Module handbook
for the
Master of Information and Electrical Engineering
of the University of Wismar
University of Applied Sciences: Technology, Business and Design

07.01.2014

Contents

Module 01: Project Seminar

Degree course:	*Master of Information and Electrical Engineering*
Module name:	*Project Seminar*
Abbreviation	*PS*
Subtitle	
Teaching sessions, if applicable: (L / S / T / P)	*0/2/2/0*
Semester:	*Annually in the summer semester*
Person responsible for the module:	*Professor heading the course*
Lecturer:	*Professor heading the course*
Language:	*German or English*
Classification in the curriculum	*Compulsory module in the Master of Information and Electrical Engineering*
Teaching format / contact hours (CH):	*2 CH seminars, 2 CH tutorials/project work* *Approved number of participants:* *Seminars 35, tutorials 20, complies with capacity guidelines*
Workload:	*150 h including 16 weeks each of 4 CH on-campus study*
Credits:	*5 CR*
Entry requirements:	
Learning targets / competencies:	*Ability to work independently on typical technical tasks in electrical engineering*
Contents:	• *Practical tasks in the particular specialist area are worked on separately in project groups* • *Project progress is discussed between the project groups under the guidance of the university teaching staff*
Assessment types:	*Alternative assessment, see Appendix 1 of the examination regulations* *Prerequisite for admission to examinations defined by the examination regulations, section 7 (4)*
Media formats:	*Board presentation, PowerPoint presentation*
Literature:	🕮 *Current literature adjusted to the issues and the specialist area*

Module 02: Simulation of Complex Systems

Degree course:	*Master of Information and Electrical Engineering*
Module name:	*Simulation of Complex Systems*
Abbreviation, if applicable	*SKS*
Subtitle, if applicable	
Teaching sessions, if applicable:	*1/1/0/2*

(L / S / T / P)	
Semester:	*Annually in the summer semester*
Person responsible for the module:	*Prof. S. Pawletta*
Lecturer:	*Prof. S. Pawletta / Prof. Auer*
Language:	*German or English*
Classification in the curriculum	*Compulsory module in the Master of Information and Electrical Engineering*
Teaching format / contact hours (CH):	*1 CH lecture, 1 CH seminar, 2 CH laboratory-based practical classes* *Approved number of participants:* *Lectures 60, seminars 35, practical classes 15, complies with capacity guidelines*
Workload:	*150 h including 16 weeks each of 4 CH on-campus study*
Credits:	*5 CR*
Entry requirements:	*Basic proficiency in handling SCEs (Matlab, etc.)*
Learning targets / competencies:	*Ability to model, simulate and analyse complex discrete event and hybrid systems*
Contents:	• *Modelling and simulation of discrete event and hybrid systems* • *Practical examples of application using SCEs (Matlab, etc.)*
Assessment types:	*120 minute written examination or 20 minute oral examination or alternative assessment, see Appendix 1 of the examination regulations* *Prerequisite for admission to examinations defined by the examination regulations, section 7 (4)*
Media formats:	*Board presentation, overhead presentation, scripts and websites presented in lectures*
Literature:	🕮 *Abel, D.; Bollig, A.: Rapid Control Prototyping – Methoden und Anwendungen, Springer Verlag*

Module 03: Quality Management

Degree course:	*Master of Information and Electrical Engineering*
Module name:	*Quality Management*
Abbreviation	*QM*
Subtitle	
Teaching sessions, if applicable: **(L / S / T / P)**	*1/1/2/0*
Semester:	*Annually in the winter semester*
Person responsible for the module:	*Prof. M. Krüger*
Lecturer:	*Prof. M. Krüger*
Language:	*German or English*

Classification in the curriculum	*Compulsory module in the Master of Information and Electrical Engineering*
Teaching format / contact hours (CH):	*1 CH lecture, 1 CH seminar, 2 CH tutorials* *Approved number of participants:* *Lectures 60, seminars 35, tutorials 20, complies with capacity guidelines*
Workload:	*150 h including 16 weeks each of 4 CH on-campus study* *Workload for independent study: 1 CH*
Credits:	*5 CR*
Entry requirements:	*Mathematics (stochastics)*
Learning targets / competencies:	• *Knowledge of the fundamental relationships in QPM* • *Ability to think and behave in a process-oriented manner* • *Knowledge of elementary tools and methods for quality assurance as well as the ability to apply them based on targets* • *Knowledge of quality planning, testing, control* • *Knowledge of quality management systems and their demonstration and auditing/certification*
Contents:	• *Introduction (terms, history, significance)* • *Processes* • *Creativity and visualisation techniques* • *Tools and methods in QM (APQP, QFD, DoE, BSC ...)* • *Total Quality Management* • *Six Sigma* • *EFQM Excellence Model* • *Quality management systems* • *Auditing and certification* • *Quality awards*
Assessment types:	*120 minute written examination or 20 minute oral examination or alternative assessment, see Appendix 1 of the examination regulations* *Prerequisite for admission to examinations defined by the examination regulations, section 7 (4)*
Media formats:	*Board presentation, PowerPoint presentation, scripts presented in lectures*
Literature:	🕮 *Kamiske, Gerd F.; Brauer, Joerg-Peter: Qualitätsmanagement von A bis Z : Erläuterungen moderner Begriffe des Qualitätsmanagements .- München [u.a.] : Hanser, 2006* 🕮 *Hering, Ekbert (Hrsg.): Qualitätsmanagement für Ingenieure .- Berlin [u.a.]: Springer, 2003* 🕮 *Qualität und Zuverlässigkeit: Qualitätsmanagement in Industrie und Dienstleistung, Organ der DGQ, Hansa Verlag* 🕮 *Magnusson, Kjell [u. a.]: Six Sigma umsetzen: Die neue Qualitätsstrategie für Unternehmen .- München, Wien: Hansa, 2001* 🕮 *Ziege, Kathrin: Erstellung und Einführung eines Qualitätsmanagementsystems . - Bremen : Europäischer Hochschulverl., 2009* 🕮 *Pfeifer, Tilo: Qualitätsmanagement : Strategien, Methoden, Techniken . - München : Hanser, Carl, 2008* 🕮 *Klein, Bernd: Versuchsplanung - DoE : Einführung in die Taguchi/Shainin-Methodik . - München [u.a.] : Oldenbourg, 2007* 🕮 *Masing, Walter: Handbuch Qualitätsmanagement . -*

	München : Hanser, 2007 🕮 *Gertz, Stefanie: Der schnelle und einfache Weg zu Business-Excellence mit Hilfe des EFQM-Modells . - Kissing : WEKA Media, 2005-*

Module 04: Research Seminar

Degree course:	*Master of Information and Electrical Engineering*
Module name:	*Research Seminar*
Abbreviation	*FoS*
Subtitle	
Teaching sessions, if applicable: **(L / S / T / P)**	*0/1/3/0*
Semester:	*Annually in the winter semester*
Person responsible for the module:	*Professor heading the course*
Lecturer:	*Professor heading the course*
Language:	*German or English*
Classification in the curriculum	*Compulsory module in the Master of Information and Electrical Engineering*
Teaching format / contact hours (CH):	*1 CH seminar, 3 CH tutorials* *Approved number of participants:* *Seminars 35, tutorials 20, complies with capacity guidelines*
Workload:	*150 h including 16 weeks each of 4 CH on-campus study* *Workload for independent study: 1 CH*
Credits:	*5 CR*
Entry requirements:	
Learning targets / competencies:	*Ability to work independently on typical technical tasks with a research character*
Contents:	• *Practical tasks in the particular specialist area are worked on separately in project groups* • *Project progress is discussed between the project groups under the guidance of the university teaching staff*
Assessment types:	*Alternative assessment, see Appendix 1 of the examination regulations* *Prerequisite for admission to examinations defined by the examination regulations, section 7 (4)*
Media formats:	*Board presentation, PowerPoint presentation*
Literature:	🕮 *Current literature adjusted to the issues and the specialist area*

Module 05: Microsystems Engineering II

Degree course:	*Master of Information and Electrical Engineering*
Module name:	*Microsystems Engineering II*
Abbreviation	*MiSyT II*
Subtitle	
Teaching sessions, if applicable: (L / S / T / P)	*1/1/1/1*
Semester:	*Annually in the summer semester*
Person responsible for the module:	*Prof. Wienecke*
Lecturer:	*Prof. Wienecke / Dr Barfels*
Language:	*German or English*
Classification in the curriculum	*Compulsory module in the Master of Information and Electrical Engineering, specialist area information and communication engineering;* *Elective in the specialist areas automation and mechatronics and electrical power engineering*
Teaching format / contact hours (CH):	*1 CH lecture, 1 CH seminar, 1 CH tutorial, 1 CH laboratory practical class* *Approved number of participants:* *Lectures 60, seminars 35, tutorials 20, practical classes 15, complies with capacity guidelines*
Workload:	*150 h including 16 weeks each of 4 CH on-campus study*
Credits:	*5 CR*
Entry requirements:	*Basic knowledge of materials and technologies in electrical engineering, microsystems technology*
Learning targets / competencies:	*With the aim of miniaturising components and processes, the methods and technologies in microelectronics are increasingly applied across broad areas of industry, particularly in the areas of medicine, environment and sensors. In this compulsory module students are taught to assess and apply the principles of operation, use and manufacturing methods of such sensor/actuator systems.*
Contents:	• *Basic technologies in microsystems technology* • *New materials in medical, environmental and sensor technology, sensor properties* • *Specific measurement technologies* • *From macrotechnology to nanotechnology, examples of applications and production methods* • *Production methods for electrical and optochemical sensors, biosensors* • *Sensor/actuator systems, examples of applications* • *Projects: e.g. optically switched hydrogen sensor*
Assessment types:	*120 minute written examination or 20 minute oral examination or alternative assessment, see Appendix 1 of the examination regulations* *Prerequisite for admission to examinations defined by the examination regulations, section 7 (4)*
Media formats:	*Board presentation, PowerPoint presentation, overhead presentation, scripts presented in lectures, project-based teaching*

	units
Literature:	🕮 *W. Menz, J. Mohr, O. Paul: Microsystem Technology,* 🕮 *Wiley-VCH, Weinheim, NY, 2001* 🕮 *J. Frühauf: Werkstoffe der Mikrotechnik,* 🕮 *Fachbuchverlag Leipzig, 2005* 🕮 *M. Köhler: Nanotechnologie,* 🕮 *Wileay-VCH, Weinheim, NY, 2001* 🕮 *W. Göpel, J. Hesse, J. N. Zemel, (Hrsg.): Sensors,* 🕮 *Wiley-VCH, Weinheim, NY, 1991* 🕮 *Work with literature and patent databases (e.g. INSPEC, ESPACENET)*

Module 06: Communication Systems

Degree course:	*Master of Information and Electrical Engineering*
Module name:	*Communication Systems*
Abbreviation	*CoSy*
Subtitle	
Teaching sessions, if applicable: (L / S / T / P)	*1/1/1/1*
Semester:	*Annually in the summer semester*
Person responsible for the module:	*Prof. Ahrens*
Lecturer:	*Prof. Ahrens*
Language:	*German or English*
Classification in the curriculum	*Compulsory module in the Master of Information and Electrical Engineering, specialist area information and communication engineering*
Teaching format / contact hours (CH):	*1 CH lecture, 1 CH seminar, 1 CH tutorial, 1 CH laboratory practical class* *Approved number of participants:* *Lectures 60, seminars 35, tutorials 20, practical classes 15, complies with capacity guidelines*
Workload:	*150 h including 16 weeks each of 4 CH on-campus study*
Credits:	*5 CR*
Entry requirements:	*Fundamentals of Communications*
Learning targets / competencies:	*Getting familiar with basic concepts and algorithms for digital data transmission over dispersive channels*
Contents:	• *Introduction to digital communications* • *Spread-Spectrum Systems* • *Multicarrier Transmission* • *MIMO Systems*
Assessment types:	*120 minute written examination or 20 minute oral examination or alternative assessment, see Appendix 1 of the examination regulations* *Prerequisite for admission to examinations defined by the examination regulations, section 7 (4)*
Media formats:	*Board presentation and PowerPoint presentation, scripts presented in lectures in the form of work sheets*

Literature:	🕮 *Haykin, S.; Moher, M.: Communication Systems. Chichester: Wiley, 2010* 🕮 *Ziemer, R.E.; Tranter, W. H.: Principles of Communications: Systems, Modulation and Noise. Chichester: Wiley, 2010* 🕮 *Goldsmith, A.: Wireless Communications. New York Cambridge, 2005* 🕮 *Öberg, T.: Modulation, Detection and Coding. Chichester: Wiley, 2001* 🕮 *Bahai, A.R.S.; Saltzberg, B.R. Ergen, M.: Multi-Carrier Digital Communications - Theory and Applications of OFDM. New York: Springer, 2004* 🕮 *Kühn, V.: Wireless Communications over MIMO Channels - Applications to CDMA and Multiple Antenna Systems, Chichester: Wiley, 2006* 🕮 *Proakis, J. G.: Digital communications. Boston: McGraw-Hill, 2000*

Module 07: Network and Security Management

Degree course:	*Master of Information and Electrical Engineering*
Module name:	*Network and Security Management*
Abbreviation	*NWSM*
Subtitle	
Teaching sessions, if applicable: (L / S / T / P)	*1/1/0/2*
Semester:	*Annually in the summer semester*
Person responsible for the module:	*Prof. Jonas*
Lecturer:	*Prof. Jonas*
Language:	*English*
Classification in the curriculum	*Compulsory module in the Master of Information and Electrical Engineering, specialist area information and communication engineering*
Teaching format / contact hours (CH):	*1 CH lecture, 1 CH seminar, 2 CH laboratory-based practical classes* *Approved number of participants:* *Lectures 60, seminars 35, practical classes 15, complies with capacity guidelines*
Workload:	*150 h including 15 weeks each of 4 CH on-campus study*
Credits:	*5 CR*
Entry requirements:	*Operating Systems, System and Network Programming,*
Learning targets / competencies:	*Competencies for planning, design and management of small computer networks,* *Competencies for evaluation of security mechanisms, design and implementation of security components, development of security policies*

Contents:	• *FCAPS: fault, configuration, accounting, performance, security management* • *OSI Management and Internet Management (SNMP)* • *WEB-based management architectures* • *Management tools, network monitoring* • *Identity management, policies, management of firewalls and proxies* • *Implementation of network security*
Assessment types:	*120 minute written examination or 20 minute oral examination or alternative assessment, see Appendix 1 of the examination regulations* *Prerequisite for admission to examinations defined by the examination regulations, section 7 (4)*
Media formats:	*Board presentation, PowerPoint presentation, overhead presentation, scripts presented in lectures*
Literature:	🕮 *Tipton H. F., Krause, M.: Information Security Management Handbook, Auerbach Publishers Inc. 2003* 🕮 *McNab Chris: Network Security Assessment, O'Reilly 2009* 🕮 *Rose, M. T.: A Simple Book – An Introduction to Management of TCP/IP based Internets. Prentice Hall 1994* 🕮 *Sloman, M.: Network and Distributed Systems Management. Addison Wesley 1994* 🕮 *stallings, W.: SNMP, SNMPv2, SNMPv3 and RMON 1 and 2, Addison Wesley 1999* 🕮 *Subramanian, M.: Network Management – Principles and Practice. Addison Wesley 2000* 🕮 *Zwicky, Cooper, Chapman: Building Internet Firewalls. O'Reilly & Assosiates 2000*

Module 08: Advanced Topics in Communications

Degree course:	*Master of Information and Electrical Engineering*
Module name:	*Advanced Topics in Communications*
Abbreviation	*ATC*
Subtitle	
Teaching sessions, if applicable: **(L / S / T / P)**	*1/1/2/0*
Semester:	*Annually in the winter semester*
Person responsible for the module:	*Prof. Lochmann*
Lecturer:	*Prof. Lochmann and Prof. Ahrens*
Language:	*German or English*
Classification in the curriculum	*Compulsory module in the Master of Information and Electrical Engineering, specialist area information and communication engineering* *Elective in the specialist areas automation and mechatronics and electrical power engineering*
Teaching format / contact hours (CH):	*1 CH lecture, 1 CH seminar,* *2 CH tutorials* *Approved number of participants:*

	Lectures 60, seminars 35, tutorials 20, *complies with capacity guidelines*
Workload:	*150 h including 16 weeks each of 4 CH on-campus study*
Credits:	*5 CR*
Entry requirements:	*Fundamentals of Communications,* *Communication Systems*
Learning targets / competencies:	*Getting familiar with advanced concepts and algorithms for digital data transmission over dispersive channels*
Contents:	*The course covers selected topics of advanced signal processing schemes and developments. Selected problems are solved with Matlab in small groups during the exercises.*
Assessment types:	*120 minute written examination or 20 minute oral examination or alternative assessment, see Appendix 1 of the examination regulations* *Prerequisite for admission to examinations defined by the examination regulations, section 7 (4)*
Media formats:	*Board presentation and PowerPoint presentation, scripts presented in lectures in the form of work sheets*
Literature:	🕮 *Goldsmith, A.: Wireless Communications. New York: Cambridge, 2005* 🕮 *Öberg, T.: Modulation, Detection and Coding. Chichester: Wiley, 2001* 🕮 *Haykin, S.; Moher, M.: Communication Systems. Chichester: Wiley, 2010* 🕮 *Ziemer, R.E.; Tranter, W. H.: Principles of Communications: Systems, Modulation and Noise. Chichester: Wiley, 2010* 🕮 *Kühn, V.: Wireless Communications over MIMO Channels - Applications to CDMA and Multiple Antenna Systems, Wiley, Chichester, 2006.* 🕮 *Proakis, J. G.: Digital communications. Boston: McGraw-Hill, 2000* 🕮 *Eberlein, D.: Lichtwellenleiter-Technik: Grundlagen, Verbindungs- und Messtechnik, Systeme, Trends. Expert-Verlag, Renningen 2002* 🕮 *Kauffels, F.: Optische Netze. mitp-Verlag, Bonn 2002* 🕮 *Krauss, O.:: DWDM und optische Netze: Eine Einführung in die Terabit-Technologie. Publicis Corp. Publ. Erlangen 2002*

Module 09: Advanced Optical Communications

Degree course:	*Master of Information and Electrical Engineering*
Module name:	*Advanced Optical Communications*
Abbreviation	*AOC*
Subtitle	
Teaching sessions, if applicable: **(L / S / T / P)**	*1/1/1/1*
Semester:	*Annually in the winter semester*

Person responsible for the module:	*Prof. Lochmann*
Lecturer:	*Prof. Lochmann*
Language:	*German or English*
Classification in the curriculum	*Compulsory module in the Master of Information and Electrical Engineering, specialist area information and communication engineering*
Teaching format / contact hours (CH):	*1 CH lecture, 1 CH seminar, 1 CH tutorial, 1 CH laboratory practical class* *Approved number of participants:* *Lectures 60, seminars 35, tutorials 20, practical classes 15, complies with capacity guidelines*
Workload:	*150 h including 16 weeks each of 4 CH on-campus study*
Credits:	*5 CR*
Entry requirements:	*Knowledge of the principles of optical communications*
Learning targets / competencies:	*Ability to describe mathematically optical sign propagation and modification in components and systems*
Contents:	• *Calculation of mode fields* • *Beam propagation method (BPM)* • *Photonic lightwave circuits* • *Nonlinear behaviour of lightwave circuits* • *Optical amplifier* • *Modulation methods* • *Detection principles, SNR analysis* • *Analysis and calculation of lightwave circuit systems*
Assessment types:	*120 minute written examination or 20 minute oral examination or alternative assessment, see Appendix 1 of the examination regulations* *Prerequisite for admission to examinations defined by the examination regulations, section 7 (4)*
Media formats:	*Board presentation and PowerPoint presentation, scripts presented in lectures in the form of work sheets*
Literature:	🕮 *Eberlein, D.: Lichtwellenleiter-Technik: Grundlagen, Verbindungs- und Messtechnik, Systeme, Trends. Expert-Verlag, Renningen 2002* 🕮 *Kauffels, F.: Optische Netze. mitp-Verlag, Bonn 2002* 🕮 *Krauss, O.:: DWDM und optische Netze: Eine Einführung in die Terabit-Technologie. Publicis Corp. Publ. Erlangen 2002* 🕮 *Brückner, V.: Optische Nachrichtentechnik. Teubner-Verlag Leipzig 2003*

Module 10: Integrated Circuit Design

Degree course:	*Master of Information and Electrical Engineering*
Module name:	*Integrated Circuit Design*
Abbreviation	*SKE*
Subtitle	

Teaching sessions, if applicable: (L / S / T / P)	*1/1/0/2*
Semester:	*Annually in the winter semester*
Person responsible for the module:	*Prof. Müller*
Lecturer:	*Prof. Müller*
Language:	*German or English*
Classification in the curriculum	*Compulsory module in the Master of Information and Electrical Engineering, in the specialist areas information and communication engineering and automation and mechatronics; elective in the specialist area electrical power engineering*
Teaching format / contact hours (CH):	*1 CH lecture, 1 CH seminar, 2 CH laboratory-based practical classes* *Approved number of participants:* *Lectures 60, seminars 35, practical classes 15, complies with capacity guidelines*
Workload:	*150 h including 16 weeks each of 4 CH on-campus study*
Credits:	*5 CR*
Entry requirements:	*Knowledge of digital circuit design, programming*
Learning targets / competencies:	*Ability to design complex digital circuits in VHDL and implement complex circuits in FPGAs*
Contents:	• *Architectures of programmable logic circuits* • *Circuit design with hardware description languages* • *Programming in VHDL* • *Simulation and implementation of complex digital circuits* • *Laboratory practical class*
Assessment types:	*120 minute written examination or 20 minute oral examination or alternative assessment, see Appendix 1 of the examination regulations* *Prerequisite for admission to examinations defined by the examination regulations, section 7 (4)*
Media formats:	*Board presentation, PowerPoint presentation, overhead presentation, scripts presented in lectures*
Literature:	🕮 *Wannemacher, M.: Das FPGA – Kochbuch. 1. Auflage, Bonn, Internat. Thomson Publ., 1998* 🕮 *Sikora, A.: Programmierbare Logikbausteine. Hanser – Verlag 2001* 🕮 *Auer, A.: Programmierbare Logic – IC. 2. Auflage, Hüthig – Verlag Heidelberg 1994* 🕮 *Auer, A.; Rudolf, D.: FPGA.Hüthig – Verlag Heidelberg 1995* 🕮 *Herrmann, G.; Müller, D.: ASIC – Entwurf und Test. Fachbuchverlag Leipzig 2004* 🕮 *Reifschneider, N.: CAE-gestützte IC-Entwurfsmethoden. Prentice Hall* 🕮 *Mäder, A.: VHDL Kompakt.* 🕮 *Ritter, J.; Molitor, P.: VHDL eine Einführung. Pearson 2004* 🕮 *Jorke, G.: Rechnergestützter Entwurf digitaler Schaltungen., Hanser - Verlag 2004*

	🕮 *Reichardt, J.; Schwarz, B.: VHDL-Synthese. Oldenbourg Verlag 2003* 🕮 *Hervé, Y.: VHDL-AMS. Oldenbourg Verlag 2006* 🕮 *Siemers, Ch.: Prozessorbau. Hanser Verlag Verlag 1999* 🕮 *Kesel. F; Bartholomä, R.: Entwurf von digitalen Schaltungen und Systemen mit HDLs und FPGAs. Oldenbourg Verlag 2006*

Module 11: Advanced Control II

Degree course:	*Master of Information and Electrical Engineering*
Module name:	*Control Engineering II*
Abbreviation	*ReTe II*
Subtitle	
Teaching sessions, if applicable: **(L / S / T / P)**	*1/1/0/2*
Semester:	*Annually in the summer semester*
Person responsible for the module:	*Prof. Dünow*
Lecturer:	*Prof. Dünow*
Language:	*German or English*
Classification in the curriculum	*Compulsory module in the Master of Information and Electrical Engineering, specialist area automation and mechatronics*
Teaching format / contact hours (CH):	*1 CH lecture, 1 CH seminar, 2 CH laboratory-based practical classes* *Approved number of participants:* *Lectures 60, seminars 35, practical classes 15, complies with capacity guidelines*
Workload:	*150 h including 16 weeks each of 4 CH on-campus study*
Credits:	*5 CR*
Entry requirements:	*Mathematics, automation engineering, principles of control engineering*
Learning targets / competencies:	*Ability to design complex control systems using models*
Contents:	• *Multivariable systems* • *Modelling* • *State space methods* • *Robust controls* • *Computer-aided design* • *Advanced methods in control engineering* • *(Choice)*
Assessment types:	*120 minute written examination or 20 minute oral examination or alternative assessment, see Appendix 1 of the examination regulations* *Prerequisite for admission to examinations defined by the examination regulations, section 7 (4)*

Media formats:	*Board presentation, PowerPoint presentation, board presentation, experiment presentation, simulation, scripts*
Literature:	🕮 *Graham C. Goodwin; Stefan F. Graebe; Mario E. Salgado. Control System Design. Pearson US Imports, PHIPEs, 2000.* 🕮 *J. Lunze. Regelungstechnik Band II, Systemtheoretische Grundlagen, Analyse und Entwurf Einschleifiger Regelungen. Springer-Verlag, 2001.* 🕮 *H. Unbehauen. Regelungstechnik Band I bis III. Vieweg-Verlag, 2001.*

Module 12: Embedded Control Systems II

Degree course:	*Master of Information and Electrical Engineering*
Module name:	*Embedded Control Systems II*
Abbreviation	*ECSy II*
Subtitle	
Teaching sessions, if applicable: **(L / S / T / P)**	*1/1/0/2*
Semester:	*Annually in the summer semester*
Person responsible for the module:	*Prof. Dr. Simanski*
Lecturer:	*Prof. Dr. Simanski*
Language:	*German or English*
Classification in the curriculum	*Compulsory module in the Master of Information and Electrical Engineering, specialist area automation and mechatronics*
Teaching format / contact hours (CH):	*1 CH lecture, 1 CH seminar, 2 CH laboratory-based practical classes* *Approved number of participants:* *Lectures 60, seminars 35, practical classes 15, complies with capacity guidelines*
Workload:	*150 h including 16 weeks each of 4 CH on-campus study*
Credits:	*5 CR*
Entry requirements:	*Physics*
Learning targets / competencies:	*Ability to design distributed controls based on embedded systems, expertise in evaluating and selecting systems*
Contents:	• *Model-based control design* • *Self-configuring systems* • *Diagnostic methods using models* • *Real-time communication in distributed embedded systems* • *Device design based on embedded systems* • *Design tools* • *Selected applications*
Assessment types:	*120 minute written examination or 20 minute oral examination or alternative assessment, see Appendix 1 of the examination regulations*

	Prerequisite for admission to examinations defined by the examination regulations, section 7 (4)
Media formats:	*Board presentation, PowerPoint presentation, board presentation, experiment presentation, simulation, scripts*
Literature:	🕮 *Peter Marwedel, "Embedded System Design", Springer, Berlin; 2nd Print (1. November 2005), ISBN-10: 0387292373.* 🕮 *H. Kopetz, "Real-Time Systems, Design Principles for Distributed Embedded Applications", Kluwer Academic Publishers, Boston, Dordrecht, London, 1997.* 🕮 *D.D. Gajski, F. Vahid, S. Narayan, J. Gong, "Specification and Design of Embedded Systems", Prentice Hall, 1994.*

Module 13: Sensor Systems/Actuators

Degree course:	*Master of Information and Electrical Engineering*
Module name:	*Sensors/Actuators*
Abbreviation	*S/A*
Subtitle	
Teaching sessions, if applicable: **(L / S / T / P)**	*1/1/0/2*
Semester:	*Annually in the summer semester*
Person responsible for the module:	*Prof. Dünow*
Lecturer:	*Prof. Dünow*
Language:	*German or English*
Classification in the curriculum	*Compulsory module in the Master of Information and Electrical Engineering, specialist area automation and mechatronics as well as electrical power engineering;* *Elective in the specialist area information and communication engineering*
Teaching format / contact hours (CH):	*1 CH lecture, 1 CH seminar, 2 CH laboratory-based practical classes* *Approved number of participants:* *Lectures 60, seminars 35, practical classes 15, complies with capacity guidelines*
Workload:	*150 h including 16 weeks each of 4 CH on-campus study*
Credits:	*5 CR*
Entry requirements:	*Physics*
Learning targets / competencies:	*Ability to apply and develop sensor systems, familiarity with diverse operating principles and their application*
Contents:	• *Sensor terms, functional structures* • *Measurement effects* • *Sensor signal detection and processing* • *Selected measurement techniques* • *Multisensor systems*

	• *Model-based information acquisition* • *(Virtual sensors)* • *Operating principles and application*
Assessment types:	*120 minute written examination or 20 minute oral examination or alternative assessment, see Appendix 1 of the examination regulations* *Prerequisite for admission to examinations defined by the examination regulations, section 7 (4)*
Media formats:	*Board presentation, PowerPoint presentation, board presentation, experiment presentation, simulation, scripts*
Literature:	🕮 *Bonfig, K.W. Sensoren und Sensorsysteme. Expert-Verlag 1991* 🕮 *Hoffmann, J. Taschenbuch der Messtechnik, Fachbuchverl. Leipzig, 1998* 🕮 *Schrüfer, E., Elektrische Messtechnik. Hanser,2004* 🕮 *Tränkler, H.R.:,Sensortechnik. Oldenbourg,1996 2000*

Module 14: Selected Aspects in Automation

Degree course:	*Master of Information and Electrical Engineering*
Module name:	*Selected Aspects in Automation*
Abbreviation	*AAAT*
Subtitle	
Teaching sessions, if applicable: **(L / S / T / P)**	*1/1/0/2*
Semester:	*Annually in the winter semester*
Person responsible for the module:	*NN*
Lecturer:	*NN*
Language:	*German or English*
Classification in the curriculum	*Compulsory module in the Master of Information and Electrical Engineering, specialist area automation and mechatronics;* *Elective in the specialist areas information and communication engineering and electrical power engineering*
Teaching format / contact hours (CH):	*1 CH lecture, 1 CH seminar, 2 CH laboratory practical classes* *Approved number of participants:* *Lectures 60, seminars 35, practical classes 15, complies with capacity guidelines*
Workload:	*150 h including 16 weeks each of 4 CH on-campus study*
Credits:	*5 CR*
Entry requirements:	*Control Engineering, Computational Engineering*
Learning targets / competencies:	*Ability to design distributed controls based on embedded systems, expertise in evaluating and selecting systems*
Contents:	• *Fuzzy systems and fuzzy control (structures and design, fuzzy controls)* • *Neuronal networks (network structures, design and applications)* • *Predictive regulation and control methods (principle,*

	algorithms, applications) • *Selected applications of modern automation approaches*
Assessment types:	*120 minute written examination or 20 minute oral examination or alternative assessment, see Appendix 1 of the examination regulations* *Prerequisite for admission to examinations defined by the examination regulations, section 7 (4)*
Media formats:	*Board presentation, PowerPoint presentation, board presentation, experiment presentation, simulation, scripts*
Literature:	🕮 *Bothe, H.-H.:* Fuzzy-Logic, *Springer-Verlag, Berlin* 🕮 *Kruse, Rudolf; Gebhardt, Jörg; Klawonn, Frank:* Fuzzy-Systeme 🕮 *Nauck, Klawonn, Kruse, Neuronale Netze und Fuzzy-Systeme, Viewegverlag* 🕮 *C. E. Garcia, D. M. Prett, M. Morari, „Model predictive control: theory and practice − a survey“,* 🕮 *Automatica, No. 25, pp. 335-348, 1987* 🕮 *Maciejowski, Predictive Control with Constraints, Prentice Hall 2002*

Module 15: Building Automation

Degree course:	*Master of Information and Electrical Engineering*
Module name:	*Building Automation*
Abbreviation	*GA*
Subtitle	
Teaching sessions, if applicable: **(L / S / T / P)**	*1/1/1/1*
Semester:	*Annually in the winter semester*
Person responsible for the module:	*Prof. Mundt*
Lecturer:	*Prof. Mundt*
Language:	*German or English*
Classification in the curriculum	*Compulsory module in the Master of Information and Electrical Engineering, in the specialist areas electrical power engineering and automation and mechatronics;* *Elective in the specialist area information and communication engineering*
Teaching format / contact hours (CH):	*1 CH lecture, 1 CH seminar, 1 CH tutorial, 1 CH laboratory practical class* *Approved number of participants:* *Lectures 60, seminars 35, tutorials 20, practical classes 15, complies with capacity guidelines*
Workload:	*150 h including 16 weeks each of 4 CH on-campus study*
Credits:	*5 CR*
Entry requirements:	*None*
Learning targets /	*Ability to use modern building BUS systems with the aim of long-*

competencies:	*term energy conservation and sustainability considering individual consumption of various buildings*
Contents:	• *Sensors, actuators in the building sector* • *BUS systems (EIB/KNX, LCN, DALI)* • *Structure, topology, technology, applications* • *EIBnet/IP communication* • *Smart home, comfort, savings*
Assessment types:	*120 minute written examination or 20 minute oral examination or alternative assessment, see Appendix 1 of the examination regulations* *Prerequisite for admission to examinations defined by the examination regulations, section 7 (4)*
Media formats:	*Board presentation, experiment presentation, PowerPoint presentation, scripts presented in lectures*
Literature:	🕮 *Merz: Gebäudeautomation, Hanser, 2007* 🕮 *Sauter: EIB Installation Bus System, Publicis, 2001* 🕮 *KNX Handbook, ZVEI, 2006*

Module 16: Energy Conversion

Degree course:	*Master of Information and Electrical Engineering*
Module name:	*Energy Conversion*
Abbreviation	*EU*
Subtitle	
Teaching sessions, if applicable: **(L / S / T / P)**	*1/2/0/1*
Semester:	*Annually in the summer semester*
Person responsible for the module:	*Prof. Timm*
Lecturer:	*Prof. Timm*
Language:	*German*
Classification in the curriculum	*Compulsory module in the Master of Information and Electrical Engineering, specialist area electrical power engineering;* *Elective in the specialist areas information and communication engineering and electrical engineering*
Teaching format / contact hours (CH):	*1 CH lecture, 2 CH seminars, 1 CH practical class* *Approved number of participants:* *Lectures 60, seminars 35, practical classes 20, complies with capacity guidelines*
Workload:	*150 h including 16 weeks each of 4 CH on-campus study*
Credits:	*5 CR*
Entry requirements:	*None*
Learning targets / competencies:	*Ability to identify the importance of the link between physical principles and engineering and scientific implementation*
Contents:	• *Mechanics and heat*

	• *Thermodynamics* *- cycle processes, entropy, Joule - Thomson* • *Heat and transport* *- heat radiation, conduction* • *Gases in machines and equipment*
Assessment types:	*120 minute written examination or 20 minute oral examination or alternative assessment, see Appendix 1 of the examination regulations* *Prerequisite for admission to examinations defined by the examination regulations, section 7 (4)*
Media formats:	*Board presentation, PowerPoint presentation, overhead presentation*
Literature:	🕮 *Stroppe, H.: Physik Fachbuchverlag Leipzig 1994* 🕮 *Hering, E.; Martin, R.; Stohrer, M .: Physik für Ingenieure Springer – Verlag 1999* 🕮 *Leute, U.: Physik und ihre Anwendungen in technik und Umwelt Hanser 2004* 🕮 *Cerbe, G. ; Hoffmann, H.-J. : Einführung in die Thermodynamik Hanser 1999*

Module 18: Grid Operation

Degree course:	*Master of Information and Electrical Engineering*
Module name:	*Grid Operation*
Abbreviation	*NB*
Subtitle	
Teaching sessions, if applicable: **(L / S / T / P)**	*1/1/1/1*
Semester:	*Annually in the winter semester*
Person responsible for the module:	*Prof. Mundt*
Lecturer:	*Prof. Mundt*
Language:	*German*
Classification in the curriculum	*Compulsory module in the Master of Information and Electrical Engineering, specialist area electrical power engineering*
Teaching format / contact hours (CH):	*1 CH lecture, 1 CH seminar, 1 CH tutorial, 1 CH laboratory practical class* *Approved number of participants:* *Lectures 60, seminars 35, tutorials 20, practical classes 15, complies with capacity guidelines*
Workload:	*150 h including 16 weeks each of 4 CH on-campus study*
Credits:	*5 CR*
Entry requirements:	*Principles of electrical power engineering, grid elements, supply structures*
Learning targets /	*Ability to make comprehensive assessments for safe operation of*

competencies:	*electrical grids with the aim of achieving a high level of availability of electrical energy.*
Contents:	• *Neutral point connection in energy grids* • *Design of grids to protect against short circuit effects* • *Symmetrical and asymmetrical faults, electrical arcs* • *Switching processes, design of circuits* • *Stability, regulation*
Assessment types:	*120 minute written examination or 20 minute oral examination or alternative assessment, see Appendix 1 of the examination regulations* *Prerequisite for admission to examinations defined by the examination regulations, section 7 (4)*
Media formats:	*Board presentation, PowerPoint presentation, overhead presentation, scripts presented in lectures*
Literature:	🕮 *Schlabbach: Kurzschlussstromberechnung, VDE Verlag, 2003* 🕮 *Schlabbach: Sternpunktbehandlung, VDE Verlag, 2002* 🕮 *Heuck: Elektrische Energieversorgung, Vieweg, 2007*

Module 19: Power Electronics II

Degree course:	*Master of Information and Electrical Engineering*
Module name:	*Power Electronics*
Abbreviation	*LE II*
Subtitle	
Teaching sessions, if applicable: **(L / S / T / P)**	*1/1/1/1*
Semester:	*Annually in the winter semester*
Person responsible for the module:	*Prof. Dr. Chiadò Caponet*
Lecturer:	*Prof. Dr. Chiadò Caponet*
Language:	*German or English*
Classification in the curriculum	*Compulsory module in the Master of Information and Electrical Engineering, specialist area electrical power engineering;* *Elective in the specialist areas information and communication engineering and automation and mechatronics*
Teaching format / contact hours (CH):	*1 CH lecture, 1 CH seminar, 1 CH tutorial, 1 CH laboratory practical class* *Approved number of participants:* *Lectures 60, seminars 35, tutorials 20, practical classes 15, complies with capacity guidelines*
Workload:	*150 h including 16 weeks each of 4 CH on-campus study*
Credits:	*5 CR*
Entry requirements:	*Power Electronics I*
Learning targets / competencies:	*Knowledge of basic principles of power semiconductor devices and circuits*

Contents:	• *Properties of power semiconductors* • *Protective circuits* • *Rectifier circuits* • *Converter circuits*
Assessment types:	*120 minute written examination or 20 minute oral examination or alternative assessment, see Appendix 1 of the examination regulations* *Prerequisite for admission to examinations defined by the examination regulations, section 7 (4)*
Media formats:	*Projector presentation, board presentation, scripts presented in lectures*
Literature:	🕮 *Michel, M.: Leistungselektronik, Springer Verlag* 🕮 *Hagmann, Gert: Leistungselektronik : Grundlagen und Anwendungen, Aula Verlag* 🕮 *Specovius, J.: Grundkurs Leistungselektronik, Vieweg-Teubner Verlag* 🕮 *Brosch, P. F.: Leistungselektronik : kompakte Grundlagen und Anwendungen* 🕮 *Jäger, Rainer: Leistungselektronik : Grundlagen und Anwendungen, VDE Verlag* 🕮 *Lappe, R.; Conrad, H.; Kronberg, M.: Leistungselektronik, Verlag Technik*

Module 20: Parallel and Distributed Systems

Degree course:	*Master of Information and Electrical Engineering*
Module name:	*Parallel and Distributed Systems*
Abbreviation	*PvSy*
Subtitle	
Teaching sessions, if applicable: **(L / S / T / P)**	*1/1/0/2*
Semester:	*Annually in the winter semester*
Person responsible for the module:	*Prof. S. Pawletta*
Lecturer:	*Prof. S. Pawletta*
Language:	*German*
Classification in the curriculum	*Elective Module in the Master of Information and Electrical Engineering*
Teaching format / contact hours (CH):	*1 CH lecture, 1 CH seminar, 2 CH laboratory practical classes* *Approved number of participants:* *Lectures 60, seminars 35, practical classes 15, complies with capacity guidelines*
Workload:	*150 h including 16 weeks each of 4 CH on-campus study*
Credits:	*5 CR*
Entry requirements:	*Basic principles of C and Matlab programming*
Learning targets / competencies:	*Ability to create parallel and distributed software applications*

Contents:	• *Principles of parallel and distributed systems (hardware, software, paradigms)* • *Examples of technical applications and projects in engineering*
Assessment types:	*120 minute written examination or 20 minute oral examination or alternative assessment, see Appendix 1 of the examination regulations* *Prerequisite for admission to examinations defined by the examination regulations, section 7 (4)*
Media formats:	*Board presentation, overhead presentation, scripts and websites presented in lectures*
Literature:	🕮 *Culler, D. E. et al: Parallel Computer Architecture: A Hardware/Software Approach, Morgan Kaufmann* 🕮 *Fink, R.: Parallelverarbeitung mit wissenschaftlich-technischen Berechnungsumgebungen*

Module 21: Microprocessor Engineering in Mobile Devices

Degree course:	*Master of Information and Electrical Engineering* *Master of Mechatronics* *Master of Multimedia Engineering*
Module name:	*Microprocessor Engineering in Mobile Devices*
Abbreviation	*MPmG*
Subtitle	
Teaching sessions, if applicable:	
Semester:	*Annually in the summer semester*
Person responsible for the module:	*Prof. Buller*
Lecturer:	*Prof. Buller*
Language:	*German*
Classification in the curriculum	*Elective Module in the Master of Information and Electrical Engineering;* *Elective Module in the Master of Mechatronics;* *Elective Module in the Master of Multimedia Engineering*
Teaching format / contact hours (CH):	*1 CH lecture, 1 CH seminar, 2 CH practical classes* *Approved number of participants:* *Lectures 40, seminars 20, practical classes 8, complies with capacity guidelines*

Workload:	*150 h including 16 weeks each of 4 CH on-campus study*
Credits:	*5 CR*
Entry requirements:	*Application-ready knowledge in the areas of microprocessor engineering, informatics, circuit engineering and programming*
Learning targets / competencies:	*Ability to develop concepts and technically detailed solutions for the use of microprocessors in mobile devices with direct user interfaces*
Contents:	• *Summary and processor examples with 16/32 bit and 32 bit processing width (Blackfin Micro Signal Architecture, ARM(TM) – Cortex family)* • *Power management* • *CapSense(TM) and TrueTouch(TM) – menu control* • *Technologies and control variants for graphic modules* • *Location and movement detection, integrated sensors* • *Interfaces for analogue and digital signals* • *Programming and signal processing* • *Examples of applications in the areas of biosignal and audio signal processing*
Assessment types:	*120 minute written examination*
Media formats:	*Board presentation, OpenOffice Impress and Mediator presentations, overhead presentation, scripts presented in lectures*
Literature:	🕮 *Yiu, Joseph:* The Definitive Guide to ARM® Cortex®-M3 and Cortex®-M4 Processors, *Elsevier, 2013, ISBN-10: 0124080820* 🕮 *Gan, Woon-Seng; Sen M. Kuo: Micro Signal Architecture, Wiley, 2007, ISBN - 978-0-471-73841-1* 🕮 *Martin, Trevor:* The Designer's Guide to the Cortex-M Processor Family: A Tutorial Approach, *Elsevier, 2013; ISBN-10: 0080982964* 🕮 *Schwark, Stefan; Bernhard Wörndl-Aichriedler: Android Programmierung und Hardware-Steuerung, Elektor, 2013, ISBN 978-3-89567-272-7* 🕮 CrossCore Embedded Studio C/C++ Compiler and Library Manual for Blackfin Processors *; Analog Devices, Inc.,2013, Part Number 82-100116-01* 🕮 *P*SoC® 5LowPower Architecture Technical Reference Manual*; Cypress Inc., 2013, Document No. 001-78426 Rev. *C* 🕮 ***Focus:*** *Use of technical documentation and additional materials provided by companies for the modules or development systems used in the practical class, updated versions of each*

Module 22: Telecommunications Engineering Project

Degree course:	*Master-Studiengang Informations- und Elektrotechnik*
Module name:	*Telecommunications Engineering Project*

Abbreviation	*NP*
Subtitle	
Teaching sessions, if applicable: (LV/SU/Ü/P)	*0/0/4/0*
Semester:	*Annually in the summer semester*
Person responsible for the module:	*Professor heading the course*
Lecturer:	*Professor heading the course*
Language:	*German or English*
Classification in the curriculum	*Elective Module in the Master of Information and Electrical Engineering*
Teaching format / contact hours (CH):	*4 CH tutorial* *Approved number of participants:* *Tutorials 20, complies with capacity guidelines*
Workload:	*150 h including 16 weeks each of 4 CH on-campus study*
Credits:	*5 CR*
Entry requirements:	*Digital Communications, Communication Systems*
Learning targets / competencies:	*Ability to independently carry out typical tasks of electrical engineering*
Contents:	• *Project groups work on practical tasks of telecommunications* • *Acquired results are prepared as scientific documentations* • *Project progress is discussed between the groups under guidance of lecturers*
Assessment types:	*Alternative assessment, see Appendix 1 of the examination regulations*
Media formats:	*Board presentation, overhead presentation, group discussions*
Literature:	🕮 *Up-to-date literature matching the specific telecommunications task*

Module 23: Thermal, Air Conditioning and Refrigeration Engineering

see modul handbook of Master course Energy and Resource Efficient Technologies

Module 24: Video Processing

see module handbook of Master course Applied Informatics - Multimedia Engineering

Module 25: Flow Machines

see modul handbook of Master course Energy and Resource Efficient Technologies

Module 26: Efficient Energy Management

see modul handbook of Master course Energy and Resource Efficient Technologies

Module 27: Knowledge based Systems

see Module handbook of Master course Business Informatics

Module 28: Electrical Drive Engineering II

Degree course:	*Master of Information and Electrical Engineering*
Module name:	*Electrical Drive Engineering II*
Abbreviation	*AnT II*
Subtitle	
Teaching sessions, if applicable: (LV/SU/Ü/P)	*1/1/1/1*
Semester:	*Annually in the summer semester*
Person responsible for the module:	*Prof. Dr.-Ing. Chiadò Caponet*
Lecturer:	*Prof. Dr.-Ing. Chiadò Caponet*
Language:	*German or English*
Classification in the curriculum	*Compulsory module in the Master of Information and Electrical Engineering, specialist area electrical power engineering*
Teaching format / contact hours (CH):	*1 CH lecture, 1 CH seminar, 2 CH practical class* *Approved number of participants:* *Lectures 60, seminars 35, practical classes 15, complies with capacity guidelines*
Workload:	*150 h including 16 weeks each of 4 CH on-campus study*
Credits:	*5 CP*
Entry requirements:	*Electrical Drive Engineering I*
Learning targets / competencies:	*Compentence in the design and use of electric drive systems* *Behavior of induction machines, in particular with power converter feeding* *Field-Oriented Control of Electrical Drives: concepts and applications*
Contents:	• *Dynamic model and behavior of the DC machine* • *Induction machine and brushless machine supplied by voltage source inverter (Six-Steps and PWM control)* • *Induction machine and brushless machine with field-oriented control*
Assessment types:	*120 minute written examination or 20 minute oral examination or alternative assessment, see Appendix 1 of the examination regulations* *Prerequisite for admission to examinations defined by the examination regulations, section 7 (4)*
Media formats:	*Board presentation, overhead presentation*
Literature:	🕮 *Hagl, R.,: Elektrische Antriebstechnik, 2 Auflage, Hanser* 🕮 *Fuest, K, Döring, P.:Elektrische Maschinen und Antriebe -Lehr- und Arbeitsbuch für Gleich-, Wechsel- und Drehstrommaschinen sowie Elektronische Antriebstechnik", Viewegs* 🕮 *Vogel, J, u.a.: Grundlagen der elektrischen Antriebstechnik mit Berechnungsbeispiel, Veb Verlag*

	Technik Berlin 📖 *Probst, U,: Servoantriebe in der Automatisierungstechnik, Vieweg+Teubner* 📖 *Mohan N.: Advanced Electric Drives: Analysis, Control, and Modeling Using MATLAB/Simulink®, John Wiley & Sons, Inc., 2014*

Module 29: Electrical Power Engineering II

Degree course:	*Master-Studiengang Informations- und Elektrotechnik*
Module name:	*Electrical Power Engineering II*
Abbreviation	*EET II*
Subtitle	
Teaching sessions, if applicable: (LV/SU/Ü/P)	*1/1/1/1*
Semester:	*Annually in the summer semester*
Person responsible for the module:	*Prof. Dr.-Ing. Chiadò Caponet*
Lecturer:	*Prof. Dr.-Ing. Chiadò Caponet*
Language:	*Deutsch*
Classification in the curriculum	*Elective Module in the Master of Information and Electrical Engineering*
Teaching format / contact hours (CH):	*1 CH lecture, 1 CH seminar, 1 CH tutorial, 1 CH laboratory practical class* *Approved number of participants:* *Lectures 60, seminars 35, tutorials 20, practical classes 15, complies with capacity guidelines*
Workload:	*150 h including 16 weeks each of 4 CH on-campus study*
Credits:	*5 CP*
Entry requirements:	*Electric Power Engineering I*
Learning targets / competencies:	*Knowledge of photovoltaic systems: construction, operating principle and design* *Knowledge of wind turbines: construction, operating principle and design*
Contents:	• *Operating principle of photovoltaic cells, comparison of different technologies, electrical parameters, equivalent circuit diagram. Integration in photovoltaic systems, island systems, network coupling.* • *Construction and operating principle of modern wind turbines: fundamentals and concepts.* • *Double-fed asynchronous wind generator. operating principle of the generator with wind strengths change and output voltage and frequency regulation. Synchronization to a running network. of Control of active and reactive power, frequency, voltage.* • *Behavior of wind turbines in the case of grid faults*

Assessment types:	*120 minute written examination or 20 minute oral examination or alternative assessment, see Appendix 1 of the examination regulations* *Prerequisite for admission to examinations defined by the examination regulations, section 7 (4)*
Media formats:	*Board presentation, overhead presentation*
Literature:	🕮 *Heuck K., Dettmann K, Schulz D., Elektrische Energieversorgung, 9., Auflage, SpringerVieweg Wiesbaden* 🕮 *Wagner A, Photovoltaik Engineering, Springer Verlag, Berlin, Heidelberg, New York*