Module descriptions of the
Faculty of Electrical Engineering and Information Technology

Table of Contents

Advanced Coding and Modulation

Kind of Lecture	Lecture, Exercise
Chair	Lehrstuhl und Institut für Nachrichtengeräte und Datenverarbeitung
Degree Programme	Master of Science (M.Sc.)
Responsible person	Univ.-Prof. Dr.-Ing. Peter Vary Dipl.-Ing. Thomas Esch Dipl.-Ing. Matthias Pawig Dipl.-Ing. Moritz Beermann
Title of module	Advanced Coding and Modulation
Short title	
Complete Reference	
Semester	Every summer semester
Link	http://www.ind.rwth-aachen.de/de/lehre/vorlesungen/advanced-coding-and-modulation/
Content	The lecture "Advanced Channel Coding and Modulation" (Nachrichtensysteme II) covers advanced methods of channel coding and modulation which are employed in modern digital communication systems, e.g., in the DVD- and Blu-ray-discs, in GSM-, UMTS- and UMTS-LTE mobile systems, in digital TV systems (DVB) or in WLAN internet access. The lecture is held in German language, the written material is offered in Englisch. Prior knowledge of the basic concepts of digital communication is required, as is tought e.g. in the lecture "Kommunikationstechnik" (Nachrichtensysteme I). Therefore, the basics of block coding, convolutional coding and digital modulation are just briefly summarized in the respective chapters. The main focus are recent methods of channel coding for communication channels and storage devices with burst errors, as well as multi-carrier modulation which ist not only employed for DSL connections, but is an integral part of all recent communication systems for frequency selective channels. In particular, covered topics are • Reed Solomon Codes • Turbo Codes (Block- and Convolutional Codes) • Low Density Parity Check Codes (LDPC) • Orthogonal Frequency Division Multiplex Modulation (OFDM). In addition to the basic principles of these topics, the above mentioned applications are covered as examples. In conjunctions with the lecture, exercises are offered. Additional lectures with coordinated topics are "Digitale Sprachverarbeitung I+II" and "Mobilfunk Systemkonzepte". The lecture notes have been developed to incorporate space for notes, examples and the derivation of proofs.
Assessment	Written exam
Language	German with english script
Prerequisites	

Algorithm Design for Digital Receivers

Kind of Lecture	Lecture, Exercise
Chair	Lehrstuhl für Integrierte Systeme der Signalverarbeitung
Degree Programme	Master of Science (M.Sc.)
Responsible person	Univ.-Prof. Dr.-Ing. Gerd Ascheid Dipl.-Ing. Adrian Ispas
Title of module	Algorithm Design for Digital Receivers
Short title	
Complete Reference	
Semester	Every summer semester
Link	http://www.iss.rwth-aachen.de
Content	The lecture will introduce the algorithm design of digital receivers, focussing on systematic design of synchronization algorithms. The first semester course "Detection and Estimation Theory" delivers the theoretical basis for this course. The lecture divides into the following parts of communication theory: • Modulation • General digital transceiver model • Digital receiver principles • Bandpass sampling • Optimum ML receiver for constant synchronization parameters • Systematic synthesis of synchronization algorithms based on the ML criteria • Digital algorithm for timing recovery • Timing adjustment by interpolation • Rate adaptation and modulation • Phase synchronization • Frequency estimation • Synchronizer performance analysis • Fading channel models • Optimum receiver for time varying channels
Assessment	Oral exam
Language	English
Prerequisites	

Automation of Complex Power Systems

Kind of Lecture	Lecture/Exercise
Chair	Lehrstuhl für Automation of Complex Power Systems
Degree Programme	Master of Science (M.Sc.)
Responsible person	Univ.-Prof. Antonello Monti, Ph.D. Dipl.-Wirt.-Ing. Marco Cupelli
Title of module	Automation of Complex Power Systems
Short title	
Complete Reference	
Semester	Every summer semester
Link	http://www.eonerc.rwth-aachen.de
Content	Automation of Complex Power Systems focuses mostly on the current technologies. Basic concepts of dynamics are introduced and analyzed with reference to the stability of modern power systems. Analysis of the current technologies will be done with tight connection to the current industrial practice.
Assessment	Oral exam
Language	English
Prerequisites	

Control Design for Power Systems

Kind of Lecture	Lecture/Exercise
Chair	Lehrstuhl für Automation of Complex Power Systems
Degree Programme	Master of Science (M.Sc.)
Responsible person	Univ.-Prof. Antonello Monti, Ph.D. Weilin Li, M.Sc.
Title of module	Control Design for Power Systems
Short title	
Complete Reference	
Semester	Every summer semester
Link	http://www.eonerc.rwth-aachen.de
Content	This class offers students a comprehensive look at the most typical control algorithms utilized in the power systems. The application of control theories to power systems is covered starting with a review of fundamental principles of control design. the topics of the class are: State Space Control, Pole Placement, Linear Quadratic Control, Linear Quadratic Gaussian Control, Sliding Mode Control and Synergetic Control. Lyapunov Control and Nonlinear Feed-back Control are also covered. The class content is focused mostly on current technologies. For this reason recently published technical papers are used as reference learning material. For each topic, the Instructor will select a major published paper that demonstrates the application of one of the control approaches in a case study.
Assessment	Oral exam
Language	English
Prerequisites	

Cryptography I

Kind of Lecture	Lecture
Chair	Lehrstuhl und Institut für Theoretische Informationstechnik
Degree Programme	Bachelor of Science (B.Sc.) / Master of Science (M.Sc.)
Responsible person	Univ.-Prof. Dr.rer.nat. Rudolf Mathar Dr.-Ing. Michael Reyer Dipl.-Ing. Henning Maier
Title of module	Cryptography I
Short title	
Complete Reference	
Semester	Every summer semester
Link	http://www.ti.rwth-aachen.de/
Content	Classical cryptosystems, Cryptanalysis of classical systems, entropy and perfect secrecy, fast block ciphers, number theoretic reference problems, cryptosystems based on discrete logarithms, public key cryptography
Assessment	Written exam
Language	English
Prerequisites	Basic knowledge in stochastics and number theory.

DSP Design Methodologies and Tools

Kind of Lecture	Lecture, Exercise
Chair	Lehrstuhl für Software für Systeme auf Silizium
Degree Programme	Master of Science (M.Sc.)
Responsible person	Univ.-Prof. Dr.rer.nat. Rainer Leupers Anastasia Stulova, M.Sc.
Title of module	DSP Design Methodologies and Tools
Short title	
Complete Reference	
Semester	Every summer semester
Link	http://www.iss.rwth-aachen.de
Content	1. Introduction: Definition of embedded systems; design challenges; design methodologies 2. System design: System design methodologies; requirements and specification 3. Instruction sets: Basic classification of computer architecture; assembly language; examples of software assembly instruction-set 4. Microprocessors: Various I/O mechanism; supervisor mode, exceptions, traps; co-processor 5. Designing with microprocessors: Architectures and components (software, hardware); debugging; manufacturing testing 6. Program design & analysis: Design patterns; representation of programs; assembling, linking 7. VLSI implementation: Importance of VLSI; Moore's Law; VLSI design process 8. RTL components: Shifters; adders; multipliers 9. Architecture and chip design: Basics of register-transfer design; data path, controller; ASM chart; VHDL, Verilog overview 10. CAD systems and algorithms: CAD systems; placement and routing; layout analysis
Assessment	Oral exam
Language	English
Prerequisites	

Electrical Machines II

Kind of Lecture	Lecture, Exercise
Chair	Lehrstuhl für Elektromagnetische Energiewandlung und Institut für Elektrische Maschinen
Degree Programme	Master of Science (M.Sc.)
Responsible person	Univ.-Prof. Dr.-Ing. Dr.h.c. dr hab. Kay Hameyer Dipl.-Ing. Michael van der Giet Dipl.-Ing. Enno Lange Dipl.-Ing. Thomas Herold Dipl.-Ing. Peter Offermann
Title of module	Electrical Machines II
Short title	
Complete Reference	
Semester	Every summer semester
Link	http://www.iem.rwth-aachen.de
Content	• Dynamic performance of direct-current machines: Alternate diagram and dynamic equations, externally excited direct-current machine, temporal process of self-excitation, coupled reference input combination for servo-motors with static converter feed, direct-current series motor in pulse operation, • Two-axis-theory of three-phase machines: Requirements , transformation from three-phase to two-phase machine, transformation of stator and rotor to a rotating co-ordinate system, flux interlinking, current-equations, torque, modell of direct-current machines, space-vector diagram. • Synchronous machine: Static operation of full-pole machines, maximum short-circuit current, two-axis-theory of salient pole machines, static operation of the salient pole machine, determination of Xd and Xq , maximum short-circuit current of the salient pole machine, transient operation of the salient pole machine, • Asynchronous machine: System of equations, fast starting and maximum load, fieldoriented feedback control with load-independent stator current, static operation with constant stator- and rotor-flux interlinking, fieldoriented feedback control with load-independent stator-current. • Permanently excited synchronous motor with magnet wheel: Mode of action, dynamic equations, static operation, voltage- and current-curvature, control procedures, • Power inverter for three-phase-machines: Synchronous machines, asynchronous machines.
Assessment	
Language	English
Prerequisites	

Electromagnetic Field Simulation for Electrical Energy Applications

Kind of Lecture	Lecture, Exercise
Chair	Lehrstuhl für Elektromagnetische Energiewandlung und Institut für Elektrische Maschinen
Degree Programme	Master of Science (M.Sc.)
Responsible person	Dr.-Ing. Herbert De Gersem Dipl.-Ing. Thomas Herold
Title of module	Electromagnetic Field Simulation for Electrical Energy Applications
Short title	
Complete Reference	
Semester	Every summer semester
Link	http://www.iem.rwth-aachen.de/index.pl/electromagnetic_field_simulation_for_electrical_energy_applic
Content	The lecture series focuses on field simulation techniques applied to electrical energy applications. The main subjects are: - field simulation for electrical energy applications - treatment of nonlinear, superconductive and hysteretic materials - time-harmonic and transient approaches for eddy-current phenomena - modelling of solid-body motion - coupled field-circuit models and specialised models for coils - optimisation of electrical energy applications - modelling of DC, induction and synchronous machines, power transformers, inductors, capacitors, accelerator components, electromechanical actuators and MEMS
Assessment	Oral exam
Language	German/English
Prerequisites	

Electronic Design Automation

Kind of Lecture	Lecture, Exercise
Chair	Lehrstuhl für Software für Systeme auf Silizium
Degree Programme	Master of Science (M.Sc.)
Responsible person	Dr.-Ing. Andreas Hoffmann Univ.-Prof. Dr.rer.nat. Rainer Leupers Jeronimo Castrillon Mazo, M.Sc.
Title of module	Electronic Design Automation
Short title	
Complete Reference	
Semester	Every summer semester
Link	http://www.ice.rwth-aachen.de
Content	Diese Vorlesung wendet sich an Studenten mit Interesse im Bereich der Entwurfsautomatisierung digitaler Schaltungen und sogenannter "System on Chips (SoC)". Während Systeme ursprünglich aus einem Mikroprozessor- oder Mikrocontroller-IC und vielen anderen ICs bestanden, die auf einer Platine aufgelötet waren, geht heute der Trend dazu, möglichst alle Funktionen auf einem IC zu realisieren. Dabei werden digitale, analoge und Mixed-Signal-Funktionseinheiten integriert. Vorteile sind vor allem Kosteneinsparung und Miniaturisierung. Im Rahmen der Vorlesung werden die Prinzipien des SoC Entwurfs erläutert - mit besondererem Fokus auf die Optimierung der Systemarchitektur und der eingebetteten Software. Dabei werden Entwurfsmethoden und Werkzeuge vorgestellt; dieses "System Level Design" wird im allgemeinen als die vielversprechendste Neuerung im Bereich der elektronischen Entwurfsautomatisierung gesehen und gehört zum Grundwerkzeug aller, die solche SoCs entwickeln wollen. Struktur der Vorlesung: 1. Eingebettete Systeme 2. Mikroprozessoren 3. Bus Systeme 4. EDA I 5. EDA II 6. Electronic System Level 7. Systembeschreibungssprachen 8. System Level Design 9. Exploration von Rechnerarchitekturen 10. Entwicklung von eingebetteter Software
Assessment	Oral exam
Language	German/English
Prerequisites	

Electrothermal Process Technology

Kind of Lecture	Lecture, Exercise
Chair	Lehrstuhl und Institut für Stromrichtertechnik und Elektrische Antriebe
Degree Programme	Master of Science (M.Sc.)
Responsible person	Dr.-Ing. Andreas Seitzer
Title of module	Elektrothermische Prozesstechnik - Grundlagen, Werkstoffe, Hochleistungsanwendungen
Short title	
Complete Reference	
Semester	Every summer semester
Link	http://www.isea.rwth-aachen.de/courses/ss2011/elektrowaerme/en
Content	
Assessment	Oral exam
Language	German/English
Prerequisites	

Forward Error Correction and Digital Modulation

Kind of Lecture	Lecture, Exercise
Chair	Lehrstuhl und Institut für Nachrichtengeräte und Datenverarbeitung
Degree Programme	Master of Science (M.Sc.)
Responsible person	Univ.-Prof. Dr.-Ing. Peter Vary Dr.-Ing. Marc Adrat Dipl.-Ing. Birgit Schotsch Dipl.-Ing. Matthias Rüngeler
Title of module	Forward Error Correction and Digital Modulation
Short title	
Complete Reference	
Semester	Every summer semester
Link	http://www.ind.rwth-aachen.de/lehre/vorlesungen/channel-coding-and-modulation/ http://www.ind.rwth-aachen.de/lehre/vorlesungen/channel-coding-and-modulation/uebung/
Content	This one-semester course is part of the Master Programme Communications Engineering at RWTH. The lecture Forward Error Correction and Digital Modulation addresses the aspects of channel coding and digital modulation in modern communication systems. The first part of the lecture covers different standard techniques of channel coding for error correction and error detection • Linear Block Codes • Cyclic Codes • Convolutional Codes and their decoding • Turbo Codes In the second part the lecture deals the baseband and the bandpass transmission • Digital Modulation • Intersymbol Interference • Matched Filter Furthermore, applications are discussed such as • GSM (cyclic codes, convolutional codes) • UMTS (Turbo codes)
Assessment	Written exam
Language	English
Prerequisites	

High Voltage Engineering, Insulation Systems

Kind of Lecture	Lecture, Exercise
Chair	Lehrstuhl und Institut für Hochspannungstechnik
Degree Programme	Master of Science (M.Sc.)
Responsible person	Univ.-Prof. Dr.-Ing. Armin Schnettler
Title of module	High Voltage Engineering, Insulation Systems
Short title	
Complete Reference	
Semester	Every summer semester
Link	
Content	• Overvoltages in power systems: travelling waves, overvoltage protection • Breakdown-phenomena: statistics, breakdown in gases, solids and liquids • Insulation systems and dielectrics
Assessment	Oral exam
Language	English
Prerequisites	

Measurement Techniques and Distributed Intelligence for Power Systems

Kind of Lecture	Lecture/Exercise
Chair	Lehrstuhl für Automation of Complex Power Systems
Degree Programme	Master of Science (M.Sc.)
Responsible person	Prof. Dr. Ferdinanda Ponci Junqi Liu, M.Sc.
Title of module	Measurement Techniques and Distributed Intelligence for Power Systems
Short title	
Complete Reference	
Semester	Every summer semester
Link	http://www.eonerc.rwth-aachen.de
Content	This course introduces the fundamental elements and technologies in use for distribution automation, and it illustrates the ongoing evolution towards distributed solutions. The focus is on the measurement challenges with particular reference to distributed solutions. The related propagation of uncertainty will be discussed within the framework of the current international standard. Concepts such as Agent-based measurement and control will also be discussed.
Assessment	Oral exam
Language	English
Prerequisites	

Medizinische Akustik II

Kind of Lecture	Lecture, Exercise
Chair	Lehrstuhl und Institut für Technische Akustik
Degree Programme	Master of Science (M.Sc.)
Responsible person	Dr.-Ing. Janina Fels Dr.-Ing. Wolfgang-Helmut Döring
Title of module	Medizinische Akustik II
Short title	
Complete Reference	
Semester	Every summer semester
Link	http://www.akustik.rwth-aachen.de/
Content	
Assessment	Written exam
Language	German/English
Prerequisites	

Microwave Circuits

Kind of Lecture	Lecture
Chair	Lehrstuhl und Institut für Theoretische Elektrotechnik
Degree Programme	Master of Science (M.Sc.)
Responsible person	Univ.-Prof. Dr.-Ing. Christoph Jungemann Jesus Cumana, M.Sc. Jan Vrba, M.Sc.
Title of module	Microwave Circuits
Short title	
Complete Reference	
Semester	Every summer semester
Link	
Content	
Assessment	
Language	English
Prerequisites	

Mobile Radio Networks 1

Kind of Lecture	Lecture/Exercise
Chair	Lehrstuhl und Institut für Vernetzte Systeme
Degree Programme	Master of Science (M.Sc.)
Responsible person	Univ.-Prof. Petri Mähönen, Ph.D.
Title of module	Mobile Radio Networks 1
Short title	
Complete Reference	
Semester	Every summer semester
Link	http://www.inets.rwth-aachen.de/index.php?id=mrn10
Content	This one-semester lecture covers the basics of mobile (cellular) radio systems. It can be combined with the Mobile Radio Systems II course (for DPO students these are together V4Ü2 course). It includes a short introduction to basic aspects of wireless communications and starts with a short historical review. The main emphasis is on cellular telephony, and most specifically we are developing the understanding of GSM system and its components. The course includes topics on radio propagation, basics of cellular systems, simple capacity estimators for the cellular network, and all important system aspects. Thus, for example, different types of handovers, frame and channel structures, GPRS and security issues are discussed. Apart from GSM, the course addresses basics of different multiple access methods such as TDMA, FDMA and CDMA. Furthermore, 3G cellular architectures such as WCDMA/UMTS, and also basics of Wireless LANs (mostly IEEE 802.11) are described only briefly; the details of these more advanced topics are left to subsequent special course. The overall aim of the course is the knowledge of the principles of cellular networks, the basics of wireless communications at system and protocol level. The special emphasis is on the architecture and evolution towards B3G and 4G systems. Radio transceiver design and coding issues are not covered in detail in this course.
Assessment	
Language	English
Prerequisites	Although the course is titled Part 2 it is not required to have passed Part 1. It is beneficial but most of the lectures can be followed without. Special attention is given so that student from different backgrounds could follow lectures successfully. However, the student is expected to know the main principles of communication such as the OSI reference model and the basics of signal theory.

Concepts of Mobile Radio Systems

Kind of Lecture	Lecture, Exercise
Chair	Lehrstuhl und Institut für Nachrichtengeräte und Datenverarbeitung
Degree Programme	Bachelor of Science (B.Sc.)
Responsible person	Univ.-Prof. Dr.-Ing. Peter Vary Dipl.-Math. Annika Böttcher Dipl.-Ing. Thomas Schlien
Title of module	Mobilfunk Systemkonzepte
Short title	
Complete Reference	
Semester	Every summer semester
Link	http://www.ind.rwth-aachen.de/de/lehre/vorlesungen/mobilfunk-systemkonzepte/ http://www.ind.rwth-aachen.de/de/lehre/vorlesungen/advanced-coding-and-modulation/
Content	
Assessment	Written exam
Language	German with english script
Prerequisites	

Multimedia Communication Systems 1 & 2

Kind of Lecture	Lecture, Exercise
Chair	Lehrstuhl und Institut für Nachrichtentechnik
Degree Programme	Master of Science (M.Sc.)
Responsible person	Univ.-Prof. Dr.-Ing. Jens-Rainer Ohm
Title of module	Multimediakommunikation 2
Short title	
Complete Reference	
Semester	Every summer semester
Link	http://www.ient.rwth-aachen.de

Content	The lectures “Multimedia Communication Systems 1 and 2“ introduce fundamental concepts of quantization and coding, as well as multimedia signal processing used in the context of compression and content analysis of multimedia signals (image, video, audio). The first part of the lecture is devoted to the topics of compression and transmission, the second part deals with problems of feature-based identification and classification. Typical multimedia representation standards such as JPEG-x, MPEG-x, H.26x are presented as well.
	
	Multimedia Communication System 1 - "Multimedia Signal Processing"
	
	• Introduction
	  ○ Concepts and Terminology
	  ○ Signal Sources and Acquisition
	  ○ Sampling and Digital Representation of Multimedia Signals;
	• Perceptual Properties of Vision and Hearing
	  ○ Properties of Vision
	  ○ Properties of Hearing
	• Analysis and Modeling
	  ○ Fourier Spectra
	  ○ Correlation Analysis
	  ○ Autoregressive Models
	  ○ Markov Models
	• Quantization and Coding
	  ○ Statistical Foundations of Information Theory
	  ○ Scalar Quantization
	  ○ Coding Theory
	  ○ Rate-Distortion Optimization of Quantizers
	  ○ Entropy Coding
	  ○ Vector Quantization
	  ○ Sliding Block Coding
	• Still Image Coding
	  ○ Compression of Binary Images
	  ○ Vector Quantization of Images
	  ○ Predictive Coding
	  ○ Trans-form Coding
	  ○ Coding based on Similarity Properties
	  ○ Component based Coding
	• Video Coding
	  ○ Methods without Motion Compensation
	  ○ Hybrid Video Coding
	  ○ MC Prediction Coding using the Wavelet Transform
	  ○ Spatio-temporal Frequency Coding with MC
	  ○ Encoding of Motion Parameters
	  ○ Model based Video Coding

- Audio Coding
  - Coding of Speech Signals
  - Waveform Coding of Audio signals
  - Parametric Coding of Audio and Sound Signals
- Applications and Standards
  - Convergence of Digital Multimedia Services
  - Adaptation to Channel Characteristics
  - Digital Broadcast
  - Media Streaming
  - Interoperability and Compatibility
  - Definitions at Systems Level
  - Still Image Coding Standards: JBIG, JPEG
  - Video Coding Standards: H.26x, MPEG-x
  - Audio Coding Standards: Speech, Music and Sound
- Quality Measurement
  - Objective Signal Quality Measurements
  - Subjective Assessment

Multimedia Communication System 2 - "Multimedia Content Analysis"

- Pre- and Postprocessing
  - Nonlinear Filters
  - Signal Enhancement
  - Amplitude-Value transformations
  - Interpolation
- Features of Multimedia Signals
  - Color
  - Texture
  - Edge Analysis
  - Feature Point Detection
  - Contour and Shape Analysis
  - Correspondence Analysis
  - Motion Analysis
  - Disparity and Depth Analysis
  - Mosaics
  - Face Detection and Description
  - Audio Signal Features
- Feature Transforms and Classification
  - Feature Transforms
  - Feature Value Normalization and Weighting
  - Feature-based Comparison
  - Feature-based Classification
- Signal Decomposition
  - Segmentation of Image Signals
  - Segmentation of Video Signals
  - Segmentation and Decomposition of Audio Signals
- Signal Composition, Rendering and Presentation
  - Composition and Mixing of Visual Signals
  - Warping and Morphing
  - Viewpoint Adaptation
  - Frame Rate Conversion
  - Rendering of Image and Video Signals
  - Composition and Rendering of Audio Signals
- Applications and Standards
  - Content-based Media Access: Content Protection
  - Interaction with Content Multimedia Content Description Standard MPEG-7

	• Quality Measurements ○ Classification Quality; Quality of Signal Analysis and Decomposition
Assessment	Oral exam
Language	English
Prerequisites	Visit of the Lecture "High Voltage Engineering I" Profound mathematical knowledge as well as knowledge in systems theory and signal processing is required.

Natural Gas Systems

Kind of Lecture	Lecture, Exercise
Chair	Lehrstuhl und Institut für Elektrische Anlagen und Energiewirtschaft
Degree Programme	Master of Science (M.Sc.)
Responsible person	Dr.-Ing. Günter Wagner Univ.-Prof. Dr.-Ing. Albert Moser
Title of module	Systeme zur Erdgasversorgung
Short title	
Complete Reference	
Semester	Every summer semester
Link	http://www.iaew.rwth-aachen.de
Content	The lecture focuses on the transportation and distribution of natural gas with the following topics: • Natural Gas Business • Pipeline Networks • Pressure Regulation, Measurement and Compression • Systemplanning, Operation and Billing • Gas Management Systems • Market Liberalization The lecture includes an excursion to an compressor station in Stolberg.
Assessment	
Language	English
Prerequisites	

Power Economics in Liberalised Electricity Markets

Kind of Lecture	Lecture, Exercise
Chair	Lehrstuhl und Institut für Elektrische Anlagen und Energiewirtschaft
Degree Programme	Master of Science (M.Sc.)
Responsible person	Prof. Dr.-Ing. Jochen Kreusel Univ.-Prof. Dr.-Ing. Albert Moser
Title of module	Power Economics in Liberalised Electricity Markets
Short title	
Complete Reference	
Semester	Every summer semester
Link	http://www.iaew.rwth-aachen.de
Content	1. Preliminary discussion, introduction of the lecturer, organisation of the lecture, examination issues, overview of contents 2. Basics in Power Economics o Introduction of the cost structures in utilities o Cost Structure of Power Generation, Transmission, Distribution 3. The Liberalised Electricity Market o Motivation for Privatisation and Liberalisation o Overview of International Deregulation Status o Tasks Within the Different Market Roles o Market Communication 4. Pricing in Liberalised Markets o Tariffs for Commercial and Industrial Customers o Pricing in the Wholesale Market 5. Experiences with Liberalisation, Summary and Perspective
Assessment	Oral exam
Language	English
Prerequisites	

Power Electronics - Fundamentals, Topologies and Analysis

Kind of Lecture	Lecture/Exercise
Chair	Lehrstuhl und Institut für Stromrichtertechnik und Elektrische Antriebe
Degree Programme	Bachelor of Science (B.Sc.) / Master of Science (M.Sc.)
Responsible person	Univ.-Prof. Dr.ir. Dr.h.c. Rik W. De Doncker
Title of module	Power Electronics - Fundamentals, Topologies and Analysis
Short title	
Complete Reference	
Semester	Every summer semester
Link	http://www.isea.rwth-aachen.de
Content	Power electronics deals with control and efficient conversion of electric energy with power-electronic switches. Areas of application are e.g. automotive electric propulsion and power systems, distributed generation using wind turbines, solar converters or fuel cells, battery systems, industrial drives and induction heaters, as well as utility-scale power flow control and DC transmission systems. The course starts with an overview of power semiconductors and general definitions. A separate section is dedicated to harmonic distortion. The course first presents Then different modes of operation and topologies of line- and self-commutated converters are presented. Line-commutated converters, switching at the frequency of the connected single or three-phase system, are introduced discussing important applications such as two-way rectifiers and cyclo converters. Self-commutated converters such as dc-dc topologies and voltage or current source inverters are analyzed, and different modulation concepts for self-commutated converters are discussed. A manuscript is available. The lecture is held in English.
Assessment	Written exam
Language	English
Prerequisites	

Power System Under Fault Conditions

Kind of Lecture	Lecture, Exercise
Chair	Lehrstuhl und Institut für Elektrische Anlagen und Energiewirtschaft
Degree Programme	Master of Science (M.Sc.)
Responsible person	Univ.-Prof. Dr.-Ing. Albert Moser
Title of module	Power System Under Fault Conditions
Short title	
Complete Reference	
Semester	Every summer semester
Link	http://www.iaew.rwth-aachen.de
Content	
Assessment	Written exam
Language	English
Prerequisites	

Principles and Architectures of Cognitive Radios

Kind of Lecture	Lecture/Exercise
Chair	Lehrstuhl und Institut für Vernetzte Systeme
Degree Programme	Master of Science (M.Sc.)
Responsible person	Univ.-Prof. Petri Mähönen, Ph.D.
Title of module	Principles and Architectures of Cognitive Radios
Short title	
Complete Reference	
Semester	Every summer semester
Link	
Content	
Assessment	Oral exam
Language	English
Prerequisites	

Radio Frequency Circuits

Kind of Lecture	Lecture, Exercise
Chair	Lehrstuhl für Integrierte Analogschaltungen und Institut für Halbleitertechnik
Degree Programme	Master of Science (M.Sc.)
Responsible person	Univ.-Prof. Dr.-Ing. Stefan Heinen Dr.-Ing. Ralf Wunderlich
Title of module	Radio Frequency Circuits
Short title	
Complete Reference	
Semester	Every summer semester
Link	http://www.ias.rwth-aachen.de/
Content	
Assessment	Oral exam
Language	English
Prerequisites	

Repetitorium (f. Masterstudiengang Electrical Power Engineering)

Kind of Lecture	Review course
Chair	Lehrstuhl und Institut für Elektrische Anlagen und Energiewirtschaft
Degree Programme	Master of Science (M.Sc.)
Responsible person	Univ.-Prof. Dr.-Ing. Albert Moser
Title of module	Repetitorium (f. Masterstudiengang Electrical Power Engineering)
Short title	
Complete Reference	
Semester	Every summer semester
Link	http://www.iaew.rwth-aachen.de
Content	
Assessment	
Language	English
Prerequisites	

Signal Processing in Multi-Antenna (MIMO) Communication Systems

Kind of Lecture	Lecture, Exercise
Chair	Lehrstuhl für Integrierte Systeme der Signalverarbeitung
Degree Programme	Master of Science (M.Sc.)
Responsible person	Univ.-Prof. Dr.-Ing. Gerd Ascheid Dan Zhang, M.Sc.
Title of module	Signal Processing in Multi-Antenna (MIMO) Communication Systems
Short title	
Complete Reference	
Semester	Every summer semester
Link	http://www.ice.rwth-aachen.de/

Content	• Modelle für Fadingkanäle (Ein- und Mehrantennenfall)
	• Parameter von Fadingkanälen
	• Modulationsverfahren, OFDM
	• Konzepte für Mehr-Antennenübertragung
	  ○ Strahlformung (Beamforming)
	  ○ Räumliche Diversität
	  ○ Räumliche Mehrfachübertragung (Spatial multiplexing)
	  ○ Kanalschätzung
	• Wichtige Sätze der Matrixalgebra
	• Matrix-Modelle der Übertragung in Mehrantennen (MIMO) Systemen
	• Übertragungskapazitäten von MIMO Systemen, Diversität in MIMO Systemen
	• Optimale und suboptimale Datendetektion
	• Kanalschätzung
	• Iterative Empfänger

Assessment	
Language	English
Prerequisites	

System and Processor Architectures for Mobile Devices

Kind of Lecture	Lecture, Exercise
Chair	Lehrstuhl für Integrierte Systeme der Signalverarbeitung
Degree Programme	Master of Science (M.Sc.)
Responsible person	Prof. Dr.-Ing. Anupam Chattopadhyay Zheng Wang, M.Sc.
Title of module	System and Processor Architectures for Mobile Devices
Short title	
Complete Reference	
Semester	Every summer semester
Link	http://www.iss.rwth-aachen.de/ http://www.ice.rwth-aachen.de/
Content	Mobile devices have to be ultra-highly integrated for energy efficiency (long battery operating time) and scale reasons. Mobile devices offer more and more functionality. The lecture starts with an overview of the resulting processing requirements. Past and future enhancements of performance rely heavily on the advances of silicon technology. Thus, issues of upcoming technology generations have to be considered for future system architectures. Since flexibility and programmability are essential, processors are key elements of mobile devices. Processor architectures for high performance and high energy efficiency represent a major part of the lecture. Particular emphasis is on (reconfigurable) Application Specific Instruction Set Processors (ASIP) and their design methodology. Already today mobile devices incorporate multiple processors to meet the processing requirements. Future devices will have to make use of large numbers of processors on a single chip. System and communication architectures of such Multi-Processor System-on-Chip (MPSoC) devices will be studied and the issues of design and programming of MPSoCs will be discussed. Major topics include: • Processing requirements in mobile devices • Flexible radio concepts • Silicon technology issues • Fundamental processor architectures • Execution speed-up and parallelism in processors • Application Specific Instruction Set Processors (ASIPs) • Reconfigurable ASIPs (rASIP) • Multi-Processor Systems-on-Chip (MPSoC) architectures • MPSoC Design
Assessment	Oral exam
Language	English
Prerequisites	