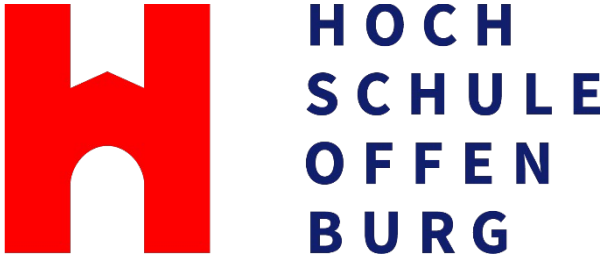

MODULHANDBUCH

Communication and Media Engineering (CME) (CME-M)

Stand: 30.04.2026
Studien- und Prüfungsordnung 20242

Modulhandbuch CME-M

Inhaltsverzeichnis

1. Semester

CME-01: Signal System Theory

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CME-01: Signal System Theory

Empfohlene Vorkenntnisse	Basic knowledge of mathematics for engineers, in particular complex numbers	
Lehrform	Vorlesung/Labor	
Lernziele	After successful completion of this course, students will be able to apply the basic laws of probability in order to quantify information. They will be able to find the optimum source code for a memoryless source and will be proficient in the computation of joint, conditional and marginal entropies, as well as the mutual information. Furthermore, students will be competent in evaluating the channel capacity of fundamental channel models, including the binary symmetric channel and various forms of the AWGN channel. Additionally, they will have a comprehensive understanding of the properties of binary linear block codes and their associated decoding algorithms. Students will be able to mathematically describe signals and linear systems in time and frequency domain and calculate the interaction of signals in linear systems. They are proficient in the use of the Fourier series and the Fourier transform to describe signals and systems in the frequency domain.	
Dauer	2 Semester	
SWS	4 SWS	
Aufwand	Lehrveranstaltung:	60,00 h
	Selbststudium/Gruppenarbeit:	120,00 h
	Workload:	180,00 h
ECTS	6,00 ECTS	
Voraussetzungen für die Vergabe von LP		
Modulverantwortung	Prof. Dr. Pfletschinger	
Empfohlenes Semester	1. Semester	
Häufigkeit	jedes Jahr (SS)	
Verwendbarkeit		

LEHRVERANSTALTUNG: Signals and Systems

Art	Vorlesung
Nr.	EMI403
SWS	2,00 SWS
Lerninhalt	1. Analog and Digital Signals in Time Domain - Definition of Signals - Elementary Signals: step, rectangle, triangle, sinusoidal signals, complex exponential - Dirac Impulse - Signal Properties and Operations - Orthogonality of Signals 2. Description of Systems in Time Domain - Definition and Basic Properties - Memoryless and Dynamic Systems - Linear Time-Invariant (LTI) Systems

	- Impulse Response and Convolution Integral - Unit Step Response - Eigenfunctions 3. Fourier Series and Fourier Transform - Orthogonal Periodic Functions - Fourier Series - Fourier Transform: definition, properties, transforms of periodic functions, the Dirac impulse train, application to LTI systems - A/D Conversion and the Sampling Theorem
Lehrveranstaltungs-sprache	de
Literatur	Stefan. M. Moser, Po-Ning Chen, A Student"s Guide to Coding and Information Theory, Cambridge University Press, 2012. Benedetto, S., Biglieri, E., Principles of Digital Transmission, Kluwer Academic, Plenum Publishers, 1999. Robert McEliece: The Theory of Information and Coding, Student Edition, Cambridge University Press, 2004. David MacKay: Information Theory, Inference, and Learning Algorithms, Cambridge University Press, 2003. Thomas M. Cover, Joy A. Thomas, Elements of Information Theory, Wiley, 2006.Alan V. Oppenheim, Alan S. Willsky: Signals & Systems. Pearson, 2013.

LEHRVERANSTALTUNG: Information Theory and Coding

Art	Vorlesung
Nr.	EMI405
SWS	2,00 SWS
Lerninhalt	1. Basic Laws of Probability and Random Variables - Events and Sets - Joint and Conditional Probabilities, Independence and Bayes Theorem - Continuous and Discrete Random Variables - Key Parameters of Random Variables: Mean, Variance, Moments - Jointly Distributed Random Variables 2. Entropy and Information Content - Information Content - Entropy and Redundancy 3. Source Coding - The Source Coding Theorem - Shannon-Fano Coding - Huffman Coding 4. Conditional Entropy and Mutual Information - Conditional and Joint Entropy - Mutual Information - Chain Rules and the Data Processing Theorem 5. Channel Capacity - The Channel Coding Theorem - The Binary Symmetric and the Binary Erasure Channel - Entropy and Mutual Information for Continuous Random Variables - The AWGN Channel 6. Channel Coding

	- Coding in Digital Communications - Error Detection and Error Correction - Binary Linear Block Codes - Decoding of Short Binary Linear Block Codes
Lehrveranstaltungs-sprache	de
Literatur	Stefan. M. Moser, Po-Ning Chen, A Student"s Guide to Coding and Information Theory, Cambridge University Press, 2012. Benedetto, S., Biglieri, E., Principles of Digital Transmission, Kluwer Academic, Plenum Publishers, 1999. Robert McEliece: The Theory of Information and Coding, Student Edition, Cambridge University Press, 2004. David MacKay: Information Theory, Inference, and Learning Algorithms, Cambridge University Press, 2003. Thomas M. Cover, Joy A. Thomas, Elements of Information Theory, Wiley, 2006.Alan V. Oppenheim, Alan S. Willsky: Signals & Systems. Pearson, 2013.

CME-02: Engineering Mathematics

Empfohlene Vorkenntnisse	mathematics on bachelor level	
Lehrform	Vorlesung	
Lernziele	Students have the mathematical skills that are necessary for CME	
Dauer	1 Semester	
SWS	6 SWS	
Aufwand	Lehrveranstaltung:	90,00 h
	Selbststudium/Gruppenarbeit:	90,00 h
	Workload:	180,00 h
ECTS	6,00 ECTS	
Voraussetzungen für die Vergabe von LP	Written examination (90 min)	
Modulverantwortung	Prof. Dr. Christoph Nachtigall	
Empfohlenes Semester	1. Semester	
Häufigkeit	jedes Jahr (WS)	
Verwendbarkeit	CME	

LEHRVERANSTALTUNG: Engineering Mathematics

Art	Vorlesung
Nr.	EMI443
SWS	6,00 SWS
Lerninhalt	
Lehrveranstaltungs-sprache	de
Literatur	

CME-03: Transcultural Media Design

Empfohlene Vorkenntnisse		
Lehrform	Seminar/Labor	
Lernziele		
Dauer	1 Semester	
SWS	4 SWS	
Aufwand	Lehrveranstaltung:	60,00 h
	Selbststudium/Gruppenarbeit:	120,00 h
	Workload:	180,00 h
ECTS	5,00 ECTS	
Voraussetzungen für die Vergabe von LP		
Modulverantwortung	Prof. Dipl.-Ing. Daniel Fetzner	
Empfohlenes Semester	1. Semester	
Häufigkeit	jedes Jahr (SS)	
Verwendbarkeit		

LEHRVERANSTALTUNG: Media Ethics

Art	Seminar
Nr.	M403
SWS	2,00 SWS
Lerninhalt	Will be announced shortly.
Lehrveranstaltungs-sprache	de
Literatur	The liste of literature will be announced in the course.

LEHRVERANSTALTUNG: Media Aesthetics Lab

Art	Labor
Nr.	M404
SWS	2,00 SWS
Lerninhalt	Will be announced shortly.
Lehrveranstaltungs-sprache	de
Literatur	Will be announced in the course.

CME-04: Language and International Competencies

Empfohlene Vorkenntnisse		
Lehrform	Seminar	
Lernziele		
Dauer	2 Semester	
SWS	6 SWS	
Aufwand	Lehrveranstaltung:	60,00 h
	Selbststudium/Gruppenarbeit:	60,00 h
	Workload:	120,00 h
ECTS	6,00 ECTS	
Voraussetzungen für die Vergabe von LP		
Modulverantwortung	Prof. Dr. Harter	
Empfohlenes Semester	1. Semester	
Häufigkeit	jedes Semester	
Verwendbarkeit		

LEHRVERANSTALTUNG: Intercultural Communication & Competence

Art	Vorlesung
Nr.	EMI430
SWS	2,00 SWS
Lerninhalt	- Self-reflection: reflecting on one's own cultural values and how these influence one's own thinking, acting and feeling - Get to know other cultures and cultural values, including German culture - Strategies to deal with cultural differences and preparation for studying and working in Germany
Lehrveranstaltungs-sprache	de
Literatur	Thomas, A.; Kinast, E.-U.; Schroll-Machl, S. (Eds.) (2010). Handbook of Intercultural Communication and Cooperation: Basics and Areas of Application. (2nd ed.) Göttingen: Vandenhoeck & Ruprecht. Schroll-Machl, S. (2008). Doing Business with Germans: Their Perception, Our Perception. (3rd ed.) Göttingen: Vandenhoeck & Ruprecht. Hall, E. & Hall, M. (1990). Understanding Cultural Differences: keys to success in West Germany, France and the United States. Yarmouth: Intercultural Press. Hofstede, Geert (2001). Culture's Consequences: Comparing Values, Behaviors, Institutions and Organizations Across Nations, 2nd Edition. Thousand Oaks CA: Sage Publications.

CME-05: Computer Science

Empfohlene Vorkenntnisse	Knowledge in programming	
Lehrform	Vorlesung/Labor	
Lernziele	Understanding the principles of object-oriented software development Being capable to analyse use case and modeling them using UML Understanding and applying important design patterns in software development	
Dauer	2 Semester	
SWS	6 SWS	
Aufwand	Lehrveranstaltung:	90,00 h
	Selbststudium/Gruppenarbeit:	150,00 h
	Workload:	240,00 h
ECTS	8,00 ECTS	
Voraussetzungen für die Vergabe von LP		
Modulverantwortung	Prof. Lauer	
Empfohlenes Semester	1. Semester	
Häufigkeit	jedes Semester	
Verwendbarkeit		

LEHRVERANSTALTUNG: Object Oriented Software Development

Art	Vorlesung
Nr.	EMI400
SWS	2,00 SWS
Lerninhalt	- Introduction to programming in C++ - Classes and Objects - Relationships between classes: composition, aggregation, inheritance - Polymorphism - Abstract classes and interfaces - Unit Testing - Design Patterns in C++
Lehrveranstaltungs-sprache	de
Literatur	- Bjarne Stroustrup "Programming: Principles and Practice Using C++" - Lippman, Lajoie and Moo "C++ Primer" - Scott Meyers "Effective C++" - Scott Meyers "Effective Modern C++" - Gamma, Helm, Johnson, Vlissides: "Design Patterns: Elements of Reusable Object-Oriented Software

LEHRVERANSTALTUNG: OO Software Development Lab

Art	Labor
Nr.	EMI401

SWS	2,00 SWS
Lerninhalt	The lab class is conducted in parallel to the lecture and supports anindependent in-depth study of the learning content. Students will write C++programs containing all concepts covered in the lecture.
Lehrveranstaltungs-sprache	de
Literatur	See lecture.

LEHRVERANSTALTUNG: Object Oriented Modelling (UML)

Art	Vorlesung
Nr.	EMI402
SWS	2,00 SWS
Lerninhalt	Introduction 2. Object Oriented Analysis 2.1. Use Case Diagram 2.2. Class + Object Diagram 2.3. Activity Diagram 2.4. State Machine Diagram 2.5. Sequence Diagram 3. Object Oriented Design 3.1. Architecture 3.2. Package Diagram 3.3. Component Diagram 3.4. Design Patterns 3.5. Anti Patterns
Lehrveranstaltungs-sprache	de
Literatur	- Brett D. McLaughlin; Gary Pollice; David West, Head first object-oriented analysis and design : [a brain-friendly guide to OOA@D], 2007. - Grady Booch, Object-oriented analysis and design with applications, 2007. - Martin Fowler: UML Distilled: A Brief Guide to the Standard Object Modeling Language, Addison-Wesley, 2004. - Bernd Oestereich, Analyse und Design mit der UML 2.5 : objektorientierte Softwareentwicklung, 2012.

CME-06: Digital Communications

Empfohlene Vorkenntnisse	Basic knowledge about signal and linear system theory Basic knowledge about digital communications Experience with MATLAB/Simulink is helpful but not strictly required	
Lehrform	Vorlesung/Labor	
Lernziele	understanding the structure and basic mechanisms in digital communication systems having the capability to design,implement and optimize digital communication systems for different applications understanding basic digital modulation schemes for baseband and passband transmission achieving the competence to design and analyse error-protection coding schemes being used in modern digital communication systems under different constraints being capable to evaluate the performance of digital communication systems having the capability to model and simulate digital communication systems by using MATLAB/Simulink in combination with the communication blockset.	
Dauer	2 Semester	
SWS	6 SWS	
Aufwand	Lehrveranstaltung:	75,00 h
	Selbststudium/Gruppenarbeit:	105,00 h
	Workload:	180,00 h
ECTS	6,00 ECTS	
Voraussetzungen für die Vergabe von LP	Exam (K60)	
Modulverantwortung	Prof. Felhauer	
Empfohlenes Semester	1. Semester	
Häufigkeit	jedes Jahr (WS)	
Verwendbarkeit	Master's degree program CME	

LEHRVERANSTALTUNG: Digital Communications with Lab

Art	Vorlesung/Labor
Nr.	EMI404
SWS	3,00 SWS
Lerninhalt	1. Introduction - Review 1.1 General block diagram of a digital communication system 1.2 Characterisation of signals and systems 1.2.1 Periodic signals 1.2.2 Transient signals 1.2.3 Random signals and noise 1.3 LTI - system characterisation 2. Basics of Digital Communications 2.1 Pulse Code Modulation 2.1.1 Sampling theorems for lowpass and bandpass signals 2.1.2 Quantization, coding and SNR calculations

	2.2 Pulse shaping for optimum transmission 2.2.1 Inter - Symbol - Interference (ISI) 2.2.2 Nyquist criteria 2.2.3 Raised cosine rolloff filtering 2.3 Filtering for Optimum Detection (Matched Filter, Correlation) 3. Baseband Transmission and Line Coding 3.1 Binary and Multilevel Signaling 3.2 Line Codes and Spectra 3.2.1 General Requirements on Line codes 3.2.2 Line Codes and Applications 3.2.3 Power Spectra and Spectral Efficiency of Binary Line Codes 4. Bandpass modulation of carrier signals 4.1 Digital bandpass modulations overview 4.2 Phase constellation diagram 4.3 Digital Quadrature Modulator and Demodulator Implementation Structures 4.4 Analysis of exemplary digital carrier modulation schemes 5. Digital communication system analysis and simulation 5.1 Eye pattern diagram 5.2 Bit-error-rate calculation 5.3 Simulation and optimization of digital communication systems using MATLAB/SIMULINK/Communication Toolbox
Lehrveranstaltungs-sprache	de
Literatur	Glover, P.M. Grant: Digital Communications. Pearson Education Limited, London, 2009. L. W. Couch II: Digital and Analog Communication Systems. Pearson India, 2013 J. G. Proakis: Digital Communications. McGraw-Hill, New York, 2007. B.Sklar: Digital Communications: Fundamentals and Applications. Prentice Hall, 2020

LEHRVERANSTALTUNG: Advanced Channel Coding

Art	Vorlesung/Labor
Nr.	EMI406
SWS	3,00 SWS
Lerninhalt	Introduction Coding; Types of Coding; Modelling of noisy Digital Communication Channels; Coding Gain Information Theoretical Analysis of a Communication Link Digital Communication System Model; Information Measures; Entropy and Redundancy, Equivocation, Irrelevance and Transinformation of a Communication Link; Channel Capacity; Examples Error Protection Coding (FEC) - General error protection strategies, Types and Capabilities of Linear Codes; Boundaries of Linear Codes - Mechanisation of Coding and Decoding of linear Block Codes - Special linear block codes: Hamming Codes, Simplex Codes, Reed-Muller Codes, cyclic block codes, Reed-Solomon (RS) Codes; Bose-Chaudhuri-Hocquenghem (BCH) Codes - Error Protection Coding for burst error channels: CRC-Codes, Fire-Codes,

	Interleaving - Convolutional Coding: Description of convolutional Codes (Tree-, State- and Trellis-Diagram); Characteristics of convolutional Codes (minimum free distance, catastrophic error propagation etc.); ML-Decoding Principle (hard/soft decision Viterbi decoding); puncturing Advanced Error Protection Coding - Concatenated Coding: serial concatenated coding (Product Codes) parallel concatenated Coding (Turbo Codes) - Low-density parity-check codes (LDPC - Gallager-Codes) - Polar Codes Lab Exercises: Simulation of different communication links applying linear block coding and convolutional coding for error protection using MATLAB/SIMULINK/Communication Toolbox
Lehrveranstaltungs-sprache	de
Literatur	W. Henkel: Channel Coding. Springer, 2025 D. Declercq et al.: Channel Coding: Theory, Algorithms, and Applications: Academic Press, 2014.

2. Semester

CME-07: Advanced Digital Signal Processing

CME-08: Interactive Distributed Applications

CME-09: Internet and Media Technologies

CME-10: Wireless Communication

CME-11: Elective Modules 2.+3. Semester

CME-07: Advanced Digital Signal Processing

Empfohlene Vorkenntnisse	Advanced DSP lecture	
Lehrform	Vorlesung/Labor	
Lernziele	Understanding the fundamental theoretical tools for analysis of most relevant DSP problems and ability to apply them in practice with Matlab	
Dauer	2 Semester	
SWS	5 SWS	
Aufwand	Lehrveranstaltung:	75,00 h
	Selbststudium/Gruppenarbeit:	105,00 h
	Workload:	180,00 h
ECTS	5,00 ECTS	
Voraussetzungen für die Vergabe von LP		
Modulverantwortung	Prof. Christian Reich	
Empfohlenes Semester	2. Semester	
Häufigkeit	jedes Jahr (SS)	
Verwendbarkeit		

LEHRVERANSTALTUNG: Advanced Digit. Signal Proc.

Art	Vorlesung
Nr.	EMI414
SWS	4,00 SWS
Lerninhalt	- Transform Analysis of Linear Time-Invariant Systems: Frequency Response Components, All-Pass Filters, Minimum-Phase Systems. - IIR Filter Design: Approximation of Differential Equation, Impulse and Step Invariance Design, Bilinear Transformation. - IIR Filter Structures: Noncanonical and Canonical Direct Form, Transposed Direct Form, Parallel Form, Cascade Form. Finite Precision Numerical Effects. - FIR Filter Design Techniques: Fourier Approximation, Windowing, Optimum Equiripple Approximation. - Discrete Fourier Transform (DFT): Linear and Circular Convolution, Fast Fourier Transform (FFT) Algorithms. - Multirate Processing: Downsampling, Decimation Filter, Upsampling, Interpolation Filter. - Adaptive Signal Processing: Configuration in different Applications, Optimum Filter, Least-Mean-Squares Algorithm.
Lehrveranstaltungs-sprache	de
Literatur	Oppenheim, Alan V.; Schafer, Ronald W.: Discrete-Time Signal Processing. Pearson, 2013.

LEHRVERANSTALTUNG: Digital Signal Processing Lab Work

Art	Labor
Nr.	EMI415
SWS	1,00 SWS
Lerninhalt	Experiment 1: Matlab Onboarding - Design of an amplitude modulation system in Matlab - Visualization of effects of its modules - Description of effects of its modules Experiment 2: Infinite Impulse Response (IIR-) Filters - Analysis of IIR filters - Approximation methods for time-continuous filter (Butterworth, Chebyshev, Elliptic) - Filter design using the Bilinear Transform with Matlab Filter Designer (lowpass and bandpass filters) Experiment 3: Finite Impulse Response (FIR-) Filters - Filter Design Using the Fourier Approximation - Modification by Using Window Functions - Optimum Design (Parks-McClellan-Algorithm) - Finite Precision Effects - Design of Hilbert Filters (Wideband Phase Shifters)
Lehrveranstaltungs-sprache	de
Literatur	User guides for experiments are provided

CME-08: Interactive Distributed Applications

Empfohlene Vorkenntnisse	good programming skills in C or Java	
Lehrform	Vorlesung/Labor	
Lernziele	After completing the module, students are familiar with the basics of Web development in theory and practice. They understand the interaction of HTML/CSS/JavaScript, server-side programming and communication via HTTP and have acquired conceptual knowledge of building applications on the World Wide Web. They have realized a concrete application in the area Internet of Things.	
Dauer	1 Semester	
SWS	5 SWS	
Aufwand	Lehrveranstaltung:	60,00 h
	Selbststudium/Gruppenarbeit:	60,00 h
	Workload:	120,00 h
ECTS	5,00 ECTS	
Voraussetzungen für die Vergabe von LP	exam K90 + lab work LA	
Modulverantwortung	Prof. Dr. rer. nat. Tom Rüdebusch	
Empfohlenes Semester	2. Semester	
Häufigkeit	jedes Jahr (SS)	
Verwendbarkeit		

LEHRVERANSTALTUNG: Interactive Distributed Applications	
Art	Vorlesung
Nr.	M400
SWS	4,00 SWS
Lerninhalt	- User Interfaces - Internet Services - The World Wide Web o Protocol (WWW System) o Page Description (HTML) o Server (Static vs. Dynamic Web Pages, CGI/C, PHP) o Client (JavaScript, CSS, DHTML) o Structuring Information (Extensible Markup Language XML) - Applications
Lehrveranstaltungs-sprache	de
Literatur	- Shneiderman et al.: Designing the User Interface. Pearson, 2009 - Freeman: The Definitive Guide to HTML5. Apress, 2011 - Flanagan: JavaScript. O'Reilly, 2011 - Tatroe, MacIntyre, Lerdorf: Programming PHP. O'Reilly, 2013 - Harold, Means: XML in a Nutshell. O"Reilly, 2004

LEHRVERANSTALTUNG: Interactive Distributed Applications Lab	
Art	Labor
Nr.	M406
SWS	1,00 SWS
Lerninhalt	Die LV gliedert sich folgendermaßen: - Web-Entwicklung auf dem Raspberry Pi - Internet der Dinge mit Arduino - Web-Anwendung als verteiltes System The course is structured as follows: - Web development on the Raspberry Pi - Internet of Things with Arduino - Web application as a distributed system
Lehrveranstaltungs-sprache	de
Literatur	Die Literaturliste wird in der Lehrveranstaltung bekannt gegeben. The liste of literature will be announced in the course.

CME-09: Internet and Media Technologies

Empfohlene Vorkenntnisse	
Lehrform	Vorlesung/Labor
Lernziele	- to know and to understand important concepts of databases and to be apply

	them to given problems - to be able to develop databases for programs, to express queries for programs and to evaluate the quality of a given database - getting overview over and insight into the topic of interactive media	
Dauer	1 Semester	
SWS	5 SWS	
Aufwand	Lehrveranstaltung:	75,00 h
	Selbststudium/Gruppenarbeit:	135,00 h
	Workload:	210,00 h
ECTS	6,00 ECTS	
Voraussetzungen für die Vergabe von LP		
Modulverantwortung	Prof. Dr. rer. pol. Volker Sänger	
Empfohlenes Semester	2. Semester	
Häufigkeit	jedes Jahr (WS)	
Verwendbarkeit		

LEHRVERANSTALTUNG: Database Systems	
Art	Vorlesung
Nr.	M401
SWS	2,00 SWS
Lerninhalt	
Lehrveranstaltungs-sprache	de
Literatur	- R. Elmasri, S.B. Navathe: Fundamentals of Database Systems, 7th Edition, Addison-Wesley, 2016. - M. Keith, M. Schincariol: Pro JPA 2 - A Definitive Guide to Mastering the Java Persistence API, Apress Media, 2013. - Hector Garcia-Molina, Jeff Ullman and Jennifer Widom: Database Systems, Prentice-Hall, 2009.

LEHRVERANSTALTUNG: Interactive Media	
Art	Vorlesung
Nr.	M402
SWS	2,00 SWS
Lerninhalt	
Lehrveranstaltungs-sprache	de
Literatur	

CME-10: Wireless Communication

Empfohlene	Basic knowledge of mathematics for engineers, in particular complex numbers

Vorkenntnisse	Basic knowledge of communications engineering and signal theory EMI444 Antennas and Wave Propagation - Solid understanding of mathematics, including: -Vector calculus -Differential equations -Complex numbers - Basic knowledge of physics, especially electromagnetics - Familiarity with electric and magnetic fields - Prior coursework in: -Signals and systems - Basic programming or simulation experience (helpful but not required)	
Lehrform	Vorlesung/Labor	
Lernziele	Upon successful completion of this module, the student will be able to: - understand the functions and the relationship of the main building blocks of a modern receiver including RF processing, modulation, demodulation and digital baseband processing - implement a basic simulation chain of a digital communication system EMI444 Antennas and Wave Propagation -The lecture introduces the theoretical framework needed to describe electromagnetic fields and their behavior, gradually building toward practical concepts used in modern communication systems. -A special feature of the course is a hands-on laboratory component: students will use Microwave Office software to simulate and analyze microstrip transmission lines, bridging the gap between theory and engineering practice. -In addition, students will explore how transmission lines guide signals, how scattering parameters describe system behavior, and how antennas convert electrical signals into radiated energy. -By the end of the course, they will not only understand the physical principles of antennas and wave propagation but also recognize their pervasive role in shaping today"s interconnected world—from 5G networks and satellite links to radar and emerging technologies	
Dauer	1 Semester	
SWS	6 SWS	
Aufwand	Lehrveranstaltung:	60,00 h
	Selbststudium/Gruppenarbeit:	90,00 h
	Workload:	150,00 h
ECTS	6,00 ECTS	
Voraussetzungen für die Vergabe von LP		
Modulverantwortung	Prof. Dr. Pfletschinger and Prof. Dr. Harter	
Empfohlenes Semester	2. Semester	
Häufigkeit	jedes Jahr (SS)	
Verwendbarkeit		

LEHRVERANSTALTUNG: Antennas and Wave Propagation

Art	Vorlesung
Nr.	EMI444

SWS	3,00 SWS
Lerninhalt	Wireless communication, satellite navigation, medical imaging, and even the everyday use of smartphones rely on one fundamental principle: the interaction between antennas and electromagnetic waves. This course provides students with a solid foundation in understanding how waves propagate through different media and how antennas enable the transmission and reception of information. - Introduction and Motivation - Basics of Electromagnetic Theory -Maxwell"s Equations -Wave propagation -Logarithmic Levels - Transmission Line Theory - Transmission Line Examples -Coaxial Cable -Microstrip Lines -Experiment "Circuit Simulation with Software Microwave Office" - Scattering Parameters - Antenna Basics
Lehrveranstaltungs-sprache	de
Literatur	Microwave engineering / David M. Pozar RF and Microwave Circuit Design / Charles E. Free, Colin S. Aitchison Antenna theory : Analysis and Design / Constantine A. Balanis D. Fleisch: A Student"s Guide to Maxwell"s Equations Cambridge University Press, 2008 C. A. Balanis: Advanced Engineering Electromagnetics John Wiley & Sons, 2. Ed., 2012.

LEHRVERANSTALTUNG: Software Radio with Python

Art	Labor
Nr.	EMI445
SWS	3,00 SWS
Lerninhalt	In this course, students will implement a working digital communication system. The project includes the following steps: - Basics of analog and digital communication - Basics of the programming language Python and the module Numpy - Description of signals and systems in Python - Simulation of communication systems - Spectral analysis of received radio signals - Modulation and demodulation - Synchronization at receiver side - Data transmission and detection
Lehrveranstaltungs-sprache	de
Literatur	Mathuranathan Viswanathan: Digital Modulations using Python, 2019. Christian Hill: Learning Scientific Programming with Python, Cambridge University Press, 2020.

CME-11: Elective Modules 2.+3. Semester

Empfohlene Vorkenntnisse	Lecture "Digital Communications with Lab" Basic knowledge about matrix calculations	
Lehrform	Vorlesung	
Lernziele	Upon successful completion of this module, the student will be able to: understand the basic challenges in modern radio communication systems and networks model and describe the impact of a time-variant multipath radio channel design and analyse the signal processing applied in modern digital radio communication systems under different constrains understand the method for multiplying the capacity of a radio link using multiple transmission and receiving antennas (smart antenna systems, MIMO) and how they are used in modern wireless communication standards.	
Dauer	1 Semester	
SWS	0 SWS	
Aufwand	Lehrveranstaltung:	60,00 h
	Selbststudium/Gruppenarbeit:	90,00 h
	Workload:	150,00 h
ECTS	15,00 ECTS	
Voraussetzungen für die Vergabe von LP	Oral exam M (50%) + Presentation RE (50%)	
Modulverantwortung	Prof. Dr. Harter	
Empfohlenes Semester	2. Semester	
Häufigkeit	jedes Jahr (WS)	
Verwendbarkeit		

3. Semester

CME-12: Wireless and Sensor Systems

CME-13: Multimedia Web Technologies

CME-14: Management and Scientific Working Skills

CME-12: Wireless and Sensor Systems

Empfohlene Vorkenntnisse	EMI442 Automotive Radar - Basic knowledge in signal processing - Basic knowledge in high-frequency but not strictly required	
Lehrform	Vorlesung/Labor	
Lernziele	EMI442 Automotive Radar - Understanding the principle and types of automotive radars - Being capable to understand the advantages of radar compared to other technologies - Being capable to know the applications and functions of current and future automotive radar systems	
Dauer	1 Semester	
SWS	4 SWS	
Aufwand	Lehrveranstaltung:	60,00 h
	Selbststudium/Gruppenarbeit:	60,00 h
	Workload:	120,00 h
ECTS	6,00 ECTS	
Voraussetzungen für die Vergabe von LP		
Modulverantwortung	Prof. Dr. Sikora	
Empfohlenes Semester	3. Semester	
Häufigkeit	jedes 2. Semester	
Verwendbarkeit		

LEHRVERANSTALTUNG: Internet of Things

Art	Vorlesung
Nr.	EMI419
SWS	2,00 SWS
Lerninhalt	Introduction to IoT -Broader IoT context - The beginnings of the IoT - The promise of IoT - defining IoT as a concept - Market potential of IoT - The current state of the market -Scope of IoT system - What technologies does IoT encompass? - How does IoT relate to existing enterprise IT/OT systems and businessprocesses? - IoT value chain -Overview of typical IoT use cases IoT Technical deep dive -IoT system architecture - End-to-end system architecture - IoT service pattern

	- Deployment considerations and challenges -IoT connectivity - Overview of existing IoT connectivity landscape - Short range (BT, Wifi, Zigbee) - Long range (LoRaWAN, Sigfox, NB-IoT, LTE-M) - Emerging technologies - Satellite IoT - Analysis of capabilities of connectivity options - Strategies for the right IoT connectivity choice - Geo-location services - Towards sub $1 devices IoT platforms - Overview of existing IoT platform landscape - Analysis of typical IoT platform capabilities - Examples of leading commercial IoT platforms
Lehrveranstaltungs-sprache	de
Literatur	Wird in der Vorlesung bekanntgegeben/siehe auch Skript

LEHRVERANSTALTUNG: Automotive Radar	
Art	Vorlesung
Nr.	EMI442
SWS	2,00 SWS
Lerninhalt	Advanced Driver Assistance Systems (ADAS), employing camera, LiDAR, and radar technologies, are today in worldwide deployment. By 2024, more than 140 million automotive radar sensors were shipped in a single year, and the global installed base on the road now exceeds 500 million radar units. ADAS are no longer seen as comfort features, but have become essential safety systems. In particular, radar sensors play a key role in Automatic Emergency Braking (AEB) for cars and trucks, contributing significantly to accident prevention and road safety worldwide. Looking ahead, radar technology is also a cornerstone for automated and autonomous driving. Higher levels of driving automation require continuous environmental perception under all weather and lighting conditions — an area where radar excels compared to other sensing modalities. - History of automotive radar - Radar basics -Wave propagation -Automotive radar frequencies and regulations -Comparison to other technologies - Radar techniques -Radar principles and components -Radar signal modulation -Basic radar signal processing -Radar system specifications and characteristics - Principles for angle measurement

	- Automotive radar in praxis -Applications of automotive radars -Examples of automotive radars -Radar sensor vehicle installation -Mutual Interference of radar sensors - Future trends in automotive radar
Lehrveranstaltungs-sprache	de
Literatur	Christian Waldschmidt, Christina Bonfert, Timo Grebner, Millimeter Wave Radar - Hardware and Signal Processing, Springer, 2025 Jonah Gamba, Radar Signal Processing for Autonomous Driving, Springer, 2025 Winner, H., Hakuli, S., Lotz, F., Singer, C. (Eds.), Handbook of Driver Assistance Systems, Basic Information, Components and Systems for Active Safety and Comfort, Springer, 2016. Skolnik, M.,Radar Handbook,3rd Edition, McGraw-Hill Education, 2008 Pozar, D. M., Microwave Engineering, 2th Edition, Wiley, 2011.

CME-13: Multimedia Web Technologies

Empfohlene Vorkenntnisse	Databases, SQL, UML, Computer Networks	
Lehrform	Vorlesung/Labor	
Lernziele	know the concepts of MMDBS and the basic technology AI, especially Deep Learning, and be able to apply them be able to - specify, create and implement multimedia databases - store and query multimedia data (with the help of AI) - analyze and evaluate existing MMDBS - reflect about the benefits and disadvantages of MMDBS be able to - identify current topics in the Internet (from research & standardization) and to analyze them - evaluate current and future protocols and architectural considerations	
Dauer	1 Semester	
SWS	4 SWS	
Aufwand	Lehrveranstaltung:	60,00 h
	Selbststudium/Gruppenarbeit:	90,00 h
	Workload:	150,00 h
ECTS	5,00 ECTS	
Voraussetzungen für die Vergabe von LP	exam (90 minutes)	
Modulverantwortung	Prof. Dr. Sänger	
Empfohlenes Semester	3. Semester	
Häufigkeit	jedes 2. Semester	
Verwendbarkeit		

CME-14: Management and Scientific Working Skills

Empfohlene Vorkenntnisse		
Lehrform	Vorlesung/Seminar	
Lernziele		
Dauer	1 Semester	
SWS	5 SWS	
Aufwand	Lehrveranstaltung:	60,00 h
	Selbststudium/Gruppenarbeit:	120,00 h
	Workload:	180,00 h
ECTS	5,00 ECTS	
Voraussetzungen für die Vergabe von LP		
Modulverantwortung	Prof. Dr. Harter	
Empfohlenes Semester	3. Semester	
Häufigkeit	jedes Semester	
Verwendbarkeit		

LEHRVERANSTALTUNG: Project Management

Art	Vorlesung
Nr.	EMI431
SWS	2,00 SWS
Lerninhalt	Students get to know project management tools and methods according to the IPMA project management standard. Based on theoretical input they will learn how to apply them in different group works and a case study. That comprises: Planning and organizing project - Context analysis - Scope planning: Work breakdown structure, work package specification - Stakeholder analysis and measures - Resource planning - Scheduling: network diagram, gantt chart, milestones - Risk analysis Controlling projects - Target verification - Cost controlling: Earned value analysis - Quality assurance - Time monitoring: Milestone trend analysis - Capacity check Project analysis (case study) - Order analysis - Problem analysis (weak point analysis) - Interface analysis - Responsibility of the project manager and project sponsor - Methods of decision making - Methods of organizationaldevelopment

	- Framework conditions of a project 44
Lehrveranstaltungs-sprache	de
Literatur	Eric Verzuh: The Fast Forward MBA in Project Management. Wiley, 2015.

LEHRVERANSTALTUNG: Rhetoric & Presentation Essentials	
Art	Seminar
Nr.	EMI447
SWS	2,00 SWS
Lerninhalt	Rhetorik- und Präsentations-Struktur und Inhalte, Übungen zu Auftritten, Körpersprache, Stimme
Lehrveranstaltungs-sprache	de
Literatur	The most important is to watch a few speakers and to take notes about their style. Also, students may try to download published speeches from the web. "Speeches sand Toasts", W.Foulsham & Co. LTD, London, 1979 Peter Ebeling: "Rhetorik- der Weg zum Erfolg", humboldt taschenbuch 627, 1990 Samy Molchow: Körpersprache", Goldmann, 1996. Wolf Schneider: "Deutsch für Profis", Stern Buch, 1.Auflg. 1982 Frank Martin Hein: "Elektronische Unternehmenskommunikation - Konzepte und Best Practices zu Kultur und Führung", Frankfurt, 2007