics of Linear Systems of Equations - Roots of Nonlinear Equations 6 Function Approximation - Polynomial Interpolation - Spline interpolation - Method of Least Squares and Pseudoinverse - Singular Value Decomposition (SVD) 7 Numerical Integration and Solution of Ordinary Differential Equations - Numerical Integration - Numerical Solution of Ordinary Differential Equations - Linear Differential Equations with Constant Coefficients
Veranstaltungen:	Advanced Mathematics for Engineers Advanced Mathematics for Engineers - Lab
Lehr- und Lernformen:	Lecture/Practical training
Voraussetzungen für die Teilnahme:	Undergraduate Mathematics, e.g. Calculus (multidimensional), Linear Algebra, Statistics, Programming
Verwendbarkeit des Moduls:	Mechatronics Electrical Engineering and Embedded Systems Informatik
Voraussetzungen Vergabe ECTS:	Portfolio with 80% weight of the written examination (K90) and 20% weight of the laboratory reports and colloquia (P).
ECTS-Leistungspunkte:	10
Benotung:	benotet
Arbeitsaufwand:	30h / 1 ECTS
Dauer des Moduls:	einsemestrig
Häufigkeit des Angebots:	Nur Wintersemester

Literatur:	] W. Cheney and D. Kincaid. Numerical mathematics and computing. Thomson Brooks/Cole, 2007. J. Nocedal and S.J. Wright. Numerical optimization. Springer Verlag, 1999. S.M. Ross. Introduction to probability and statistics for engineers and scientists. Academic Press, 2009. G. Strang. Introduction to linear algebra. Wellesley Cambridge Press, 3rd edition, 2003. H. Schwarz: Numerische Mathematik, Teubner Verlag. M. Brill.: Mathematik für Informatiker. Hanser Verlag, 2001. W. Nehrlich: Diskrete Mathematik, Fachbuchverlag Leipzig.

Kompetenzstufen

Wissen und Verstehen

Wissensvertiefung

After successfully attending this course the graduates is able to solve mathematical problems arising in typical engineering tasks. Primary focus is on numerically solvingn on linear problems and on the statistical interpretation of results from measurements. In numerical mathematics, the focus is put on methods for function approximation from data, solution of equations, integration and solution of differential equations. Generation and test of random numbers are essential foundations of simulation and cryptography.

Einsatz, Anwendung und Erzeugung von Wissen/Kunst

Nutzung und Transfer

The graduates have broadened their knowledge in the following fields and are capable of reproducing this knowledge: High level programming languages with built in mathematical functions like Octave or Python will be used for the practical assignments (e.g. programming of algorithms).

Modul: Communication 1

Studiengang:	EMM
Abschlussgrad:	Master of Science (M.Sc.)
Modulnummer:	02
Modultitel:	Communication 1
Modulverantwortliche/r:	Prof. Andreas Siggelkow
Art des Moduls:	Pflicht
Inhalt des Moduls:	Introduction Part A. Channel models for wireless communications 1 Wave propagation (1.1 Free Space propagation, 1.2 Physical propagation models, 1.3 Statistical models of propagation, 1.4 Wideband channels) 2. Noise and Interference (2.1 Noise, 2.2 Interference, 2.3 Link Budget) 3 Spectrum issues Part B. Key technologies of modern wireless systems 4. Code Division Multiple Access (CDMA) 5 Frequency-Division Multiplex 6. Scheduling and rate control 7 Diversity 8. Multi-Hop Networks 9. Network Coding 10. Cognitive radio Part C. Wireless Systems 11. Universal Mobile Telecommunications System (UMTS) 12. Long Term Evolution and System Architecture Evolution 13. Beyond LTE and the path to 5G (13.1 Enhanced Mobile Broadband, 13.2 Massive machine-type communications, 13.3 Ultra-reliable and low-latency communications)
Veranstaltungen:	Wireless Communication
Lehr- und Lernformen:	Lecture and Project
Voraussetzungen für die Teilnahme:	Basics of Communication (Bachelor)
Verwendbarkeit des Moduls:	Electrical Engineering and Embedded Systems
Voraussetzungen Vergabe ECTS:	K90
ECTS-Leistungspunkte:	5
Benotung:	benotet
Arbeitsaufwand:	Es wird von einem Workload von 30 Stunden je ECTS ausgegangen.
Dauer des Moduls:	einsemestrig
Häufigkeit des Angebots:	Jedes Semester

Literatur:	Dahlman, E. et al:4G: LTE/LTE-Advanced for Mobile Broadband. Academic Press, 2014 Dahlman, E. et al:4G: LTE-Advanced Pro and the road to 5G Academic Press, 2016. Molisch, A. F.: Wireless Communications. John Wiley & Sons, 2011 Holma H.; Toskala, A.: WCDMA for UMTS: HSPA Evolution and LTE. John Wiley & Sons, 2006 Holma H.; Toskala, A.: LTE for UMTS: HSPA Evolution to LTE-Advanced. John Wiley & Sons, 2011 Haykin, S.; Moher, M.: Modern Wireless Communications. Pearson Prentice Hall, 2005 Lescuyer, P.; Lucidarme, T.: Evolved Packet System (EPS) – The LTE and SAE Evolution of 3G UMTS. Wiley 2008. Larmo A. et al: The Link-Layer Design. IEEE Communications Magazine. April 2009 Wannstrom J.: LTE-Advanced. www.3gpp.org/technologies/keywords-acromyms/97-lte-advanced.

Kompetenzstufen

Wissen und Verstehen

Wissensverbreiterung

The graduates have broadened their knowledge in the following fields and are capable of reproducing this knowledge: Describe construction and functionality of modern mobile communication systems.

Einsatz, Anwendung und Erzeugung von Wissen/Kunst

Nutzung und Transfer

The graduates are capable of applying the knowledge they have acquired in the following fields: Mathematical methods for planning and optimization of communication systems.

Modul: Communication 2

Studiengang:	EMM
Abschlussgrad:	Master of Science (M.Sc.)
Modulnummer:	03
Modultitel:	Communication 2
Modulverantwortliche/r:	Prof. Andreas Siggelkow
Art des Moduls:	Pflicht
Inhalt des Moduls:	Basics of Nearfield Communication Transmission standards Protocols Applications
Veranstaltungen:	Nearfield Communication
Lehr- und Lernformen:	Lecture and Project
Voraussetzungen für die Teilnahme:	Basics of Communication (Bachelor)
Verwendbarkeit des Moduls:	Electrical Engineering and Embedded Systems
Voraussetzungen Vergabe ECTS:	K90
ECTS-Leistungspunkte:	5
Benotung:	benotet
Arbeitsaufwand:	Es wird von einem Workload von 30 Stunden je ECTS ausgegangen.
Dauer des Moduls:	einsemestrig
Häufigkeit des Angebots:	Jedes Semester
Literatur:	Coscun et. al.: Near Field Communication (NFC): From Theory to Practice Wiley, 2012 Hendry :Near Field Communications Technology and Applications. Cambridge University Press, 2014

Kompetenzstufen

Wissen und Verstehen

Wissensverbreiterung

The graduates have deepened their existing knowledge in the following areas and are capable of not only reproducing the corresponding contents but also of explaining them. They understand the underlying principles, the whys and wherefores: - describe the function of NFC systems with own words

Einsatz, Anwendung und Erzeugung von Wissen/Kunst

Nutzung und Transfer

The graduates are capable of applying the knowledge they have acquired in the following fields and, additionally, of assessing their own approach to the theory-praxis-transfer and the result thereof: - evaluate and optimize NFC systems.

Wissenschaftliche Innovation

The graduates can not only apply their knowledge and assess the application methods and / or results, they can also independently develop further research questions in the following fields: - create applications.

Modul: Circuit & Systems 1

Studiengang:	EMM
Abschlussgrad:	Master of Science (M.Sc.)
Modulnummer:	04
Modultitel:	Circuit & Systems 1
Modulverantwortliche/r:	Prof. Andreas Siggelkow
Art des Moduls:	Pflicht
Inhalt des Moduls:	- ASIC-Design - Bus-Systems - Peripherals in a System-on-Chip (SoC) - Test and Debug of SoC - Principles of Micro-controller - MMU - Parallel Architectures
Veranstaltungen:	System-on-Chip
Lehr- und Lernformen:	Lecture and Project
Voraussetzungen für die Teilnahme:	Knowledge of computer architectures from Bachelor courses
Verwendbarkeit des Moduls:	Electrical Engineering and Embedded Systems
Voraussetzungen Vergabe ECTS:	PF (50% P, 50% K60)
ECTS-Leistungspunkte:	5
Benotung:	benotet
Arbeitsaufwand:	Es wird von einem Workload von 30 Stunden je ECTS ausgegangen.
Dauer des Moduls:	einsemestrig
Häufigkeit des Angebots:	Jedes Semester
Literatur:	1. John L. Hennessy, David A. Patterson; Computer Architecture: A Quantitative Approach 2. David A. Patterson, John L. Hennessy; Computer Organization and Design: The Hardware/Software Interface

Kompetenzstufen

Wissen und Verstehen

Wissensverbreiterung

The graduates know the principle of computer architectures. They know how to design an ASIC.

Einsatz, Anwendung und Erzeugung von Wissen/Kunst

Nutzung und Transfer

The graduates can implement and organize a system on Chip with its peripherals. They can implement and use Test- and-Debug methods.

Kommunikation und Kooperation

With the contents for the module, sustainable work, design and economics will be teached. It will be improved to a level, that it fits to the needs of companies. The intercultural competence of the graduates will be developed by

- international tandem teams
- mixed teams in the labs
- mixed teams for projects and seminars

Modul: Circuit & Systems 2

Studiengang:	EMM
Abschlussgrad:	Master of Science (M.Sc.)
Modulnummer:	05
Modultitel:	Circuit & Systems 2
Modulverantwortliche/r:	Prof. Andreas Siggelkow
Art des Moduls:	Pflicht
Inhalt des Moduls:	- Introduction to System-on-Chip - Requirements management - Writing a Specification - Modelling (SystemC) of a SoC - Development of a SoC
Veranstaltungen:	SW- and HW-Design
Lehr- und Lernformen:	Lecture and Project
Voraussetzungen für die Teilnahme:	Bachelor knowledge of digital circuit design, Circuit & Systems 1, VHDL and C++
Verwendbarkeit des Moduls:	Electrical Engineering and Embedded Systems
Voraussetzungen Vergabe ECTS:	PF (50% P, 50% K60)
ECTS-Leistungspunkte:	5
Benotung:	benotet
Arbeitsaufwand:	Es wird von einem Workload von 30 Stunden je ECTS ausgegangen.
Dauer des Moduls:	einsemestrig
Häufigkeit des Angebots:	Jedes Semester
Literatur:	1. Arora, Mohit; The Art of Hardware Architecture: Design Methods and Techniques for Digital Circuits 2. Douglas Perry; VHDL : Programming By Example 3. Patrick Schaumont; A Practical Introduction to Hardware/Software Codesign

Kompetenzstufen

Wissen und Verstehen

Wissensverbreiterung

The graduates know what the specifics of a System-on-Chip are.

Einsatz, Anwendung und Erzeugung von Wissen/Kunst

Nutzung und Transfer

The graduates will be able to develop a SoC and to describe a SoC with SystemC. They will be able to describe a SoC with VHDL and synthesize it.

Kommunikation und Kooperation

The intercultural competence of the graduates will be developed by
- international tandem teams
- mixed teams in the labs
- mixed teams for projects and seminars

With the contents for the module, sustainable work, design and economics will be teached. It will be improved to a level, that it fits to the needs of companies.

Wissenschaftliches / künstlerisches Selbstverständnis und Professionalität

The graduates can organize an architecture of a SW-HW project.

Modul: Signalprocessing 1

Studiengang:	EMM
Abschlussgrad:	Master of Science (M.Sc.)
Modulnummer:	06
Modultitel:	Signalprocessing 1
Modulverantwortliche/r:	Prof. Andreas Siggelkow
Art des Moduls:	Pflicht
Inhalt des Moduls:	Deterministic Continuous Signals - Laplace- and Fourier Transforms - Continuous Systems and Circuits for Signal Processing - Stability Issues - Nodal Admittance Method - MATLAB - OP-Amp Circuits - Stochastic Signals - Noise Analysis of OP-Amps - Integrated Lab Exercises
Veranstaltungen:	Signalprocessing 1 Signalprocessing 1 Lab
Lehr- und Lernformen:	Lecture and Laboratory / practical course
Voraussetzungen für die Teilnahme:	Bachelor knowledge
Verwendbarkeit des Moduls:	Electrical Engineering and Embedded Systems
Voraussetzungen Vergabe ECTS:	K60
ECTS-Leistungspunkte:	5
Benotung:	benotet
Arbeitsaufwand:	Es wird von einem Workload von 30 Stunden je ECTS ausgegangen.
Dauer des Moduls:	einsemestrig
Häufigkeit des Angebots:	Jedes Semester
Literatur:	[Ghausi] Ghausi, Laker Modern Filter Design, Prentice-Hall, 1981 [Horowitz] Paul Horowitz, W. Hill The Art of Electronics, Cambridge University Press [Cooper] Cooper G. R., McGillem C. D., Probabilistic Methods of Signal an System Analysis, CBS 1986 [Doe] Doetsch, G. Anleitung zum praktischen Gebrauch der Laplace-Transformation. Oldenbourg, 1989

Kompetenzstufen

Kommunikation und Kooperation

With the contents for the module, sustainable work, design and economics will be teached. It will be improved to a level, that it fits to the needs of companies.

The intercultural competence of the graduates will be developed by
- international tandem teams
- mixed teams in the labs
- mixed teams for projects and seminars

Wissenschaftliches / künstlerisches Selbstverständnis und Professionalität

The graduates understand specifications for analog circuits for signal processing. Thus being able to design new circuits based on the basic circuits and methods known in theory and in practice from the teaching module.

Modul: Signalprocessing 2

Studiengang:	EMM
Abschlussgrad:	Master of Science (M.Sc.)
Modulnummer:	07
Modultitel:	Signalprocessing 2
Modulverantwortliche/r:	Prof. Andreas Siggelkow
Art des Moduls:	Pflicht
Inhalt des Moduls:	Sampling Systems - discrete signals and LTI systems - convolution - Fourier-transforms for discrete signals DFT, FFT - spectral analysis - z-transform - digital filter design - random signals - MATLAB as the main tool in signal processing
Veranstaltungen:	Signalprocessing 2 Signalprocessing 2 Lab
Lehr- und Lernformen:	Lecture, Practical (In parallel to the lecture, there are practical lab exercises and MATLAB exercises deepening the theoretical results. In the practical exercises the design of digital sampling systems is mediated.)
Voraussetzungen für die Teilnahme:	Signalprocessing 1, Math.
Verwendbarkeit des Moduls:	Electrical Engineering and Embedded Systems
Voraussetzungen Vergabe ECTS:	K90
ECTS-Leistungspunkte:	5
Benotung:	benotet
Arbeitsaufwand:	Es wird von einem Workload von 30 Stunden je ECTS ausgegangen.
Dauer des Moduls:	einsemestrig
Häufigkeit des Angebots:	Jedes Semester
Literatur:	[Opp] Oppenheim, Schafer, Buck, Discrete-Time Signal Processing, Pearson 2004 [Brigh] Brigham, E. O., FFT – Fast Fourier-Transform [Cooper] Cooper G. R., McGillem C. D., Probabilistic Methods of Signal an System Analysis, CBS 1986

Kompetenzstufen

Einsatz, Anwendung und Erzeugung von Wissen/Kunst

Wissenschaftliche Innovation

The graduates are able to design digital sampling systems and filter algorithms for digital discrete systems, like microcontrollers and programmable digital hardware, as FPGA.

Kommunikation und Kooperation

With the contents for the module, sustainable work, design and economics will be teached. It will be improved to a level, that it fits to the needs of companies.

The intercultural competence of the graduates will be developed by
- international tandem teams
- mixed teams in the labs
- mixed teams for projects and seminars

Modul: Advanced Control Systems

Studiengang:	EMM
Abschlussgrad:	Master of Science (M.Sc.)
Modulnummer:	08
Modultitel:	Advanced Control Systems
Modulverantwortliche/r:	Prof. Andreas Siggelkow
Art des Moduls:	Pflicht
Inhalt des Moduls:	The lecture starts with an introduction to analysis and modeling of dynamic systems (electrical, mechanical, thermal). Design and optimization of single and multiple stage digital P/PI/PD/PID control is presented, as well as single-input and multi-input state control without and with observer, and optimal control. The lecture closes with illustrating adaptive control methods (with recursive parameter estimation, neural nets, fussification) The lab starts with practical exercises in digital control design with MATLAB and C and then proceeds to experimental setups: motor control, heater control, liquid mixer tank, and inverted pendulum.
Veranstaltungen:	Digital Control Digital Control Lab.
Lehr- und Lernformen:	Lecture and Laboratory / practical course
Voraussetzungen für die Teilnahme:	Mathematics
Verwendbarkeit des Moduls:	Electrical Engineering and Embedded Systems
Voraussetzungen Vergabe ECTS:	K60
ECTS-Leistungspunkte:	5
Benotung:	benotet
Arbeitsaufwand:	Es wird von einem Workload von 30 Stunden je ECTS ausgegangen.
Dauer des Moduls:	einsemestrig
Häufigkeit des Angebots:	Jedes Semester
Literatur:	Printed lecture notes and exercises. Recommended: Macia, N. F., Thaler, G. J.: Modeling and Control of Dynamic Systems, Cengage; Moudgalya, K. M.: Digital Control, Wiley; Press, W. H., Teukolsky, S. A., Numerical Recipes, Cambridge

Kompetenzstufen

Wissen und Verstehen

Wissensvertiefung

The lecture should enable engineering graduates to:

- characterize, model, and simulate dynamic systems (electrical, mechanical, thermal)
- choose and implement a suitable digital control method (P/PI/PD/PID control, state control without/with observer, optimal control, adaptive control)
- assess digital control methods regarding effort, safety, and cost-effectiveness
- implement digital control methods by computer-based tools like MATLAB/Simulink
- implement digital control methods as algorithms by programming in C

Einsatz, Anwendung und Erzeugung von Wissen/Kunst

Nutzung und Transfer

The lab should enable engineering graduates to:

- implement digital control methods in experimental setups

Wissenschaftliches / künstlerisches Selbstverständnis und Professionalität

The graduates can not only handle simple but also the following complex issues and act accordingly: Develop sustainable electrical products and systems. In the course of their study, the graduates have already reached a level of knowledge and understanding that enables them to analyze not only simple but also complex interactions. On this basis, they are capable of independently identifying scientific or practice-related issues. They can also develop solutions to problems for the following complex issues and thus make a contribution to the further development of science/society/practice.

Modul: Embedded Control

Studiengang:	EMM
Abschlussgrad:	Master of Science (M.Sc.)
Modulnummer:	09
Modultitel:	Embedded Control
Modulverantwortliche/r:	Prof. Andreas Siggelkow
Art des Moduls:	Pflicht
Inhalt des Moduls:	Within the seminar, engineering students research and work out the methods required to do a complete design and implementation of an industrial process embedded control, and compile their results in a report. The lab comprises of the complete design and implementation of an industrial process embedded control: graphical user interface, communication interface, distributed control, and hardware-in-the-loop.
Veranstaltungen:	Embedded Control Seminar Embedded Control Lab.
Lehr- und Lernformen:	Seminar, Lab
Voraussetzungen für die Teilnahme:	Advanced Control Systems
Verwendbarkeit des Moduls:	Electrical Engineering and Embedded Systems
Voraussetzungen Vergabe ECTS:	PF (50% P, 50% R) Seminar report and Lab report
ECTS-Leistungspunkte:	5
Benotung:	benotet
Arbeitsaufwand:	Es wird von einem Workload von 30 Stunden je ECTS ausgegangen.
Dauer des Moduls:	einsemestrig
Häufigkeit des Angebots:	Jedes Semester
Literatur:	Printed lecture notes and exercises. Recommended: Macia, N. F., Thaler, G. J.: Modeling and Control of Dynamic Systems, Cengage; Moudgalya, K. M.: Digital Control, Wiley; Press, W. H., Teukolsky, S. A., Numerical Recipes, Cambridge

Kompetenzstufen

Wissen und Verstehen

Wissensverständnis

The seminar should enable engineering graduates to: implement a graphical user interface on an industrial PC implement a communication interface to an industrial controller implement a digital control algorithm by programming in C utilize hardware-in-the-loop. The lab should enable engineering graduates to: implement a complete industrial process embedded control.

Einsatz, Anwendung und Erzeugung von Wissen/Kunst

Wissenschaftliche Innovation

The graduates can not only handle simple but also the following complex issues and act accordingly: Develop sustainable electrical products and systems.

Kommunikation und Kooperation

With the contents for the module, sustainable work, design and economics will be teached. It will be improved to a level, that it fits to the needs of companies.

The intercultural competence of the graduates will be developed by

- international tandem teams
- mixed teams in the labs
- mixed teams for projects and seminars

Modul: Embedded Computing

Studiengang:	EMM
Abschlussgrad:	Master of Science (M.Sc.)
Modulnummer:	10
Modultitel:	Embedded Computing
Modulverantwortliche/r:	Prof. Andreas Siggelkow
Art des Moduls:	Pflicht
Inhalt des Moduls:	- Embedded Systems in motor management, ABS, medical devices and its increasing programming needs. - Modeling of embedded systems (Cyber-Physical Systems) - Functions of 32-bit micro controllers (ARM), interface functions, its programming under Linux - Implementation of operating systems on microcontrollers
Veranstaltungen:	Embedded Computing Embedded Computing Lab Embedded Project
Lehr- und Lernformen:	Lecture and Laboratory / practical course and Project Lecture with integrated applications, development and programming of functions for embedded systems, project management (project idea, realization, presentation)
Voraussetzungen für die Teilnahme:	Bachelor knowledge
Verwendbarkeit des Moduls:	Electrical Engineering and Embedded Systems
Voraussetzungen Vergabe ECTS:	PF
ECTS-Leistungspunkte:	10
Benotung:	benotet
Arbeitsaufwand:	10 ECTS Embedded Computing 150 h (60 h Lecture, 90 h Homework) Embedded Computing Lab 60 h (30 h Lecture, 30 h Homework) Embedded Project 90 h (30 Lecture, 60 h Homework)
Dauer des Moduls:	zweisemestrig
Häufigkeit des Angebots:	Jedes Semester
Literatur:	B. P. Douglas; "Real-Time UML", Second Edition. Addision Wesley Longman, Inc., 2000. P. Marwedel; "Embedded System Design", Springer Verlag, 2006. D. Abbott; "Linux for Embedded and Real-time Applications", Elsevier Science, 2003

Kompetenzstufen

Wissen und Verstehen

Wissensverständnis

The graduates have broadened their knowledge in the following fields and are capable of reproducing this knowledge:
- Mechatronic and electrical engineering
- Model and simulate mechatronic systems
- Construct electrical and IT components

Kommunikation und Kooperation

With the contents for the module, sustainable work, design and economics will be teached. It will be improved to a level, that it fits to the needs of companies. The intercultural competence of the graduates will be developed by
- international tandem teams
- mixed teams in the labs
- mixed teams for projects and seminars

Wissenschaftliches / künstlerisches Selbstverständnis und Professionalität

In the course of their study, the graduates have already reached a level of knowledge and understanding that enables them to analyze not only simple but also complex interactions. On this basis, they are capable of independently identifying scientific or practice-related issues in the following fields:
- mechatronic questions
- model and simulate mechatronic systems
- construct electrical and IT components
- present mechatronic projects

Die Absolventinnen und Absolventen sind in der Lage:
- mechatronische Fragestellungen zu analysieren, zu modellieren und das Verhalten zu simulieren,
- elektrische und ITKomponenten zu erstellen und zu programmieren,
- mechatronische Projekte in ihrem interdisziplinären Charakter zu erfassen, zu konzipieren und zu realisieren,
- Ergebnisse mechatronischer Projekte auch fachfremden Interessierten zu präsentieren,
- Projektgruppen zu bilden und zu leiten.

Modul: Optional Module

Studiengang:	EMM
Abschlussgrad:	Master of Science (M.Sc.)
Modulnummer:	11
Modultitel:	Optional Module
Modulverantwortliche/r:	Prof. Andreas Siggelkow
Art des Moduls:	Wahlpflicht
Inhalt des Moduls:	s.M. Table 2 § 30SPO
Veranstaltungen:	Elective (Table 2 §30 SPO)
Lehr- und Lernformen:	s.M. Table 2 §30 SPO
Voraussetzungen für die Teilnahme:	Dependent on the lecture
Verwendbarkeit des Moduls:	Electrical Engineering and Embedded Systems
Voraussetzungen Vergabe ECTS:	s.M. Table 2 §30 SPO
ECTS-Leistungspunkte:	5
Benotung:	s.M. Table 2 §30 SPO
Arbeitsaufwand:	s.M. Table 2 §30 SPO
Dauer des Moduls:	einsemestrig
Häufigkeit des Angebots:	NaN
Literatur:	

Kompetenzstufen

Einsatz, Anwendung und Erzeugung von Wissen/Kunst

Nutzung und Transfer

The graduates can develop sustainable products and learn the content of a new aspect of embedded systems.

Wissenschaftliche Innovation

The graduates can create sustainable products under the aspects of different kinds of embedded systems.

Kommunikation und Kooperation

The graduates prove their achieved knowledge at a practical project.

Wissenschaftliches / künstlerisches Selbstverständnis und Professionalität

The graduates prove their achieved knowledge at a practical project and can create a system within an embedded system.

Modul: Master Thesis

Studiengang:	EMM
Abschlussgrad:	Master of Science (M.Sc.)
Modulnummer:	12
Modultitel:	Master Thesis
Modulverantwortliche/r:	Prof. Andreas Siggelkow
Art des Moduls:	Pflicht
Inhalt des Moduls:	The students should prove their knowledge of the theoretical and practical lectures on an engineering project. With the contents for the module, sustainable work, design and economics will be teached. It will be improved to a level, that it fits to the needs of companies. Die Studierenden sollen anhand eines umfangreichen Projekts ihre während des Studiums erworbenen theoretischen und praktischen Fähigkeiten zum Einsatz bringen. Neben und mit den Inhalten der Module werden die Studierenden nachhaltiges Arbeiten, Entwerfen und Wirtschaften lernen. Die Kenntnisse aus dem Studium werden vertieft und werden bis zur Masterarbeit auf einem Niveau sein, dass die Arbeit in den Firmen den Ansprüchen der Nachhaltigkeit entspricht.
Veranstaltungen:	Master-Thesis incl. Colloquium
Lehr- und Lernformen:	Ingenieurarbeit
Voraussetzungen für die Teilnahme:	The Master's thesis can only be commenced if all courses and related coursework required for semesters EE1 and EE2 have been completed, corresponding to at least 50 credit points.
Verwendbarkeit des Moduls:	Electrical Engineering and Embedded Systems
Voraussetzungen Vergabe ECTS:	MT After completion of the Master's thesis the results shall be presented at the Hochschule Ravensburg-Weingarten – University of Applied Sciences in an event open to all members of the university.
ECTS-Leistungspunkte:	25
Benotung:	benotet
Arbeitsaufwand:	The Master's thesis shall have a duration of 6 months. It will be assessed and graded by two professors one of whom shall be lecturing at the Hochschule Ravensburg-Weingarten – University of Applied Sciences.
Dauer des Moduls:	einsemestrig
Häufigkeit des Angebots:	Jedes Semester
Literatur:	

Kompetenzstufen

Wissenschaftliches / künstlerisches Selbstverständnis und Professionalität

Realize an engineering project by means of the knowledge so far achieved.

- Energy transition,
- Sustainable economic activity,
- Application of green energy,
- Application of autonomous cars and the problems,
- embedded systems and IoT, Industry 4.0 and autonomous driving.

Communication in international teams in projects and seminars.

Bemerkungen:

The consecutive Master program of Electrical Engineering and Embedded Systems comprises three semesters and has been designed especially for graduates of electrical engineering or information technology programs having at least a Bachelor or a Diploma degree.

The curriculum for the Master program Electrical Engineering and Embedded Systems is shown in tables 1 and 2.
Two elective courses have been scheduled for the first two semesters (EE1 und EE2) examples of which are shown in table 2. At the beginning of the lecture period (no later than three weeks after lecture start), the examination committee will publish the permissible elective subjects with a notice on the bulletin board.

Students are required to complete a scientific project work (engineering project) in one of the university's laboratories. The project must be finished by the end of the second semester (EE2) and must be performed alongside the lectures or in the lecture-free period. The project shall comprise a part from the field of engineering science, i.e. the student shall work on an issue related to electrical engineering. In an introductory part, aspects of project management shall be presented and tested. The engineering projects shall close with a report summarizing the results achieved. The results shall be presented in a talk open to all members of the university.

The third semester (EE3) shall be dedicated primarily to the completion of the Master's thesis.

Gültig ab: