OTTO VON GUERICKE UNIVERSITÄT MAGDEBURG

EIT

FAKULTÄT FÜR ELEKTROTECHNIK UND INFORMATIONSTECHNIK

Module descriptions

Master program

Electrical Engineering and Information Technology

January 13, 2016

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Technical compulsory modules

Enrolment: All modules

Non-technical compulsory modules

Enrolment: All modules

Technical elective modules

Enrolment: Choice of modules according to the regular curriculum.
Technical elective modules can be chosen from the list given in the catalogue of elective modules, whereby it is recommended to put a focus on one of the subject areas

Automation Systems

Information and Communication Technology

Microsystems

Power and Energy

General

Non-technical elective modules

Enrolment: Choice of modules according to the regular curriculum.
Modules from Master courses of OvGU can be selected- but without technical engineering modules.
Explicitly allowed are also foreign languages, such as German for foreign students.

Master thesis

Technical compulsory modules

Enrolment: All modules

Module	**Electromagnetic Field Theory**
Objectives and contents	**Objectives:** The student will ▪ know mathematical basics (vector analysis, operators and integral theorems) ▪ know and understand fundamental laws of electromagnetics, constituting the system of Maxwell's field equations and the boundary conditions for the different fields ▪ learn how to solve basic problems for static and dynamic fields **Contents:** 1. Mathematical fundamentals 2. Static electric fields 3. Stationary currents and the static magnetic field 4. Time-varying electromagnetic
Teaching	Lectures and exercises
Literature	J.A. Edminster, Schaum's Outline of Electromagnetics - (Schaum's Outline Series), McGraw-Hill Book Company
Prerequisites	Bachelor in Electrical Engineering or related studies
Usability of the module	Compulsory module for the Master Course “Electrical Engineering and Information Technology”
Exam	Written test at the and of the course
Credit points	5 Credit Points = 150 h (42 h time of attendance + 108 h autonomous work)
Work load	Time of attendance: 2 hours/week – lecture, 1 hours/week - exercises Autonomous work: Post processing of lectures, preparation of exercises, preparation of exam
Availability	Every winter semester
Duration	One semester
Responsibility	Prof. Dr.-Ing. Marco Leone (FEIT-IMT)

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Module	**Electronic Circuits**
Objectives and contents	**Objectives:** The student will ▪ understand the main function principles on the interface between analog and digital circuit design ▪ have an overview about the realization of some complex function blocks **Contents:** ▪ digital analog converters: methods, characteristics, errors, applications ▪ analog digital converters: classification, methods, characteristics, errors, applications ▪ phase locked loops: principle, linear model, circuit design of the function blocks, applications ▪ programmable logic devices: overview, characteristics, circuit design of some function blocks, design process, introduction VHDL ▪ design and test of digital circuits with programmable logic devices
Teaching	Lectures, exercises and laboratory
Literature	U. Tietze, C. Schenk, D. Gamm: Electronic Circuits: Handbook for Design and Applications. Springer R. Best: Phase-Locked Loops: Design, Simulation and Applications. McGraw-Hill
Prerequisites	Bachelor in Electrical Engineering or related studies
Usability of the module	Optional module in the Master Course "Electrical Engineering and Information Technology"
Exam	Oral test at the end of the course
Credit points	5 Credit points = 150 h (42 h time of attendance and 108 h autonomous work)
Work load	Time of attendance ▪ 2 hours/week - lecture ▪ 1 hours/week – exercises/laboratory Autonomous work ▪ post processing of lectures and laboratory work, preparation of exercises, laboratory work, research report and exam
Availability	Every winter semester
Duration	One semester
Responsibility	Prof. Dr. rer. nat. Georg Rose (FEIT-IIKT)

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Module	**Digital Communication Systems**
Objectives and contents	**Objectives:** The student will ▪ Gain knowledge about the functions and properties of digital communication systems ▪ Understand the physical principles underlying digital communication ▪ Gain knowledge about the modern wired and wireless digital communication standards **Contents:** ▪ Introduction ▪ Signal representation ▪ Stochastic processes and noise ▪ Sampling, quantization, and coding ▪ Transmission bandwidth, data rate, and channel capacity ▪ Calculation of error rates ▪ PCM, ASK, PSK, and FSK modulation techniques ▪ OFDM and CDMA ▪ Modeling of wireless channels
Teaching	Lectures and exercises
Literature	Jerry D. Gibson: Principles of Digital and Analog Communications. Macmillian Publishing Company, 1989, ISBN 0-02-341780-3
Prerequisites	Bachelor in Electrical Engineering or related studies
Usability of the module	Mandatory module for the Master "Electrical Engineering and Information Technology"
Exam	Written exam K120 at the end of the course
Credit points	5 Credit points = 150 h (42 h time of attendance and 108 h autonomous work)
Work load	Time of attendance ▪ 2 hours/week - lecture ▪ 1 hours/week – exercises Autonomous work ▪ post processing of lectures, preparation of exercises, research report and exam
Availability	Every summer semester
Duration	One semester
Responsibility	Prof. Dr.-Ing. Abbas Omar (FEIT-IIKT)

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Module	**Digital Information Processing**
Objectives and contents	**Objectives:** ▪ The participant has an overview of basic problems and methods of digital signal processing. ▪ The participant understands the functionality of a digital signal processing system and can mathematically explain the modus of operation. ▪ The participant can assess applications in terms of stability and other markers. He / She can calculate the frequency response and reconstruction of analogue signals. ▪ The participant can perform these calculations and assessments as well on stochastically excited digital systems. ▪ The participant can apply this knowledge in a field of specialization, e.g. Medical Signal Analysis **Contents:** 1. Digital Signals and Digital LTI Systems 2. Z-Transform and Difference Equations 3. Sampling and Reconstruction 4. Synthesis and analysis of such systems 5. Discrete and Fast Fourier Transformations 6. Processing of Stochastic Signals by LTI-Systems: Correlation Techniques and Model-Based Systems (ARMA) 7. Selected Specialization Topics, e.g. Medical Signal Analysis
Teaching	Lecture and exercises
Literature	Oppenheim, A; Schafer R (1975): “Digital Signal Processing” 784 pages, Prentice Hall, ISBN: 0132146355
Prerequisites	Bachelor in Electrical Engineering or related studies Knowledge of signals and systems, Analog Fourier transformations
Usability of the module	Master Courses in the Faculty of Electrical Engineering and Information Technology, and other Master Courses
Exam	Mandatory participation in exercise classes, successful results in exercises / written exam at the and of the course
Credit points	5 Credit points = 150 h (42 h time of attendance and 108 h autonomous work)
Work load	Time of attendance ▪ 2 hours/week - lecture ▪ 1 hours/week - exercises Autonomous work ▪ postprocessing of lectures, preparation of exercises and exam
Availability	Winter Semester, every year
Duration	One semester
Responsibility	Prof. Dr. rer. nat. Andreas Wendemuth (FEIT-IESK)

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Module	**Power Electronics**
Objectives and contents	**Objectives:** Knowledge about important power electronic circuits shall be imparted. Major methods to understand power electronic circuits are practised. Applications will be demonstrated in the exercise. Cross-links to related fields of electrical and information engineering will be shown. **Contents:** ▪ choppers ▫ buck chopper ▫ boost chopper ▫ phase leg ▪ self commutated bridges with constant voltage DC link ▫ H-bridge ▫ three phase bridge ▪ rectifiers ▫ single and three phase ▫ uncontrolled, half controlled, controlled ▪ AC controllers
Teaching	Lecture, excercise
Literature	Ned Mohan: Power electronics - converters, applications and design; Wiley, Hoboken NJ, 3rd edition 2003
Prerequisites	Bachelor in Electrical Engineering or related studies, comprising, fundamentals of electrical engineering, electronics – circuit theory, fundamentals of semiconductor components, mathematics
Usability of the module	Compulsory module for the Master Course “Electrical Engineering and Information Technology” belonging to the field of electrical energy systems
Exam	Written examination without auxiliaries at the and of the course
Credit points	5 Credit points = 150 h (42 h time of attendance and 108 h autonomous studies)
Work load	Time of attendance ▪ 2 hours/week – lecture ▪ 1 hour/week – exercises Autonomous work ▪ postprocessing of lectures ▪ preparation of exercises and exam
Availability	Winter semester
Duration	One semester
Responsibility	Prof. Dr.-Ing. Andreas Lindemann (FEIT-IESY)

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Module	**Power Network Planning and Operation**
Objectives and contents	**Objectives:** The student will learn about steady-state and quasi-stationary algorithms to model and calculate grid states for the purpose of power system planning and operation. This includes the modelling of topology and equipment in natural and modal components, power flow calculation, state estimation, stability and short-circuit calculations as well as modelling of shunt and series faults. **Contents:** ▪ Introduction to the tasks of network planning and system operation ▪ Equation systems to describe steady-state and quasi-steady-state problems in electric power networks ▪ Grid modeling using modal component systems ▪ Basic algorithms of power flow, short-circuit and stability calculations as well as state estimation ▪ Introduction to power grid modelling with MATLAB
Teaching	Lecture and exercises
Literature	Electric Power System Planning“, H. Seifi, M.S. Sepasian, Springer-Verlag, 2011 „Power system engineering : planning, design, and operation of power systems and equipment”, Juergen Schlabbach. - Weinheim : WILEY-VCH, 2008
Prerequisites	Bachelor in Electrical Engineering or related studies
Usability of the module	Compulsory module for the Master Course “Electrical Engineering and Information Technology”
Exam	Written test at the end of the course
Credit points	5 Credit points = 150 h (42 h time of attendance and 108 h autonomous work)
Work load	Time of attendance ▪ 2 hours/week - lecture ▪ 1 hours/week - exercises Autonomous work ▪ Post processing of lectures preparation of exercises and exam
Availability	Every winter semester
Duration	One semester
Responsibility	Prof. Dr.-Ing. habil. Martin Wolter (FEIT-IESY)

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Module	**Systems and Control**
Objectives and contents	**Objectives:** The student will learn how to ▪ mathematically describe and analyse dynamic systems ▪ design feedback control systems using frequency and time domain techniques ▪ efficiently apply modern software tools to achieve the aforementioned goals **Contents:** ▪ Introduction to control systems ▪ Mathematical models of systems ▪ Feedback control systems characteristics ▪ The performance of feedback control systems ▪ The stability of linear feedback systems ▪ The root locus method ▪ Frequency response method ▪ The design of state variable feedback systems (Full-state feedback design and observer design methods)
Teaching	Lecture and exercises
Literature	R. C. Dorf, R. H. Bishop: Modern Control Systems, Pearson Education, 2005
Prerequisites	Bachelor in Electrical Engineering or related studies
Usability of the module	Compulsory module for the Master's course "Electrical Engineering and Information Technology", optional module for students of the "International Max-Planck Research School" and the Master's course "Chemical Process Engineering"
Exam	Written test at the and of the course
Credit points	5 Credit points = 150 h (42 h time of attendance and 108 h autonomous work)
Work load	Time of attendance ▪ 2 hours/week - lecture ▪ 1 hours/week - exercises Autonomous work ▪ post-processing of lectures, preparation of exercises and exam
Availability	Every winter semester
Duration	One semester
Responsibility	Prof. Dr.-Ing. habil. Achim Kienle (FEIT-IFAT)

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Non-technical compulsory modules

Enrolment: All modules

Name of module	**Project**
Objectives and contents	**Objectives:** ▪ The student knows the typical processes and techniques of scientific work. After passing the module, the student is able to analyze the current state of science and technology and to develop own scientific project ideas. The student can perform a market analysis, develop project specifications and write a scientific project report. ▪ The student knows the basic rules of scientific writing. After completing the module, the student is able to structure a report or thesis, to create significant plots and figures, and to cite all used sources. The student is very well aware of the problem of plagiarism. The student is also able to defend his project results in an oral presentation. **Contents:** **Part 1 (Non-technical Project Seminar)** The seminar consists of four lectures with the topics ▪ Literature survey and reference management, ▪ Rules of scientific writing, ▪ Visualization, schematics and diagrams, ▪ Effective oral presentations, writing a short paper (1 page) and giving a short presentation (5 minutes) about a given topic. **Part 2 (Non-technical Project Work)** ▪ application of the obtained skills on a specific topic under supervision of the project supervisor **Schedule** **Lecture week** – **Event** 1 to 4 – Lectures of part 1 5 – Short paper submission/review of part 1 6 – Short presentations of part 1, issue of the certificates of attendance of part 1 7 to 14 – Part 2
Teaching	Research project
Prerequisites	Part 2 of the module can only be attended if the part 1 was successfully passed
Usability of the module	Master EEIT
Exam	Research project (PRO)
Credit points	5 Credit Points = 150 h
Work load	The first part of the module is accounted with 12 hours of attendance and 8 hours of autonomous work. The remaining time for the second part of the module is then 30 hours of attendance and 100 hours of autonomous work.
Availability	Every summer semester
Duration	One semester
Responsibility	Dr. Magdowski in conjunction with work supervisor

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Technical elective modules

Enrolment: Choice of modules according to the regular curriculum.
Technical elective modules can be chosen from the list given in the catalogue of elective modules, whereby it is recommended to put a focus on one of the subject areas

Automation Systems

Module	**Distributed Control Systems**
Objectives and contents	**Objectives:** ▪ Architecture of distributed control systems ▪ Function chain of field devices ▪ Programmable Logic Controller ▪ Supervisory systems ▪ Industrial communication system ▪ Engineering **Contents:** The lectures and exercises provide students with basic knowledge about instrumentation of automation systems. The instrumentation executes the algorithms of the application design. The devices are connected via digital industrial communication systems therefore they perform together a distributed control system. The students get theoretical and practical skills in installation and commissioning of distributed control systems.
Teaching	Lectures (2) + Exercises (1) + Lab Courses (1)
Literature	Richard Zurawski (ed): The industrial information technology. Handbook. CRC Press 2005. ISBN 0-8493-1985-4
Prerequisites	Bachelor in Electrical Engineering or related studies
Usability of the module	Optional module for the Master Course “Electrical Engineering and Information Technology”
Exam	Written test at the end of the module
Credit points	5 Credit Points = 150 h (56 h time of attendance + 94 h autonomous work)
Work load	Time of attendance ▪ 2 hours/week – lecture ▪ 1 hours/week – exercises ▪ 1 hours/week – lab courses Autonomous work ▪ Post processing of lectures, preparation of exercises, preparation of presentation, preparation of exam
Availability	Every summer semester
Duration	One semesters
Responsibility	Prof. Dr.-Ing. Christian Diedrich (FEIT-IFAT)

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Module	**Automotion Lab**
Objectives and contents	**Objectives:** To develop practical skills in the field of (process) automation. **Contents:** The acquired knowledge from the courses “Systems and Control” and “Distributed Control Systems” should be applied to practical examples/systems of automation. For these purposes miscellaneous experiments will be conducted.
Teaching	Laboratory
Literature	According to modules "Systems and Control” and “Distributed Control Systems
Prerequisites	Bachelor in Electrical Engineering or related studies, Systems and Control, Distributed Control Systems
Usability of the module	Optional module for the Master Course “Electrical Engineering and Information Technology”
Exam	Oral test after every experiment
Credit points	5 Credit points = 150 h (28 h time of attendance and 122 h autonomous work)
Work load	Time of attendance ▪ 2 hours/week - laboratory Autonomous work ▪ post processing and preparation of laboratory
Availability	Every winter semester
Duration	One semester
Responsibility	Prof. Dr.-Ing. habil. Achim Kienle (FEIT-IFAT)

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Module	**Non-linear Control**
Objectives and contents	**Objectives:** The students will be able to describe and model nonlinear systems, to analyze the system dynamic behaviour such as stability considering different stability concepts, and to design controllers for nonlinear systems. **Contents:** ▪ Review of mathematical basics ▪ Review of linear MIMO systems ▪ Lyapunov stability ▪ Concepts of BIBO stability ▪ Passivity ▪ I/O linerarization ▪ Design of controllers for nonlinear systems
Teaching	Lecture and exercises/tutorials
Literature	D.E. Kirk. Optimal Control Theory – An Introduction. Prentice-Hall Inc., Englewood Cliffs, New Jersey, 2004 D.P. Bertsekas. Dynamic Programming and Optimal Control, volume 1. Athena Scientific Press, Belmont, MA, 2006 R. Bellman. Dynamic Programming. Princeton University Press, Princeton, New Jersey, 1957
Prerequisites	Knowledge in control theory
Usability of the module	Optional module for the Master Courses "Systemtechnik und Technische Kybernetik" Optional module for the Master Course "Electrical Engineering and Information Technology"
Exam	Oral test at the end of the course and project report
Credit points	5 Credit points = 150 h (42 h time of attendance and 108 h autonomous work)
Work load	Time of attendance ▪ 2 hours/week – lecture ▪ 1 hour/week – exercise/tutorial Autonomous work ▪ Post-processing of lectures, preparation of project work/report and exam
Availability	Every summer semester
Duration	One semester
Responsibility	Prof. Dr.-Ing. Rolf Findeisen (FEIT-IFAT)

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Module	**Process Control**
Objectives and contents	**Objectives:** Students should ▪ learn fundamentals of multivariable process control with special emphasis on decentralized control ▪ gain the ability to apply the above mentioned methods for the control of single and multi unit processes ▪ gain the ability to apply advanced software (MATLAB) for computer aided control system design **Contents:** 1. Introduction 2. Process control fundamentals ▫ Mathematical models of processes ▫ Control structures ▫ Decentralized control and Relative gain analysis ▫ Tuning of decentralized controllers ▫ Control implementation issues 3. Case studies 4. Plantwide control
Teaching	Lecture and exercises/tutorials
Literature	B. W. Bequette: Process Control, Modeling Design and Simulation, Pearson Education, 2003
Prerequisites	Basic knowledge in control theory
Usability of the module	Compulsory module for the Master Course "Elektrotechnik und Informationstechnik" Option "Automatisierungstechnik" Optional module for the Master Courses "Systemtechnik und Technische Kybernetik" and "Chemical Process Engineering", for students of the International Max-Planck Research School Optional module for the Master Course "Electrical Engineering and Information Technology"
Exam	Oral test at the end of the course and project report
Credit points	5 Credit points = 150 h (42 h time of attendance and 108 h autonomous work)
Work load	Time of attendance ▪ 2 hours/week – lecture ▪ 1 hour/week – exercise/tutorial Autonomous work ▪ Post-processing of lectures, preparation of project work/report and exam
Availability	Every summer semester
Duration	One semester
Responsibility	Prof. Dr.-Ing. habil. Achim Kienle (FEIT-IFAT)

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Module	**Structure and Behaviour Modelling - UML**
Objectives and contents	**Objectives:** ▪ Basements of object oriented modelling of technical and medicine systems ▪ Main focus on modelling of structure and behaviour aspects ▪ Description method using UML ▪ Practical use of the UML tool Rhapsody **Contents:** The module teaches object-oriented system analyses and modelling approach applying mechatronic, embedded and medicine systems. This includes the principles of structural and behavioural analyses and syntheses processes. Systematic specification and development processes are presented using the UML languages for the mechatronic components and medicine systems. The basis of UML languages as well as the relations between language elements (e.g. class diagram, sequence diagram and state machine) is explained. The lecture and exercises are based on the UML tool Rhapsody of IBM.
Teaching	Lectures (2) + Exercises (1)
Literature	Booch/ Rumbaugh/ Jacobson: Das UML- Benutzerhandbuch, Addison Wesley, 2006 Harald Störrle: UML2 für Studenten, Pearson Studium, 2005
Prerequisites	Bachelor in Electrical Engineering or related studies
Usability of the module	Optional module for the Master Course "Electrical Engineering and Information Technology"
Exam	Oral test at the end of the module
Credit points	5 Credit Points = 150 h (42 h time of attendance + 108 h autonomous work)
Work load	Time of attendance ▪ 2 hours/week - lecture ▪ 1 hours/week - exercises Autonomous work ▪ Post processing of lectures, preparation of exercises, preparation of presentation, preparation of exam
Availability	Every winter semester
Duration	One semesters
Responsibility	Prof. Dr.-Ing. Christian Diedrich (FEIT-IFAT)

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Information and Communication Technology

Module	**Introduction to RF Communication Systems**
Objectives and contents	**Objectives:** The student will ▪ Understand the differences between low-frequency and radio-frequency networks ▪ Gain knowledge about radio-frequency communication systems ▪ Be capable of analyzing and designing selected components of radio-frequency communication systems **Contents:** ▪ Introduction ▪ Transmission lines ▪ Scattering parameters ▪ Matching networks and filters ▪ Attenuators, phase shifters, directional couplers, and circulators ▪ Microwave amplifiers and oscillators
Teaching	Lectures and exercises
Literature	R.E. Collin, "Foundations for Microwave Engineering", McGraw-Hill, 1966
Prerequisites	Bachelor in Electrical Engineering or related studies
Usability of the module	Master Courses in the Faculty of Electrical Engineering and Information Technology, and other Master Courses
Exam	Written exam K90 at the end of the course
Credit points	5 Credit points = 150 h (42 h time of attendance and 108 h autonomous work)
Work load	Time of attendance ▪ 2 hours/week - lecture ▪ 1 hours/week – exercises Autonomous work ▪ post processing of lectures, preparation of exercises, research report and exam
Availability	Every summer semester
Duration	One semester
Responsibility	Prof. Dr.-Ing. Abbas Omar (FEIT-IIKT)

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Module	**Image Coding**
Objectives and contents	**Objectives:** Learn about methods and techniques of image coding as essential part of image communication. Problems of image acquisition are treated as far as they are relevant for image coding. **Contents:** ▪ Fundamentals ▪ Basics of human perception ▪ TV systems ▪ Basics of information ▪ Quantisation ▪ Lossless Coding ▪ Lossy Coding ▪ DPCM ▪ Interframe Prediction ▪ Transform Coding ▪ Content based and semantic Coding ▪ Standards and applications
Teaching	Lectures and exercises
Literature	John W. Woods: Multidimensional signal, image, and video processing and coding, Academic Press, 2012,
Prerequisites	Bachelor in Electrical Engineering or related studies
Usability of the module	Optional module for the Master Course “Electrical Engineering and Information Technology”
Exam	Oral test at the end of the module
Credit points	5 Credit Points = 150 h (42 h time of attendance + 108 h autonomous work)
Work load	Time of attendance ▪ 1 x 2 hours/week - lecture ▪ 1 x 1 hours/week - exercises Autonomous work ▪ Post processing of lectures, preparation of exercises, preparation of presentation, preparation of exam
Availability	Every winter semester
Duration	One semester
Responsibility	Dr.-Ing. Gerald Krell (FEIT-IESK)

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Module name	**Medical Imaging - CT**
Objective and content	**Objectives:** The student will: ▪ understand the system theory of imaging systems ▪ learn the functional principle of the computed tomography ▪ understand the mathematical principle of tomographic reconstruction ▪ have an overview about the current research work in the area of tomographic imaging **Content:** Starting with the system theory of imaging systems, the first part of the module is focused on the physical properties of x-rays and it's interaction with manner. The second part deals with X-ray based standard radiography. The third and final part brings the mathematical methods of tomographic image reconstruction into focus. The particular content is: ▪ System theory of imaging systems ▪ Basic principle of underlying physics ▪ X-ray tubes and detectors ▪ Radiography ▪ Reconstruction: Fourier-based principle, Filtered back projection, Algebraic approach, statistical methods ▪ Beam-geometry: Parallel-, Fan- and Conebeam ▪ Implementation ▪ Artefacts and Adjustment
Teaching	Lecture and tutorial
Literature	Provided by e-learning system
Prerequisites	Digital Signal Processing, Fundamental Physics
Applicability of the module	Master Courses in the Faculty of Electrical Engineering and Information Technology, and other Master Courses
Certificates and examination	Oral test
Credit points	5 Credit Points = 150 h (42 h time of attendance + 108 h autonomous work)
Work load	Time of attendance: ▪ 2 hours/week – lecture ▪ 1 hour/week – tutorial Autonomous work: ▪ Rework of lectures and tutorial, preparation of excersices
Frequency	Every summer semester
Duration	One semester
Responsible person	Prof. Dr. rer. nat. Georg Rose (FEIT-IIKT)

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Module	**Speech Recognition**
Objectives and contents	**Objectives:** ▪ The participant understands basic problems and methods of automatic speech recognition with Hidden Markov Models. ▪ The participant understands the functionality of the relevant computer modules in speech recognition and can mathematically explain the modus of operation. ▪ The participant knows specific requirements for speech recognition. These can include reliability, availability, speaker verification. ▪ The participant knows specific requirements and differences in command, dictation and dialogue mode, particularly in the field of applications (e.g. medical) and support systems. **Contents:** 1. Production and Reception of Natural Speech 2. Feature Extraction 3. Classification Techniques 4. Hidden Markov Models (DTW, Viterbi, Baum-Welch) 5. Language Models 6. Aspects of robust Speech Recognition: adaptivity, reliability, availabilty, speaker verification. 7. Practical Speech Recognition Systems Design
Teaching	Lecture, exercises, lab course
Literature	Rabiner, L & Juang, B (1993): „Fundamentals of Speech Recognition“, 507 pages, Prentice Hall, ISBN: 0-13-015157-2
Prerequisites	Bachelor in Electrical Engineering or related studies Knowledge of digital signal processing
Usability of the module	Optional module for the Master Course “Electrical Engineering and Information Technology”
Exam	Mandatory participation in exercise classes, successful results in exercises / written exam at the and of the course
Credit points	5 Credit points = 150 h (56 h time of attendance and 94 h autonomous work)
Work load	Time of attendance ▪ 2 hours/week – lecture ▪ 1 hours/week – exercises ▪ 1 hours/week – lab courses Autonomous work ▪ postprocessing of lectures preparation of exercises and exam
Availability	Once a year, Summer Semester
Duration	One term
Responsibility	Prof. Dr. rer. nat. Andreas Wendemuth (FEIT-IESK)

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Module	**FPGA and Microcontroller Programming**
Objectives and contents	**Objectives:** The student will ▪ have an overview about the design process of FPGAs and Microcontrollers **Contents:** ▪ Programmable logic devices: overview, circuit design of special function blocks, introduction in the hardware description languages and their realization ▪ Microcontroller: overview, description of special function blocks from the view of circuit design, realization of projects in assembly language and C ▪ simulation and methods of debugging
Teaching	Laboratory
Literature	Documentation available: www.xilinx.com
Prerequisites	Bachelor in Electrical Engineering or related studies, Electronic Circuits
Usability of the module	Optional module in the Master Course "Electrical Engineering and Information Technology"
Exam	Oral test at the end of the course
Credit points	5 Credit points = 150 h (70 h time of attendance and 80 h autonomous work)
Work load	Time of attendance ▪ 5 hours/2 weeks - laboratory Autonomous work ▪ post processing, preparation of laboratory work, research report and exam
Availability	Start every summer semester
Duration	Two semesters
Responsibility	Dr.-Ing. Thomas Schindler (FEIT-IIKT)

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Module	**Theoretical Neuroscience II**
Objectives and contents	**Objektives:** Based on Chapters 7-10 of Dayan & Abbott. Rate models of network dynamics, synaptic plasticity, reinforcement learning, and generative models. Linear models of neural networks, dynamic analysis of state-space, eigenvalue analysis of steady-states, models of activity-dependent plasticity, associative learning with neural networks, modern theories of reinforcement learning (Rescorla-Wagner, temporal-difference, actor-critic models), and abstract approaches to representational learning and generative models (expectation maximization, principal components, independent components). To develop a deeper understanding and to acquire applied and practical skills, students perform weekly homework assignments with Matlab programming. A passing grade on all assignments is required for admission to the final exam. The tutorial is open to all students and provides an opportunity for more extensive questions and discussions of the lecture material. It is particularly recommended for students with a weaker background in mathematics and physics.
Teaching	Lectures and exercieses
Literature	Dayan and Abbott (2001) Theoretical Neuroscience, MIT Press
Prerequisites	Required: basic knowledge in Calculus und Linear Algebra. Useful: basic knowledge in programming
Usability of the module	Master Courses in the Faculty of Electrical Engineering and Information Technology, and other Master Courses
Exam	Oral test
Credit points	5 Credit Points = 150 h (70 h time of attendance + 80 h autonomous work)
Work load	Time of attendance: 3 hours/week - lecture, 2 hours/week - exercises autonomous work: reworking of the lectures, the solution of exercises, exam preparation, project work
Availability	Every summer semester
Duration	One semester
Responsibility	Prof. Dr. Jochen Braun (FNW-IBIO)

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Module	**Mobile and Satellite Communication Systems**
Objectives and contents	**Objectives:** The student will ▪ Gain knowledge about wireless communication systems ▪ Gain overview on the attributes of mobile communication systems ▪ Understand the special problems of satellite communication **Contents:** ▪ Introduction ▪ General properties of wireless communication ▪ Mobile communication systems ▪ Satellite communication systems ▪ Special problems encountered in satellite communication
Teaching	Lectures and exercises
Literature	J. D. Gibson,"Principles of Digital and Analog Communications", Macmillan, 1989
Prerequisites	Bachelor in Electrical Engineering or related studies
Usability of the module	Elective module for the Master major "Electrical Engineering and Information Technology"
Exam	Oral test at the end of the course
Credit points	5 Credit points = 150 h (42 h time of attendance and 108 h autonomous work)
Work load	Time of attendance ▪ 2 hours/week - lecture ▪ 1 hours/week – exercises Autonomous work ▪ post processing of lectures, preparation of exercises, research report and exam
Availability	Every winter semester
Duration	One semester
Responsibility	Prof. Dr.-Ing. Abbas Omar (FEIT-IIKT)

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Module	**Advanced Antenna Theory**
Objectives and contents	**Objectives:** The student will ▪ Gain knowledge about antenna characteristics ▪ Gain knowledge about antenna-system design methods ▪ Understand the fundamentals of phased arrays and beam forming ▪ Gain knowledge about space-domain multiplexing **Contents:** ▪ Introduction ▪ Linear antennas ▪ Antenna arrays ▪ Beam forming ▪ Buttler matrix and Rotmann lens
Teaching	Lectures and exercises
Literature	R.F. Harrington,"Time-Harmonic Electromagnetic Fields", McGraw-Hill, 1961
Prerequisites	Bachelor in Electrical Engineering or related studies
Usability of the module	Elective module for the Master major “Electrical Engineering and Information Technology”
Exam	Oral test at the end of the course
Credit points	5 Credit points = 150 h (42 h time of attendance and 108 h autonomous work)
Work load	Time of attendance ▪ 2 hours/week - lecture ▪ 1 hours/week – exercises Autonomous work ▪ post processing of lectures, preparation of exercises, research report and exam
Availability	Every winter semester
Duration	One semester
Responsibility	Prof. Dr.-Ing. Abbas Omar (FEIT-IIKT)

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Module	**Digital Information Processing Laboratory**
Objectives and contents	**Objectives:** ▪ The participant has an overview of basic methods of applied digital signal processing. ▪ The participant can transform physiological knowledge into technical digital signal processing methods. ▪ Selected Feature Space transformations and their applications are known. ▪ Gaussian Production System Architectures are being estimated under Maximum-Likelihood Assumptions **Contents:** 1. Digital Signals and Digital LTI Systems 2. Synthesis and analysis of such systems 3. Discrete and Fast Fourier Transformations 4. Selected Feature Space transformations 5. Gaussian Production System Architectures 6. Characteristics of Human Speech
Teaching	Seminar, Laboratory Course
Literature	Oppenheim, A; Schafer R (1975): "Digital Signal Processing" 784 pages, Prentice Hall, ISBN: 0132146355
Prerequisites	Credits obtained in the Course „Digital Signal Processing“ (Wendemuth)
Usability of the module	Master Courses in the Faculty of Electrical Engineering and Information Technology, and other Master Courses
Exam	Successful laboratory attendance (Praktikumsschein), and oral exam at the end of the course
Credit points	5 Credit points = 150 h (42 h time of attendance and 108 h autonomous work)
Work load	Time of attendance ▪ 3 hours/week – seminar + lab course Autonomous work ▪ Pre- and postprocessing of course; preparation of exam
Availability	Summer Semester, every year
Duration	One semester
Responsibility	Prof. Dr. rer. nat. Andreas Wendemuth (FEIT-IESK)

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Microsystems

Module	**CMOS Si Process**
Objectives and contents	**Objectives:** The student will ▪ learn how to carry out silicon based process sequences, ▪ obtain basic knowledge of fabrication processes for digital complementary MOS integrated circuits on silicon. **Contents:** 1. Front-end of line processes ▫ LOCOS ▫ n- and p-well ▫ drain/source-doping ▫ gate stack ▫ BPSG passivation 2. Back-end of line processes ▫ contact holes ▫ diffusion barriers ▫ metallization ▫ intermetal dielectric ▫ passivation
Teaching	Lectures and exercises
Literature	To be announced in the lecture
Prerequisites	Bachelor in Electrical Engineering or related studies
Usability of the module	Optional module for the Master Course “Electrical Engineering and Information Technology”
Exam	Written examination at the end of the module
Credit points	5 Credit Points = 150 h (42 h time of attendance + 108 h autonomous work)
Work load	Time of attendance ▪ 2 hours/week - lecture ▪ 1 hour/week - exercises Autonomous work ▪ Post processing of lectures, preparation of exercises, preparation of exam
Availability	Every winter semester
Duration	One semester
Responsibility	Prof. Dr.-Ing. Edmund P. Burte (FEIT-IMOS)

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Module	**Sensors**
Objectives and contents	**Objectives:** The students gain knowledge in fundamentals and applications of sensors and sensor systems. After finishing the module they will understand modern sensor principles and sensor technologies and will be able applying sensors and sensor systems. They will further achieve basic knowledge in the design of sensors and sensor systems. By means of exercises they learn to deepen their knowledge for further research and to apply it to solve complex problems. **Contents:** 1. Fundamentals and principles of sensors 2. Physical sensors, incl. mechanical sensors, magnetic sensors, thermal sensors 3. Chemical/biochemical sensors 4. Resonant sensors 5. Selected application examples
Teaching	Lectures and exercises
Literature	Fraden, J., Handbook of Modern Sensors, AIP Press 2004.
Prerequisites	Bachelor in Electrical Engineering or related studies
Usability of the module	Optional module for the Master “Electrical Engineering and Information Technology”
Exam	Oral test
Credit points	5 Credit Points = 150 h (42 h time of attendance + 108 h autonomous work)
Work load	Time of attendance: 2 hours/week – lecture, 1 hour /week exercise Autonomous work: Post processing of lectures, preparation of exercises, preparation of presentation, preparation of exam
Availability	Every summer semester
Duration	One semester
Responsibility	apl. Prof. Dr. rer. nat. habil. Ralf Lucklum (FEIT-IMOS)

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Module	**Microsystems**
Objectives and contents	**Objectives:** The students gain knowledge in fundamentals of microsystems and microfabricated devices. After finishing the module they will understand the function of microsystems and are able to apply this knowledge in different applications. They will further achieve basic knowledge in the design of microsensors, microactuators and complete microsystems and how to handle different packaging and manufacturing technologies. By means of exercises they learn to deepen their knowledge for further research and to apply it to solve complex problems. **Contents:** ▪ Microsystems materials ▪ Microsystems technologies ▪ Design of microsystems ▪ Microsystems packaging ▪ Applications and of microsystems ▪ Future trends
Teaching	Lectures and exercises
Literature	Fundamentals of microfabrication : the science of miniaturization; Marc J. Madou. - 2. ed. - Boca Raton: CRC Press, 2002, ISBN: 0-8493-0826-7
Prerequisites	Bachelor in Electrical Engineering or related studies
Usability of the module	Optional module for the Master Course “Electrical Engineering and Information Technology”
Exam	Oral test
Credit points	5 Credit Points = 150 h (42 h time of attendance + 108 h autonomous work)
Work load	Time of attendance: 2 hours/week – lecture, 1 hour /week exercise Autonomous work: Post processing of lectures, preparation of exercises, preparation of presentation, preparation of exam
Availability	Every winter semester
Duration	One semester
Responsibility	Prof. Dr. rer. nat. Bertram Schmidt (FEIT-IMOS)

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Module	**Optoelectronic and Photovoltaic Devices**
Objectives and contents	**Objectives:** The student will ▪ review basic principles of light transforming optoelectronic devices, ▪ learn how optoelectronic and photovoltaic devices work, ▪ obtain basic knowledge of design and fabrication processes for optoelectronic and photovoltaic devices. **Contents:** 1. Band diagrams of semiconductors and their connection with emission and absorption of light in matter 2. Light emitting diodes and semiconductor lasers, 3. Photodetectors, 4. Photovoltaic solar cells
Teaching	Lectures and exercises
Literature	To be announced in the lecture
Prerequisites	Bachelor in Electrical Engineering or related studies
Usability of the module	Optional module for the Master Course "Electrical Engineering and Information Technology"
Exam	Oral test at the end of the module
Credit points	5 Credit Points = 150 h (42 h time of attendance + 108 h autonomous work)
Work load	Time of attendance ▪ 2 hours/week - lecture ▪ 1 hour/week - exercises Autonomous work ▪ Post processing of lectures, preparation of exercises, preparation of exam
Availability	Every summer semester
Duration	One semester
Responsibility	Prof. Dr.-Ing. Edmund P. Burte (FEIT-IMOS)

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Module	**Ultrasonic Sensors for Imaging**
Objectives and contents	**Objectives:** The students gain information on the fundamental concepts and principles of ultrasonic sensors and the characteristics and requirements of ultrasonic sensors for imaging. At the end of the module they are able to engineer ultrasonic sensors and apply the physics behind signal analysis for ultrasonic imaging. They will be able to join interdisciplinary groups working on ultrasonic imaging, develop new sensors and imaging schemes. **Contents:** 1. Principles of generation and detection of ultrasound 2. Fundamentals of acoustic wave propagation 3. Methods of signal optimization and signal extraction 4. New trends in ultrasonic sensor development and imaging principles
Teaching	Lectures and exercises
Literature	Sanches, J.M., Ultrasound Imaging: Advances and Applications, Springer 2012 http://dx.doi.org/10.1007/978-1-4614-1180-2. Scabo, T.L., Diagnostic Ultrasound Imaging, Elsevier,2007
Prerequisites	Bachelor in Electrical Engineering or related studies
Usability of the module	Optional module for the Master Course "Electrical Engineering and Information Technology"
Exam	Oral test at the end of the module
Credit points	5 Credit Points = 150 h (42 h time of attendance + 108 h autonomous work)
Work load	Time of attendance ▪ 2 hours/week - lecture ▪ 1 hour/week - exercises Autonomous work ▪ Post processing of lectures, preparation of exercises, preparation of exam
Availability	Every winter semester
Duration	One semester
Responsibility	apl. Prof. Dr. rer. nat. habil. Ralf Lucklum (FEIT-IMOS)

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Module name	**Introduction into Medical Imaging**
Objective and content	**Objectives:** The student will: ▪ get on overview about modern medical imaging modalities ▪ understand the functional principle of the different technologies ▪ get to know to the most important medical applications of imaging ▪ discuss the pros and cons of the particular modalities with respect to image quality and patient safety ▪ have an overview about the required data and image processing **Content:** ▪ Radiography ▪ Computed Tomography ▪ Nuclear medicine imaging (PET, SPECT) ▪ Sonography ▪ Magnetic Resonance Imaging
Teaching	Lecture and tutorial
Literature	provided by e-learning system
Prerequisites	Mathematics, Physics, Fundamentals in Electrical Engineering, Basic understanding of medical terms
Applicability of the module	Optional module
Certification and examination	Written exam of 90 minutes
Credit points	5 Credit Points = 150 h (42 h time of attendance + 108 h autonomous work)
Work load	Time of attendance: ▪ 2 hours/week – lecture ▪ 1 hour/week – tutorial Autonomous work: ▪ Rework of lectures and tutorial, preparation of excersices
Frequency	Every summer semester
Duration	One semester
Responsible person	Prof. Dr. rer. nat. Georg Rose (FEIT-IIKT)

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Module	**MEMS Technologies**
Objectives and content	**Objectives:** The students gain knowledge in fundamentals of microsystems technologies as well as knowledge about products and markets of microsystems. After finishing the module they will understand the production technologies for MEMS devices and will be able applying these technologies for the conceptual development of MEMS components (e.g. micropumps, microvalves, pressure sensors). They will further achieve basic knowledge in the design of MEMS devices like sensors, actuators and microsystems. By means of exercises they learn to deepen their knowledge for further research and to apply it to solve complex problems. **Content:** ▪ MEMS: definition, technologies, markets ▪ Materials for MEMS ▪ Cleanroom and vacuum techniques ▪ Thin film technologies: PVD, CVD ▪ Lithography: resists, optical lithography, e-beam and x-ray lithography ▪ Etching techniques ▪ Bulk-micromachining, surface-micromachining, LIGA principles, ▪ Selected examples of microsystems
Teaching	Lectures (L) and exercises (E)
Literature	Fundamentals of microfabrication : the science of miniaturization; Marc J. Madou. - 2. ed. - Boca Raton: CRC Press, 2002, ISBN: 0-8493-0826-7
Prerequisites	Bachelor in Electrical Engineering or related studies
Usability of module	Optional module for the Master Course “Electrical Engineering and Information Technology”
Exam	Oral test (unaided) at the end of the module
Credit points	5 Credit Points = 150 h (42 h time of attendance + 108 h autonomous work)
Work load	Time of attendance: ▪ 2 hours/week – lecture, 1 hour /week exercise Autonomous work: ▪ Post processing of lectures, preparation of exercises, preparation of exam
Availability	Each summer semester
Duration	One semester
Responsibility	Prof. Dr. rer. nat. Bertram Schmidt (FEIT-IMOS)

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Module	**Packaging for Microelectronics and Microsystems**
Objectives and content	**Objectives:** The students gain basic knowledge in packaging technologies for microelectronics and microsystems. They learn about packaging materials, packaging processes and packaging technologies. After finishing the module they will understand the importance of packaging technologies for microelectronics, MEMS and medical applications. They gain knowledge packaging substrates, methods of thermal management, different packaging methods and reliability. They will be able to select an appropriate packaging solution for a given application. By means of exercises they learn to deepen their knowledge for further research and to apply it to solve complex problems. **Content:** ▪ Packaging: definition, packages, trends ▪ Introduction to electronic and MEMS packaging ▪ Basic semiconductor packaging ▪ Substrates and their technologies ▪ Packaging for MEMS-devices ▪ Reliability and test ▪ Device and housing requirements
Teaching	Lectures (L) and exercises (E))
Literature	Integrated Circuit Packaging, Assembly and Interconnections ISBN 978-0-387-33913-9; Fundamentals of Microsystems Packaging ISBN 0-07-120301-X, Advanced Electronic Packaging ISBN 0-471-46609-3
Prerequisites	Bachelor in Electrical Engineering or related studies;
Usability of module	Optional module for the Master Course “Electrical Engineering and Information Technology”
Exam	Oral test (unaided) at the end of the module
Credit points	5 Credit Points = 150 h (42 h time of attendance + 108 h autonomous work)
Work load	Time of attendance: ▪ 2 hours/week – lecture, 1 hour/week exercise Autonomous work: ▪ Post processing of lectures, preparation of exercises, preparation of presentation, preparation of exam
Availability	Each winter semester
Duration	One semesters
Responsibility	Prof. Dr. rer. nat. Bertram Schmidt (FEIT-IMOS)

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Power and Energy

Module	**Modern Concepts of EMC and EMC Measurements**
Objectives and contents	**Objectives:** The student will ▪ understand the fundamentals of Electromagnetic Compatibility (EMC) ▪ have an overview about the international EMC standards ▪ learn methods to analyse the EMC behaviour of electrical systems ▪ understand and apply measures to improve EMC ▪ efficiently apply modern software tools to EMC problems **Contents:** ▪ Introduction ▪ EMC regulation ▪ EM coupling, shielding, filtering ▪ EMC analysis, numerical techniques ▪ Interference models for special applications ▪ EMC measures in electronic circuits ▪ Radiation hazards ▪ Measurement techniques ▪ Laboratory exercises
Teaching	Lectures, exercises and laboratory
Literature	K.-H. Gonschoreck, R. Vick: Electromagnetic Compatibility for Device Design and System Integration. Springer Verlag
Prerequisites	Bachelor in Electrical Engineering or related studies
Usability of the module	Optional module for the Master Course “Electrical Engineering and Information Technology”
Exam	Oral test at the end of the course
Credit points	10 Credit points = 300 h (84 h time of attendance and 216 h autonomous work)
Work load	Time of attendance ▪ 2 hours/week - lecture ▪ 2 hours/week – exercises ▪ 2 hours/week - laboratory Autonomous work ▪ post processing of lectures and laboratory work, preparation of exercises, laboratory work, research report and exam
Availability	Every summer semester 2/1/0, every winter semester 0/1/2
Duration	Two semesters
Responsibility	Prof. Dr.-Ing. Ralf Vick (FEIT-IMT)

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Module	**Advanced Power Electronics**
Objectives and contents	**Objectives:** Knowledge about typical power electronic systems shall be imparted. Major methods to understand and design power electronic systems are practised. Applications will be demonstrated in the exercise. System oriented experiences shall be collected in laboratory. Cross-links to related fields of electrical and information engineering will be shown. **Contents:** ▪ system design by combinations of basic circuits ▪ selected advanced circuits, e. g. ▫ power factor correction ▫ switched mode power supplies ▪ selected systems with advanced circuits, e. g. ▫ power supplies ▫ drive converters
Teaching	Lecture, exercise, laboratory
Literature	Josef Lutz: Semiconductor Power Devices - Physics, Characteristics, Reliability; Springer-Verlag Berlin, Heidelberg, 2011
Prerequisites	Bachelor in Electrical Engineering or related studies and Master Course "Power Electronics"
Usability of the module	Selectable module for the Master Course "Electrical Engineering and Information Technology" belonging to the field of electrical energy systems
Exam	Lab certificate, oral examination
Credit points	5 Credit points = 150 h (42 h time of attendance and 108 h autonomous work)
Work load	Time of attendance ▪ 1 hour/week – lecture ▪ 1 hour/week – exercises ▪ 1 hour/week – laboratory Autonomous work ▪ postprocessing of lectures and laboratory ▪ preparation of exercises, laboratory and exam
Availability	Summer semester
Duration	One semester
Responsibility	Prof. Dr.-Ing. Andreas Lindemann (FEIT-IESY)

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Module	**Power Electronic Components and Systems**
Objectives and contents	**Objectives:** ▪ Knowledge about power semiconductor components as part of power supply or drive systems shall be imparted, considering the mutual interaction between component and system level. Applications will be demonstrated in the exercise. To strengthen the competence for interdisciplinary work, consideration of questions of reliability shall show cross-links to related fields of engineering. **Contents:** ▪ power electronic components ▫ functionality, ratings and characteristics of IGBT, MOSFET and diode ▫ packaging and assembly ▪ power electronic systems ▫ component stress in selected power supply and drive systems ▫ dimensioning ▫ reliability
Teaching	Lecture, excercise
Literature	Ned Mohan: Power electronics - converters, applications and design; Wiley, Hoboken NJ, 3rd edition 2003
Prerequisites	Bachelor in Electrical Engineering or related studies and Master Course “Power Electronics”
Usability of the module	Selectable module for the Master Course “Electrical Engineering and Information Technology”, belonging to the field of electrical energy systems
Exam	Oral examination at the and of the course
Credit points	5 Credit points = 150 h (42 h time of attendance and 108 h autonomous studies)
Work load	Time of attendance ▪ 2 hours/week – lecture ▪ 1 hour/week – exercises Autonomous work ▪ postprocessing of lectures ▪ preparation of exercises and exam
Availability	Winter semester
Duration	One semester
Responsibility	Prof. Dr.-Ing. Andreas Lindemann (FEIT-IESY)

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Module	**Renewable Energy Sources**
Objectives and contents	**Objectives:** The student will learn about energy conversion processes of different types of renewable energy sources, the regulatory framework and the challenges of grid integration. Thereby, wind energy, photovoltaic systems, biomass and fuel cells are focused. Grid integration includes possibilities and limitations of energy storage as well. **Contents:** ▪ Introduction to Renewable sources ▪ Legal Framework, priority and subsidies ▪ Functionality of energy conversion ▪ Introduction to Fuel Cells ▪ Introduction to energy storage
Teaching	Lecture, exercises
Literature	"Renewable Energy Systems Fundamentals, Technologies, Techniques and Economics", Z. A. Styczynski, N. I. Voropai (Editors), ISBN: 978-3-940961-42-6, 2010 "Power Conversion of Renewable Energy Systems", E. F. Fuchs, Mohammad A. S. Masoum, Springer-Verlag, 2011
Prerequisites	Bachelor in Electrical Engineering or related studies
Usability of the module	Optional module for the Master Course "Electrical Engineering and Information Technology"
Exam	Written test at the end of the course
Credit points	5 Credit points = 150 h (42 h time of attendance and 108 h autonomous work)
Work load	Time of attendance ▪ 2 hours/week - lecture ▪ 1 hours/week - exercises Autonomous work ▪ Post processing of lectures preparation of exercises and exam
Availability	Every summer semester
Duration	One semester
Responsibility	Prof. Dr.-Ing. habil. Martin Wolter (FEIT-IESY)

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Module	**Power System Economics and Special Topics**
Objectives and contents	**Objectives:** The student will learn ▪ the main principles of high voltage and high current engineering ▪ the principles of materials used as isolator ▪ how to calculate economics of power systems ▪ how the energy market is structured and organized ▪ how to calculate the reliability and ability of power grid components ▪ how energy trading is organized and power prices will be calculated **Contents:** 1. Electric power market and its liberalization 2. Financing account 3. The costs of transmission 4. Liberalization of European energy market 5. Energy trading 6. Network reliability 7. Network planning 8. Computing in network planning 9. High voltage measurement 10. High voltage and high current generation 11. Isolation materials 12. Isolation technology engineering 13. Use of high voltage technology in testing
Teaching	Lecture and exercises
Literature	“Fundamentals of Power System Economics”, Daniel S. Kirschen,Goran Strbac, John Wiley & Sons Ltd, 2004 “Power System Economics: designing marktes for electricity", Steven Stoft. Wiley Interscience, 2002
Prerequisites	Bachelor in Electrical Engineering or related studies
Usability of the module	Optional module for the Master Course “Electrical Engineering and Information Technology”
Exam	Written test at the end of the course
Credit points	5 Credit points = 150 h (42 h time of attendance and 108 h autonomous work)
Work load	Time of attendance ▪ 1 hours/week - lecture ▪ 2 hours/week - exercises Autonomous work ▪ Post processing of lectures preparation of exercises and exam
Availability	Every winter semester
Duration	One semester
Responsibility	Prof. Dr.-Ing. habil. Martin Wolter (FEIT-IESY)

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General

Module	**Integrated Project**
Objectives and contents	**Objectives:** This module serves to improve and apply the knowledge gained in a research-related topic. The student will develop his skills to work on a scientific topic under supervision. He will learn to perform research including accessible literature. In addition, the student will be able to develop his own research project. **Contents:** The content of teaching is largely determined by the research project.
Teaching	Scientific project
Prerequisites	Bachelor in Electrical Engineering or related studies
Usability of the module	Optional module for the Master Course "Electrical Engineering and Information Technology"
Exam	Research project
Credit points	10 Credit Points = 300 h (84 h time of attendance and 216 h autonomous work)
Work load	Time of attendance: 6 hours/week - scientific project autonomous work: Post processing of seminars and tutorials, preparation and performance of scientific work, preparation of presentations, preparation of a project
Availability	Every winter semester
Duration	One semester
Responsibility	Supervisor of the project

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Non-technical elective modules

Enrolment: Choice of modules according to the regular curriculum.
Modules from Master courses of OvGU can be selected- but without technical engineering modules.
Explicitly allowed are also foreign languages, such as German for foreign students.

Master thesis

Module	**Master thesis**
Objectives and contents	**Objectives:** ▪ The participants created a research-oriented scientific work ▪ The participant is safe in writing scientific text in the extent of a master thesis ▪ The participant is able to respond scientifically, to present his work and to answer questions to his work **Contents:** According to the consultation with the supervisor
Teaching	Thesis, presentation
Prerequisites	--
Usability of the module	Master EEIT There is no interaction with other modules.
Exam	Presentation of a scientific text created by the participants themselves with novel character in the extent of a master thesis. Presentation and defense of the work.
Credit points	30 Credit Points = 900 h autonomous work
Work load	Time of attendance: - Autonomous work: Research-oriented scientific work
Availability	Every summer or winter semester
Duration	One semester
Responsibility	Supervisor of Master thesis

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