Hochschule Rosenheim
University of Applied Sciences

Course Descriptions

EE/IT Master's (M.Eng.) Program

in

Electrical Engineering

and

Information Technology

Rev. Feb. 13, 2012

Contents

Abbreviation explanations and footnotes see following page.

Abbreviations and Footnotes

MG	Advanced Mathematical and Electrical Engineering Fundamentals 1)
MA	Application-Oriented Subjects
MV	Specialization Courses, to be Elected from a Range of Subjects in the Areas of Automation&Control or Communications 2)
MF	General Technical Elective Courses 3)
MP	Project Management Related Courses
SU	Lecture
P	Lab Class
Ü	Exercise
PR	Project
SWS	Weekly Hours (a 45 Minutes)
CPs	ECTS Credit Points

1) Courses MG01 or MG02 may be taken alternatively. Course MG03 is mandatory.

2) A minimum of 21 CPs must be earned from the MV group of courses.

3) A minimum of 12 CPs must be earned from the MF group of elective courses.

   Please note that Rosenheim University of Applied Sciences is under no obligation to offer an EE/IT Master's program elective course (MF group) when enrolment is insufficient ! For courses which are mainly based on lab class work, enrolment may be limited.

   On request also courses from the MV group can be taken to fulfil the MF credits requirement of 12 CPs. However this has to be explicitly approved by the EE/IT Master's Program Examination Commission.

4) Course MV05 can only be taken in combination with course MV02. Both courses are graded independently.

5) Course MV06 comprises a lecture part MV06.1 and a lab class part MV06.2 which can only be taken in combination. The lab class part is graded separately and counts for the overall final mark.

Sample Study Plan - Specialization in Automation & Control

Starting with Spring/Summer Term (Sommersemester)

The order of semesters may be changed if necessary as course contents in all three semesters are independent of each other. Please note that courses are typically held *once* per year, i.e. *either* in the spring/summer term *or* in the fall/winter term.

Semester 1 Spring/Summer Term (Lecture Period: March 15th - approx. July 7th)

No.	Module / Course Title	Type	Hours	CPs
MV01	Advanced Control Systems	Lecture/Lab	4	5
MV02	Industrial Process Control	Lecture/Lab	4	5
MV05	Industrial Process Technology	Lecture	2	2
MA01	Real-Time Systems	Lecture/Lab	4	5
MA02	Integrated Circuit System Design	Lecture/Lab	4	5
MFnn	General Technical Elective	Lecture/Lab	4	5
MFnn	German Course for Intl. Students - Beginner's Level II	Lecture	4	2
	Total		26	29

Semester 2 Fall/Winter Term (Lecture Period: October 1st - approx. January 20th)

No.	Module / Course Title	Type	Hours	CPs
MG03	Solid State Electronics	Lecture/Lab	4	5
MV03	Electrical Motion Control	Lecture/Lab	4	5
MV10	Electromagnetic Compatibility	Lecture/Lab	2	3
MP01	Project Management	Lect./Exerc.	2	2
MP02	Master's Project	Project	4	8
MFnn	General Technical Elective	Lect/Lab/Ex.	2	3
MFnn	General Technical Elective	Lecture/Lab	2	3
	Total		20	29

Semester 3 Spring/Summer Term (Lecture Period: March 15th - approx. July 7th)

No.	Module / Course Title	Type	Hours	CPs
MG01	Advanced Engineering Mathematics	Lect./Exerc.	4	5
MP03	Master's Thesis	Project	6	27
	Total		10	32

The examination period in the winter semester is from about January 25th until February 15th ; the examination period in the summer semester is typically from about July 5th until July 25th.

Sample Study Plan - Specialization in Automation & Control

Starting with Fall/Winter Term (Wintersemester)

The order of semesters may be changed if necessary as course contents in all three semesters are independent of each other. Please note that courses are typically held *once* per year, i.e. *either* in the spring/summer term *or* in the fall/winter term.

Semester 1 Fall/Winter Term (Lecture Period: October 1st - approx. January 20th)

No.	Module / Course Title	Type	Hours	CPs
MG03	Solid State Electronics	Lecture/Lab	4	5
MV03	Electrical Motion Control	Lecture/Lab	4	5
MV10	Electromagnetic Compatibility	Lecture/Lab	2	3
MP01	Project Management	Lect./Exerc.	2	2
MP02	Master's Project	Project	4	8
MFnn	General Technical Elective	Lect/Lab/Ex	2	2
MFnn	General Technical Elective	Lect/Lab/Ex	2	2
MFnn	German Course for Intl. Students - Beginner's Level I	Lecture	4	2
	Total		24	29

Semester 2 Spring/Summer Term (Lecture Period: March 15th - approx. July 7th)

No.	Module / Course Title	Type	Hours	CPs
MG01	Advanced Engineering Mathematics	Lect./Exerc.	4	5
MV01	Advanced Control Systems	Lecture/Lab	4	5
MV02	Industrial Process Control	Lecture/Lab	4	5
MV05	Industrial Process Technology	Lecture	2	2
MA01	Real-Time Systems	Lecture/Lab	4	5
MA02	Integrated Circuit System Design	Lecture/Lab	4	5
MF13	Programming with LabVIEW	Lecture/Lab	4	5
	Total		26	32

Semester 3 Fall/Winter Term (Lecture Period: October 1st - approx. January 20th)

No.	Module / Course Title	Type	Hours	CPs
MFnn	General Technical Elective	Lecture/Lab	2	3
MP03	Master's Thesis	Project	6	27
	Total		8	30

The examination period in the winter semester is from about January 25th until February 15th ; the examination period in the summer semester is typically from about July 5th until July 25th.

Sample Study Plan - Specialization in Communication Technology

Starting with Spring/Summer Term (Sommersemester)

The order of semesters may be changed if necessary as course contents in all three semesters are independent of each other. Please note that courses are typically held *once* per year, i.e. *either* in the spring/summer term *or* in the fall/winter term.

Semester 1 Spring/Summer Term (Lecture Period: March 15th - approx. July 7th)

No.	Module / Course Title	Type	Hours	CPs
MV07	Advanced Digital Communication	Lecture/Lab	4	5
MV08	Digital Signal Processing	Lecture/Lab	4	5
MA01	Real-Time Systems	Lecture/Lab	4	5
MA02	Integrated Circuit System Design	Lecture/Lab	4	5
MFnn	General Technical Elective	Lecture/Lab	4	5
MFnn	German Course for Intl. Students - Beginner's Level II	Lecture	4	2
	Total		24	27

Semester 2 Fall/Winter Term (Lecture Period: October 1st - approx. January 20th)

No.	Module / Course Title	Type	Hours	CPs
MG02	Electrodynamics	Lect./Exerc.	4	5
MG03	Solid State Electronics	Lecture/Lab	4	5
MV06	Wireless Communication Systems	Lecture/Lab	6	7
MV09	Computer Aided Design of Analog ICs	Lecture/Lab	3	4
MFnn	General Technical Elective	Lect/Lab/Ex	2	3
MP01	Project Management	Lect./Exerc.	2	2
MP02	Master's Project	Project	4	8
	Total		25	34

Semester 3 Spring/Summer Term (Lecture Period: March 15th - approx. July 7th)

No.	Module / Course Title	Type	Hours	CPs
MFnn	General Technical Elective	Lect/Lab/Ex	2	3
MP03	Master's Thesis	Project	6	27
	Total		8	30

The examination period in the winter semester is from about January 25th until February 15th ; the examination period in the summer semester is typically from about July 5th until July 25th.

Sample Study Plan - Specialization in Communication Technology

Starting with Fall/Winter Term (Wintersemester)

The order of semesters may be changed if necessary as course contents in all three semesters are independent of each other. Please note that courses are typically held *once* per year, i.e. *either* in the spring/summer term *or* in the fall/winter term.

Semester 1 Fall/Winter Term (Lecture Period: October 1st - approx. January 20th)

No.	Module / Course Title	Type	Hours	CPs
MG02	Electrodynamics	Lect./Exerc.	4	5
MG03	Solid State Electronics	Lecture/Lab	4	5
MV06	Wireless Communication Systems	Lecture/Lab	6	7
MV09	Computer Aided Design of Analog ICs	Lecture/Lab	3	4
MP01	Project Management	Lect./Exerc.	2	2
MF01	Microelectronics	Lect/Lab	4	5
MFnn	German Course for Intl. Students - Beginner's Level I	Lecture	4	2
	Total		27	30

Semester 2 Spring/Summer Term (Lecture Period: March 15th - approx. July 5th)

No.	Module / Course Title	Type	Hours	CPs
MV07	Advanced Digital Communication	Lecture/Lab	4	5
MV08	Digital Signal Processing	Lecture/Lab	4	5
MA01	Real-Time Systems	Lecture/Lab	4	5
MA02	Integrated Circuit System Design	Lecture/Lab	4	5
MF15	Memory Technologies	Lecture	2	2
MP02	Master's Project	Project	4	8
	Total		22	30

Semester 3 Fall/Winter Term (Lecture Period: October 1st - approx. January 20th)

No.	Module / Course Title	Type	Hours	CPs
MFnn	General Technical Elective	Lect/Lab/Ex	2	3
MP03	Master's Thesis	Project	6	27
	Total		8	30

The examination period in the winter semester is from about January 25th until February 15th ; the examination period in the summer semester is typically from about July 5th until July 25th.

MG: Advanced Mathematical and Electrical Engineering Fundamentals

Program:	**Master's Program in Electrical Engineering and Information Technology**
Module / Course Title:	**Advanced Engineering Mathematics**
No:	**MG01**
Semester:	EIT M1-3 (summer term)
Coordinator / Responsibility:	Prof. Dr. Walter Häußler
Teacher:	Prof. Dr. Walter Häußler
Language:	English
Position in Curriculum:	Semi-mandatory course in EE/IT Master's program (alternatively to Electrodynamics, MG02)
Course Type / Weekly Hours:	70% lecture, 30% exercises, 4 hours per week
Workload:	Duration 1 semester Lecture/class presence: 4 hours x 15 weeks = 60 hours Lecture follow-up: 30 hours Exercise preparation/follow-up: 40 hours Examination preparation: 20 hours Total workload: 150 hours
Credits:	5
Prerequisites:	Knowledge of mathematical fundamentals
Goals / Learning Objectives:	**Goals** • Knowledge of selected numerical algorithms and insight into the necessity of approximate solutions for real world engineering problems. Capability to assess limits of numerical methods. **Learning Objectives** • Understanding of rounding errors and limited precision of numerical methods • Assessing algorithmic variants with respect to ist use, performance and reliability of results
Contents:	Representation of numbers, rounding errors, error analysis. Iterative solution of zeroes of nonlinear equations. Matrix- and vectornorms. Iterative solution of eigenvector problems. Direct and iterative solution of linear systems of equations. Iterative solution of nonlinear systems of equations. Interpolation, approximation and Fourier transformations. Numerical integration and differentiation. Numerical solution of ordinary and partial differential equations. Finite element method.
Grading / Examination:	Written examination (90 minutes) in examination period
Material:	Lecture notes, exercise problem descriptions, MatLab sample programs, demonstration of program results
Literature:	J. Faires, R. Burden: *Numerical Analysis*, Brooks/Cool, 2001 A. Quarteroni, R. Sacco, F.Saleri: *Numerical Mathematics*, Springer Verlag, 2000 J. Stoer: *Numerische Mathematik*, Bd. 1, Springer Verlag, 1999 J. Stoer, R. Bulirsch: *Numerische Mathematik*, Bd. 2, Springer Verlag, 2000

Program:	**Master's Program in Electrical Engineering and Information Technology**
Module / Course Title:	**Electrodynamics**
No:	**MG02**
Semester:	EIT M1-3 (winter term)
Coordinator / Responsibility:	Prof. Dr. Michael Diegelmann
Teacher:	Prof. Dr. Michael Diegelmann
Language:	English
Position in Curriculum:	Semi-mandatory course in EE/IT Master's program (alternatively to Advanced Engineering Mathematics, MG01)
Course Type / Weekly Hours:	50% lecture, 50% exercises, 4 hours per week
Workload:	Duration 1 semester Lecture/class presence: 4 hours x 15 weeks = 60 hours Lecture follow-up: 30 hours Exercise preparation/follow-up: 40 hours Examination preparation: 20 hours Total workload: 150 hours
Credits:	5
Prerequisites:	Mathematics (analysis and geometry) Physics (electrostatics and magnetostatics)
Goals / Learning Objectives:	**Goals** • The mathematical and physical principles of classical electrodynamics form the basis of all applications where the interaction of electromagnetic fields with technical systems is of importance, e.g. propagation of electromagnetic waves, antenna theory, electromagnetic compatibility (EMC) etc. **Learning Objectives** • Introduction to vector analysis 1) • Analysis of static and time-dependent electromagnetic fields and their interaction with electrical systems 1) • Introduction to numerical methods and FEM software for the solution of practical electrodynamics problems 2)
Topics:	**Part I – Mathematical Principles (Vector Analysis)** Vector representations and coordinate systems, coordinate transformations. Operations and functions involving vectors, scalar fields and vector fields. Differentiation of functions involving vectors (gradient, divergence, curl, laplacian operator). Integration of functions involving vectors (line, surface and volume integrals). Integral theorems (Gauss, Stokes, Green's theorems). 1) **Part II – Electrodynamics** Electric fields of static charge distributions. Gauss' law. Energy of charge distributions and of electric fields. Magnetic fields of stationary current distributions. Lorentz force, vector potential, divergence and curl of magnetic fields. Time dependent electromagnetic fields. Faraday's law of induction. Maxwell's addition; the set of Maxwell's equations. The differential equation of waves in free space and in a dielectric; plane wave solution. Retarded potentials. 1) Dipole radiation. Wave guides and resonators. Applica-

	tion of the theory of special relativity to electrodynamics; Minkovski space; Four Vectors; Lorentz transformation of electromagnetic fields. Quantum aspects of electromagnetic fields. Numerical evaluation of electromagnetic fields using FEM techniques. [2)]
Grading / Examination:	Written examination (90 minutes) in examination period
Material:	Lecture notes, worksheets available as download files
Literature:	Jackson, John David: *Classical Electrodynamics*, John Wiley & Sons, 1998; ISBN 0-471-30932-X Spiegel, Murray R.: *Vector Analysis*, McGraw-Hill, 1959; ISBN 0-07-060228-X Bronstein, I.N., Semendjajew, K.A.: *Handbook of Mathematics*, Springer Verlag, 2003; ISBN 3-540-43491-7

[1]) main/core topics

[2]) optional/additional topics depending on students' interests, skills and time available

Program:	**Master's Program in Electrical Engineering and Information Technology**
Module / Course Title:	**Solid State Electronics**
No:	**MG03**
Semester:	EIT M1-3 (winter term)
Coordinator / Responsibility:	Prof. Dr. Popp (I), Prof. Dr. Müller (II)
Teacher:	Prof. Dr. Popp (I), Prof. Dr. Müller (II)
Language:	English
Position in Curriculum:	Mandatory course in EE/IT Master's program
Course Type / Weekly Hours:	75% lectures, 25% lab class, 4 hours per week
Workload:	Duration 1 semester Lecture/class presence: 4 hours x 15 weeks = 60 hours Lecture follow-up: 40 hours Lab class preparation/follow-up: 30 hours Examination preparation: 20 hours Total workload: 150 hours
Credits:	5
Prerequisites:	Working principles of electronic devices. Basic knowledge of the atomic structure of matter and electronic properties of materials. Knowledge of the fundamental mechanisms of interaction.
Goals / Learning Objectives:	**Goals** • Enable students to understand the principles of quantum effect devices • Give insight into fundamentals of nano technology
Topics:	**Part I (Popp)** Fundamental principles of quantum mechanics. Bandgap engineering. Heterostructure devices and quantum effect devices. **Part II (Müller)** Scanning probe microscopy: Working principle, interaction between sample and cantilever, modes of operation (contact, non-contact, tapping, MFM), structuring at a nanoscale. Scanning electron microscopy: Interaction electron beam with matter, EDX. Nano materials: Production methods, properties. Practical lab exercises.
Grading / Examination:	Oral test (15 minutes) at end of lecture period
Material:	Lecture notes, worksheets available as PDF download
Literature:	R. E. Hummel: *Electronic Properties of Materials*, Springer, New York, 2001 S. M. Sze: *High-Speed Semiconductor Devices*, John Wiley, New York, 1990 G. Timp: *Nanotechnology*, Springer, New York, 1998 J. I. Goldstein: *Scanning Electron Microscopy and X-Ray Microanalysis*, Plenum Press, New York, 1992 D. Sarid: *Scanning Force Microscopy*, Oxford University Press, New York, 1991 Application notes by: - Veeco Instruments [http://www.veeco.com] - NT-MDT [http://www.ntmdt.com]

Program:	**Master's Program in Electrical Engineering and Information Technology**
Module / Course Title:	**Real-Time Systems**
No:	**MA01**
Semester:	EIT M1-3 (summer term)
Coordinator / Responsibility:	Prof. Dr. B. Mysliwetz (I), Prof. Dr. W. Schittenhelm (II)
Teacher:	Prof. Dr. B. Mysliwetz (I), Prof. Dr. W. Schittenhelm (II)
Language:	English
Position in Curriculum:	Mandatory course in EE/IT Master's program. Technical elective course for EIT-Diplom program in 8th semester.
Course Type / Weekly Hours:	50% lectures, 50% lab class, 4 hours per week
Workload:	Duration 1 semester Lecture/class presence: 4 hours x 15 weeks = 60 hours Lecture follow-up: 20 hours Lab class preparation/follow-up: 50 hours Examination preparation: 20 hours Total workload: 150 hours
Credits:	5
Prerequisites:	Working principles of microprocessors (IO, interrupts, stack). Programming experience in a blockstructured high level language, preferably ANSI C or C++. Basic knowledge of structure and working principles of a 'general purpose' operating system. Fundamental knowledge of the functional units of a personal computer. Fundamentals of control theory.
Goals / Learning Objectives:	**Goals** To enable students to design and implement software for real-time applications **Learning Objectives** at the end of this course, students will be able to: • Understand the mechanisms and problems associated with real-time applications • Apply real-time software design rules • Know the working principles and utilize the services of real-time operating systems • Realize the advantages of using real-time operating systems
Topics:	**PartI I – Real-Time Software Design and Real-Time Operating Systems (Mysliwetz)** Technical terms and definitions; examples of embedded real-time systems; real-time operating system concepts; processes, threads, tasks; scheduling principles; real-time software design; rate-monotonic scheduling approach; reentrant code; semaphores, mutual exclusion, shared resources; synchronization mechanisms; deadlocks; priority inversion; interprocess communication, overview of commercial real-time operating systems; practical laboratory exercises. **Lab (Part I)** Processes and Threads under Windows; Analysis of Fundamental Real-Time Properties of Windows on a PC; implementing a step motor control application with the real-time kernel µC/OS on an ARM Cortex-M based mi-

	crocomputer; application of semaphores as a mutual exclusion mechanism while accessing shared resources, effect of priority inversion. **Part II – PC-based Real-Time Control Systems (Schittenhelm)** Real-time applications based on personal computers: requirements, hardware and software design, overview and comparison of commercial PC-based systems. **Lab (Part II)** PC-based real-time systems via OPC-servers; Windows-CE development environment; real-time programming under VxWorks.
Grading / Examination:	Lab class preparation tests (3 x 15 minutes, 15%) in part I plus written test (60 minutes, 85%) at end of lecture period
Material:	Lecture notes, worksheets and lab-class problem descriptions available as PDF download files
Literature:	Labrosse, J. J.: *MicroC/OS-II - The Real-Time Kernel*, CMP Books, 1999; ISBN 0-87930-543-6 Tanenbaum, A. S.: *Modern Operating Systems*, Prentice Hall, 1992 Brause, R.: *Betriebssysteme - Grundlagen und Konzepte*, Springer, 2001; ISBN 3-540-67598-1 Iwanitz, F., Lange, J.: *OPC Fundamentals, Implementation and Application*; Hüthig-Verlag, 2002; ISBN 3-77-852883-1 Stallings, W.: *Operating Systems: Internals and Design Principles*, Prentice Hall, 2001; ISBN 0-13-031999-6

MA: Application-Oriented Subjects

Program:	**Master's Program in Electrical Engineering and Information Technology**
Module / Course Title:	**Integrated Circuit System Design**
No:	**MA02**
Semester:	EIT M1-3 (summer term)
Coordinator / Responsibility:	Prof. Dr. H. Thurner (I), Prof. Dr. W. Mayr (II)
Teacher:	Prof. Dr. H. Thurner (I), Prof. Dr. W. Mayr (II)
Language:	English
Position in Curriculum:	Mandatory course in the EE/IT Master's program
Course Type / Weekly Hours:	Part I lectures (80%), Lab (20%) / 2 hours per week Part II lectures / 2 hours per week
Workload:	Duration: 1 semester **Part I** Lecture/class presence: 2 hours x 15 weeks = 30 hours Lab class preparation: 15 hours Lecture follow-up: 15 hours Examination preparation: 15 hours Total workload for part I: 75 hours **Part II** Lecture/class presence: 2 hours x 15 weeks = 30 hours Lecture follow-up: 15 hours Problem sheet solution: 15 hours Examination preparation: 15 hours Total workload for part II: 75 hours
Credits:	5 CP
Prerequisites:	**Part I** Familiarity with digital logic and switching circuits; basic knowledge of a high level programming language. **Part II** Good knowledge of the representation of continuous and time discrete signals in the time and frequency domain; fundamentals of digital signal processing, analogue and digital circuit design.
Goals / Learning Objectives:	**Learning Objectives** at the end of this course, students shall be able to: **Part I** • Understanding the fundamentals of digital VLSI (or SoC) circuit design methodology. • Design digital VLSI (or SoC) circuits using a hardware description language (e.g. VHDL) to model the circuit behavior at different abstraction layers, circuit synthesis and circuit and system verification. • Optimizing architecture design at RTL level using equivalent transforms for combinational and sequential computations **Part II** • Understand the fundamental problems associated with analogue to digital and digital to analogue conversion • Assess the properties of data converters as given in the corresponding data sheets in order to select ap-

	propriate components for a given application **Goals** **Part I** • To enable students to design complex digital circuits (ASICS or FPGAs) and systems using architecture optimization at RTL level and a hardware description language (e.g. VHDL), synthesis and system simulation. **Part II** • To enable students to design mixed signal systems in a professional manner with respect to the properties of real world data converters
Topics:	**Part I – Design of Digital Integrated VLSI Circuits** Design methodology: modelling behaviour and structure using different levels of abstraction. Design flow, synthesis etc., synchronous design. Introduction to VHDL: design of combinational logic (multiplexers, coders etc.), logic design with processes (adders etc.), design of sequential circuits (synchronous counters, finite state machines etc.), synchronous design in VHDL, testbenches for simulation Architecture design at RTL level: Data dependency graph, isomorphic architecture, equivalent transforms for combinational and sequential computations **Part II - Analog Digital and Digital Analog Converters** Fundamentals of data conversion, discrete and fast Fourier transform including the use of windows, analogue and quantization noise, voltage references, static properties of data converters, dynamic properties of data converters, fast ADC architectures
Grading / Examination:	Written test (90 minutes) at the end of the semester
Material:	**Part I**: Lecture notes, problem sheets and lab-class problem descriptions **Part II**: Book like lecture notes and problem sheets including detailed solutions
Literature:	**Part I** Hubert Kaeslin: *Digital Integrated Circuit Design*; Cambridge University Press, ISBN 978-0-521-88267-5 M.J.S.Smith: *Application-Specific Integrated Circuits*; Addison-Wesley; ISBN 0-205-50022-1 Mark Zwolinski: *Digital System Design with VHDL*; Prentice Hall; ISBN 0 20136063 2 Peter J. Ashenden: *The VHDL Cookbook*; ftp://ftp.cs.adelaide.edu.au/users/petera or in http://tech-www.informatik.uni-hamburg.de/VHDL/ Peter J. Ashenden: *The Student's Guide to VHDL*; Morgan Kaufman Publishers Inc.; ISBN 1-55860-520-7 J. Reichardt, B. Schwarz: *VHDL-Synthese, Entwurf digitaler Schaltungen und Systeme*; Oldenburg Verlag;

	ISBN 3-486-25809-5 Dirk Jansen: *Handbuch der Electronic Design Automation*; Hanser Verlag; ISBN 3-446-21288-4 Norbert Reifschneider: *CAE-gestützte IC-Entwurfsmethoden*; Prentice Hall; ISBN 3-8272-9550-5 A.Mäder: *VHDL Kurzbeschreibung*; http://tech-www.informatik.uni-hamburg.de/VHDL/ **Part II** Demler, Michael J.: *High Speed Analog to Digital Conversion*, Academic Press 1991,ISBN-0-122-09048-9 Hoeschele, *David F.: Analog to Digital and Digital to Analog Conversion Techniques*, J. Wiley, 1994, ISBN-0-471-57147-4 Kester, Walt (Ed.): *Mixed Signal and DSP Design Techniques*, Analog Devices Inc., 2000, ISBN-0-916550-23-0 Kester, Walt (Ed.): *System Application Guide*, Analog Devices Inc., 1993, ISBN-0-916550-13-3

Program:	**Master's Program in Electrical Engineering and Information Technology**
Module / Course Title:	**Advanced Control Systems**
No:	**MV01**
Semester:	EIT M1-3 (summer term)
Coordinator / Responsibility:	Prof. Dr. W. Schittenhelm
Teacher:	Prof. Dr. W. Schittenhelm
Language:	English:
Position in Curriculum:	Specialization subject in EE/IT Master's program
Course Type / Weekly Hours:	75% lectures, 25% lab class, 4 hours per week
Workload:	Duration 1 semester Lecture/class presence: 4 hours x 15 weeks = 60 hours Lecture follow-up: 25 hours Lab class preparation/follow-up: 40 hours Examination preparation: 25 hours Total workload: 150 hours
Credits:	5
Prerequisites:	'Classical' control theory in time and frequency domain. Vector and matrix fundamentals.
Goals / Learning Objectives:	**Goals** Enable students to design modern control systems **Learning Objectives** at the end of this course, students will be able to: • Apply state space descriptions to control systems • Analyse a system's stability, controllability and observability • Design state space controllers by pole placement • Apply Fuzzy logic to control systems
Topics:	**State Space Control** State space description, solutions for the state space equations, analysis of state space description (stability, controllability, observability). State space controller design, controller structure, computation of the filter, computation of the controller matrix. State observer. **Non-linear control** Application of Fuzzy logic in control systems, fundamental ideas of Fuzzy logic, operations with Fuzzy sets, Fuzzy controller design, summary of advantages and disadvantages of Fuzzy control.
Grading / Examination:	Written examination (90 minutes) in examination period
Material:	Lecture notes, worksheets and lab-class problem descriptions available as PDF download files
Literature:	Dabney, J., Harman, Th. L.: *Mastering SIMULINK*, Pearson Prentice Hall; 2004; ISBN 013142477-7 Biran, A., Bell, A.H., Breiner, M.: *MatLab 6 for Engineers*, Prentice Hall of Australia, 2002; ISBN 0130336319 Ogata, K.: *Modern Control Engineering*, Prentice Hall, 4th edition, 2001; ISBN 0130609072 Ogata, K.: *Discrete-Time Control Systems*, Prentice Hall, 2nd edition, 1994; ISBN 0130342815

	Franklin, G.F., Powell, J.D., Emani-Naeini, A.: *Feedback Control of Dynamic Systems*, Prentice Hall; 4th edition, 2002; ISBN 0130980412 Dorf, R.C., Bishop, R.H.: *Modern Control Systems*, Prentice Hall, 9th edition, 2001; ISBN 013031411-0

Program:	**Master's Program in Electrical Engineering and Information Technology**
Module / Course Title:	**Industrial Process Control**
No:	**MV02**
Semester:	EIT M1-3 (summer term)
Coordinator / Responsibility:	Prof. Werner Braatz
Teacher:	Prof. Werner Braatz
Language:	English
Position in Curriculum:	Specialization subject in EE/IT Master's program
Course Type / Weekly Hours:	50% lectures, 50% lab class, 4 hours per week
Workload:	Duration 1 semester Lecture/class presence: 4 hours x 15 weeks = 60 hours Lecture follow-up: 25 hours Lab class preparation/follow-up: 40 hours Examination preparation: 25 hours Total workload: 150 hours
Credits:	5
Prerequisites:	Basics of sensor applications in automation technology. Knowledge of electrical drives and pneumatic actuators. Experience in designing logic and sequential controllers. Basics of safety rules and safety devices in industrial automation.
Goals / Learning Objectives:	**Goals** To enable students to design and implement solutions for industrial automation **Learning Objectives** at the end of this course, students will be able to: • Design and implement control functions for process and plant automation • Evaluate different devices and methods • Develop more complex PLC programs • Integrate fieldbus systems
Topics:	Structure and operation of a PLC system (SIMATIC S7). Application of the hardware configurator: Examples for parallel wired plants and fieldbus configurations. Characteristic parameters of CPU and signal modules. Program block structure in PLC technology. Program examples in FBD/LAD/STL. Application of bit logic, timer and counter instructions. Overview of further functions. Processing of analogue measurement values. Simulation and program test with PLCSIM. Programming sequential control functions with GRAPH7. Integrating ProfiBus and ASI configurations. Connection of HMI Terminals. Integration of safety requirements.
Grading / Examination:	Written examination (90 minutes) in examination period
Material:	Lecture notes, worksheets and lab course descriptions available as download files. Videos, PPT-presentations, PC-simulations.
Literature:	Siemens A&D Translation Services (Eds.): *Dictionary of Electrical Engineering, Power Engineering and Automation*, 5th edition, 2003; ISBN 3-89578-192-4 FESTO Didactic: *Dictionary of Control Technology*

	Dietmar Schmid: *Automatisierungstechnik mit Informatik und Telekommunikation*, EUROPA Lehrmittel, 5. Auflage, 2002; ISBN 3-8085-5155-0 Hans Berger: *Automating with SIMATIC*, Siemens / MCD Verlag, 1. Auflage, 2000; ISBN 3-89578-133-9 W. Kriesel, O.W. Madelung: *The AS-Interface for Automation*, Carl Hanser Verlag, 2. Auflage, 1999; ISBN 3-89578-133-9

Program:	**Master's Program in Electrical Engineering and Information Technology**
Module / Course Title:	**Electrical Motion Control**
No:	**MV03**
Semester:	EIT M1-3 (winter term)
Coordinator / Responsibility:	Prof. Dr. Hagl
Teacher:	Prof. Dr. Hagl
Language:	English
Position in Curriculum:	Specialization subject in EE/IT Master's program
Course Type / Weekly Hours:	50 % lecture, 50% lab class, 4 hours per week
Workload:	Duration: 1 semester Lecture/class presence: 2*2 hours x 15 weeks = 60 hours Lecture follow-up: 25 hours Lab class preparation/follow-up: 40 hours Examination preparation: 25 hours Total workload: 150 hours
Credits:	5
Prerequisites:	Basic knowledge of time discrete control, mechanical transfer elements, MATLAB, electronics, DC-/ AC-motors.
Goals / Learning Objectives:	**Goals** Enable students to design and commission electromechanical and direct driven servo drives. Selection of the different components for servo drives (Motion controller, power electronics, measuring systems and mechanical transfer elements). Optimization of controller parameters and contouring behavior **Learning Objectives** Knowledge of static and dynamical behavior of different drive components and their interaction. Functional principles of motion controllers, including feed forward and filters. Specific characteristics of digital motion controllers. Optimization of parameter setting of motion controller. Understanding of field oriented control for 3-phase AC-motors without and with field weakening. Usage of simulation and engineering tools e.g. MATLAB and SIMULINK
Topics:	Static and dynamical requirements. Control structures and motion profiles. Motion control of stiff drive systems, including influence of sample time and processing dead time. Simulation and engineering tools. Motion control of elastic drive systems. Feed forward and filters. Practical courses for drive simulation. Dynamical models of DC and AC drives including field oriented control. Interaction of motor and mechanics. Influence of axis controllers on contouring behavior. Influence of position encoder. Practical exercises with drive systems.
Grading / Examination:	Written examination (90 minutes) for both parts at the end of part II in examination period. *)
Material:	Lecture notes, documentation for lab classes.
Literature:	Hans Groß, Jens Hamann, Georg Wiegärtner*: Electrical Feed Drives in Automation*, SIEMENS consumer publications, 2001, MLFB No. 6ZB3500-0AF02-0AA0 Kiel, Edwin: *Mechatronics for Production and Logistics*, Springer 2008, ISBN: 978-3-540-76704-6

Program:	**Master's Program in Electrical Engineering and Information Technology**
Module / Course Title:	**Automation Systems**
No:	**MV04**
Semester:	EIT M1-3 (winter term)
Coordinator / Responsibility:	Prof. Dr. W. Schittenhelm
Teacher:	Prof. Dr. W. Schittenhelm, Prof. W. Braatz (Lab Part 1)
Language:	English
Position in Curriculum:	Specialization subject in EE/IT Master's program
Course Type / Weekly Hours:	50% lectures, 50% lab class, 4 hours per week
Workload:	Duration 1 semester Lecture/class presence: 4 hours x 15 weeks = 60 hours Lecture follow-up: 25 hours Lab class preparation/follow-up: 40 hours Examination preparation: 25 hours Total workload: 150 hours
Credits:	5
Prerequisites:	Control theory in time domain. Familiarity with PLC- and C-programming.
Goals / Learning Objectives:	**Learning Objectives** at the end of this course, students will be able to: • Know the design of a robot control • Programming an industrial robot • Working with vision systems connected to a robot **Goals** To enable students to apply modern robot control systems
Topics:	Construction of an IR, coordinate systems, algorithms for path generation, transformation algorithms, interpolation, position control, blocks of a robot control, programming of IR, handling devices. Remote diagnostics and applications in shop floor.
Grading / Examination:	Written examination (90 minutes) in examination period
Material:	Lecture notes and lab-class problem descriptions available as PDF download files
Literature:	Angeles, J.: *Fundamentals of Robotic Mechanical Systems: Theory, Methods and Algorithms*, 2nd ed., Springer Verlag, New York, 2003; ISBN 0-387-95368-X

Program:	**Master's Program in Electrical Engineering and Information Technology**
Module / Course Title:	**Industrial Process Technology**
No:	**MV05**
Semester:	EIT M1-3 (summer term)
Coordinator / Responsibility:	Prof. Werner Braatz
Teacher:	Prof. Werner Braatz
Language:	English
Position in Curriculum:	Specialization subject in EE/IT Master's program Automation Technology
Course Type / Weekly Hours:	100% lectures, 2 hours per week
Workload:	Duration 1 semester Lecture/class presence: 2 hours x 15 weeks = 30 hours Lecture follow-up: 15 hours Examination preparation: 15 hours Total workload: 60 hours
Credits:	2
Prerequisites:	Basic knowledge of the communication structure in an industrial enterprise. Working principles of control systems (NC, RC, PLC). Knowledge about installation and wiring of automation systems. Strongly recommended to be combined with MV02.
Goals / Learning Objectives:	**Learning Objectives** at the end of this course, students will be able to: • Evaluate the demands of field bus systems in automation technology • Calculate the costs of installation and maintenance of automation plants • Know about the parameterization and operation of an actuator-sensor network • Design a safety network **Goals** To enable students to design and implement field bus applications for the Industrial Automation
Topics:	Levels of industrial communication. The ISO-OSI 7-layer model. Field bus structures and architectures. Open systems. Comparison of different field bus systems. Realisation of an ASi/ProfiBus configuration. Integration of safety requirements.
Grading / Examination:	Written examination (90 minutes) in examination period
Material:	Lecture notes, worksheets and PPT presentations available as download files, videos, PC presentations.
Literature:	Siemens A&D Translation Services (Eds.): *Dictionary of Electrical Engineering, Power Engineering and Automation*, 5th edition, 2003; ISBN 3-89578-192-4 Dietmar Schmid: *Automatisierungstechnik mit Informatik und Telekommunikation*, EUROPA Lehrmittel, 5. Auflage, 2002; ISBN 3-8085-5155-0 Jürgen Bergmann: *Automatisierungs- und Prozessleittechnik, Lehr- und Übungsbuch für Ingenieure und Wirtschaftsingenieure*, Fachbuchverlag Leipzig; ISBN 3-446-19569-6

	Rolf Becker: *AS-Interface, Intelligence in the Network, Info Guide*, AS-International, 2000 W. Kriesel, O. W. Madelung: *The AS-Interface for Automation*, Carl Hanser Verlag, 2. Auflage, 1999; ISBN 3-89578-133-9 Phoenix Contact: *Industrial Communication*, Chapt. 1-7, PPT Presentation SIEMENS: *Kommunikation mit SIMATIC*, PDF-File

Program:	**Master's Program in Electrical Engineering and Information Technology**
Module / Course Title:	**Wireless Communication Systems**
No:	**MV06.1 (Lecture) and MV06.2 (Lab)**
Semester:	EIT M1-3 (winter term)
Coordinator / Responsibility:	Prof. Dr. H. Stahl
Teacher:	Prof. Dr. H. Stahl
Language:	English
Position in Curriculum:	Specialization subject in EE/IT Master's program
Course Type / Weekly Hours:	67% lectures, 33% lab class, 4+2 hours per week
Workload:	Duration 1 semester Lecture/class presence: 6 hours x 15 weeks = 90 hours Lecture follow-up: 40 hours Lab class preparation/follow-up: 50 hours Examination preparation: 30 hours Total workload: 210 hours
Credits:	7
Prerequisites:	Fundamentals of System Theory, Digital Modulation and Communication Protocols.
Goals / Learning Objectives:	Understanding the structure and and the underlying transmission techniques of current wireless communication systems and networks. Analysis and assessment of services, components, and protocols of wireless networks.
Topics:	**Lecture MV06.1** Basics of wireless communication: Propagation and wireless channel characteristics; link budget of noise-limited systems; cellular systems, handover. Current wireless communication standards: - Networking: NGN and VoIP-Standards SIP and H.323 - PLMNs: *GSM*, *GPRS*, *EDGE*, *UMTS, and LTE* - WLANs: *IEEE 802.11* family. - Digital TV: *The DVB-T standard* Introduction of transmission techniques: Multiple-access by *FDMA*, *TDMA*, *CDMA*; high-speed transmission by *OFDM* and *MIMO.* **Lab Class MV06.2** *GSM* experiments; *UMTS* coverage measurements; analysis of the DVB-T channel and signals.
Grading / Examination:	Written examination (90 minutes) in examination period
Material:	Lecture notes, worksheets and lab-class handouts are available in hardcopy and PDF
Literature:	J. Eberspächer, H.-J. Vögel: *GSM, Global System for Mobile Communication*, Teubner, Stuttgart, 2001 M.S. Gast: *802.11 Wireless Networks – The Definitive Guide*, O'Reilly, USA, 2005 *Wireless Communication – the interactive multi-media CD ROM*, Springer, NL, 2001 W. Fischer: Digital Video and Audio Broadcasting Technology, Springer, Berlin, 2008

Program:	**Master's Program in Electrical Engineering and Information Technology**
Module / Course Title:	**Advanced Digital Communication**
No:	**MV07**
Semester:	EIT M1-3 (summer term)
Coordinator / Responsibility:	Prof. Dr. Markus Stichler
Teacher:	Prof. Dr. Markus Stichler
Language:	English
Position in the Curriculum:	Specialization subject in EE/IT Master's program
Course Type / Weekly Hours:	75% lectures with integrated exercises, 25% lab course, 4 hours per week
Workload:	Duration 1 semester Lecture/class presence: 4 hours x 15 weeks = 60 hours Lecture follow-up: 25 hours Lab class preparation/follow-up: 40 hours Examination preparation: 25 hours Total workload: 150 hours
Credits:	5
Prerequisites:	Basics of system theory and digital signal processing
Goals / Learning Objectives:	Understanding of the basics of digital communication systems; concepts of modern digital communication systems: OFDM and CDMA.
Topics:	**Lecture** Basics of digital communication systems: Modulation, mobile communication channel, time variant multi-path propagation, demodulation, synchronization, channel estimation and equalization. Concepts of modern mobile communication systems: OFDM, basics, synchronization, equalization. CDMA, basics, synchronization, equalization. **Lab Class** Simulation of methods and algorithms used in digital communication systems with tools like e.g. MatLab
Grading / Examination:	Written examination (90 minutes) in examination period
Material:	Lecture notes, worksheets and lab class handouts are available in hardcopy and PDF
Literature:	B. Sklar: *Digital Communications, Fundamentals and Applications*, Prentice Hall, 2000; ISBN 0-13-084788-7 John G. Proakis: *Digital Communications*, McGraw Hill, 2001; ISBN 0-07-232111-3

Program:	**Master's Program in Electrical Engineering and Information Technology**
Module / Course Title:	**Digital Signal Processing**
No:	**MV08**
Semester:	EIT M1-3 (summer term)
Coordinator / Responsibility:	Prof. Dr. Markus Stichler
Teacher:	Prof. Dr. Markus Stichler
Language:	English
Position in the Curriculum:	Specialization subject in EE/IT Master's program
Course Type / Weekly Hours:	75% lectures with integrated exercises, 25% lab course, 4 hours per week
Workload:	Duration 1 semester Lecture/class presence: 4 hours x 15 weeks = 60 hours Lecture follow-up: 25 hours Lab class preparation/follow-up: 40 hours Examination preparation: 25 hours Total workload: 150 hours
Credits:	5
Prerequisites:	Fundamentals of system theory
Goals / Learning Objectives:	Advanced knowledge in applied digital signal processing with view on applications in the areas of information- and communication technology as well as control technology
Topics:	**Lecture** Deterministic and stochastic signals and systems, discrete Fourier- and Wavelet-Transformation, LTI systems, design and implementation of digital systems, sample rate conversion, multirate signal processing. **Lab class** Design, simulation (using MatLab and/or Simulink) and implementation of simple algorithms on digital signal processors (DSPs) and/or FPGAs.
Grading / Examination:	Written examination (90 minutes) in examination period
Material:	Overhead, board, beamer
Literature:	Oppenheim, Schafer: *Discrete-Time Processing*, Prentice Hall, 1992 V. K. Ingle, J. G. Proakis: *Digital Signal Processing using Matlab*, Brooks/Cole, 2000; ISBN 0-534-37174-4 J.H. Chow, D. K. Frederick, N. W. Chbat: *Discrete-Time Control Problems using Matlab*, Brooks/Cole, 2003; ISBN 0-534-38477-3

Program:	**Master's Program in Electrical Engineering and Information Technology**
Module / Course Title:	**Computer-Aided Design of Analog Integrated Circuits**
No:	**MV09**
Semester:	EIT M1-3 (winter term)
Coordinator / Responsibility:	Prof. Dr. H. Thurner
Teacher:	Prof. Dr. H. Thurner
Language:	English / German
Position in Curriculum:	Specialization subject in EE/IT Master's program
Course Type / Weekly Hours:	33% lectures, 1 hour per week, 66% lab class, 2 hours per week
Workload:	Duration 1 semester Lecture/class presence: 3 hours x 15 weeks = 45 hours Lecture follow-up: 20 hours Lab class preparation/follow-up: 35 hours Examination preparation: 20 hours Total workload : 120 hours
Credits:	4
Prerequisites:	Fundamentals of analysis and design of analog circuits
Goals / Learning Objectives:	**Learning Objectives** at the end of this course, students will be able to: • Design linear and nonlinear circuits at transistor level using tools for DC-, AC- and time domain analysis • Apply strategies for systematic, modular design and circuit optimization **Goals** To enable students to design analog (and digital) circuits in a systematic way using appropriate simulators.
Topics:	**Lecture** DC- and AC-behavior of Common Emitter, Common Base, Common Collector circuits and differential amplifiers; different types of feedback; concept of impedance mismatch; different types of analysis in Spice simulators. **Lab** Based on a specification of a broadband amplifier (bandwidth, group delay, gain, linearity) the following steps have to be done: • Choose a suitable circuit concept based on specific basic circuit blocks. Split the circuits into a few parts. • Investigation of the properties of the basic cells and their dependency on specific parameters with a SPICE type simulator. • Design and optimization of circuit parts and the whole circuit.
Grading / Examination:	50% lab class work results, plus 50% oral test (20 minutes) at end of lecture period
Material:	Lecture notes an lab class problem descriptions. Circuit simulatior pSPICE.
Literature:	P. R. Grey, R. G. Meyer: *Analysis and Design of Analog Integrated Circuits*, John Wiley & Sons, New York, 1993; ISBN 0-471-57495-3 Donald A.Neamen: *Electronic Circuit Analysis and Design*,

	McGraw-Hill, Boston, New York; ISBN 0-256-11919-8 U. Tietze, Ch. Schenk: *Halbleiterschaltungstechnik*, Springer Verlag Berlin, Heidelberg, New York; ISBN 3-540-64192-0

Program:	**Master's Program in Electrical Engineering and Information Technology**
Module / Course Title:	**Electromagnetic Compatibility (EMC)**
No:	**MV10**
Semester:	EIT M1-3 (winter or summer term)
Coordinator / Responsibility:	Prof. Dr. Norbert Seliger
Teacher:	Prof. Dr. Norbert Seliger
Language:	English
Position in Curriculum:	Specialization subject in EE/IT Master's program
Course Type / Weekly Hours:	70% lectures, 30% lab class, 2 hours per week
Workload:	Duration 1 semester Lecture/class presence: 2 hours x 15 weeks = 30 hours Lecture follow-up: 20 hours Lab class preparation/follow-up: 20 hours Examination preparation: 20 hours Total workload: 90 hours
Credits:	3
Prerequisites:	Knowledge in electromagnetic fields, transmission lines, electrical signals and circuit components
Goals / Learning Objectives:	**Learning Objectives** Understanding of basic aspects of EMC: theory of emission and reception of conducted and radiated electromagnetic interference signals, coupling mechanisms and their models. Design methods and techniques for EMC compliance: PCB and circuit design, grounding, filter design, signal spectra, system design, shielding aspects. EMC measurement techniques and EMC standards **Goals** Within this lecture students will learn the basics of EMC engineering and its application in early system design. By discussing case studies and lab experiments we will bridge the gap between theory and practical implementation.
Topics:	- Introduction to EMC and EMI phenomena - Basic concepts (conducted and radiated emission and susceptibility) - Electrical signals and their spectra - Propagation and crosstalk, coupling, EMC modeling - Interference control techniques (PCB and circuit design, shielding, grounding, filter design) - EMC measurements and EMC Standards - Case studies and Lab experiments
Grading / Examination:	Written examination (90 minutes) in examination period
Material:	Lecture notes and problem sheets
Literature:	Paul: *Introduction to EMC*, Wiley 2006 Ott: *EMC Engineering*, Wiley 2009 Franz: *EMV*, Vieweg+Teuber 2008 Christopoulos: *Principles and Techniques of EMC*, CRC Press Montrose, Nakauchi: *Testing for EMC Compliance*, Wiley 2004 Schwab: *Elektromagnetische Verträglichkeit*, Springer

	2007 Dhia, Ramdani, Sicard: *EMC of Integrated Circuits*, Springer 2006

MF: Technical Electives

Program:	**Master's Program in Electrical Engineering and Information Technology**
Module / Course Title:	**Microelectronics**
No:	**MF01**
Semester:	EIT M1-3 (winter term)
Coordinator / Responsibility:	Prof. Dr. Popp
Teacher:	Prof. Dr. Popp
Language:	English
Position in Curriculum:	Technical elective course in EE/IT Master's program. Technical elective for EIT-, PT-, WI-Diploma program.
Course Type / Weekly Hours:	50% lectures, 50% lab class, 4 hours per week
Workload:	Duration 1 semester Lecture/class presence: 4 hours x 15 weeks = 60 hours Lecture follow-up: 15 hours Lab class preparation/follow-up: 60 hours Examination preparation: 15 hours Total workload: 150 hours
Credits:	5
Prerequisites:	Working principles of semiconductor devices. DC- and AC-description of MOS- and bipolar-devices. Basic familiarity with SPICE-modelling.
Goals / Learning Objectives:	Enable students to understand the principles of full custom design and fabrication of integrated circuits
Topics:	**Lecture** Semiconductor technology (layer growth, doping, masking, mounting). MOS- and BIP-Circuit integration, layout-rules, dimensioning with typical examples. **Lab class** On-wafer measurements of MOS- and BIP-devices and circuits. Electrical characterisation, SPICE-parameter extraction. Mounting and bonding of a small IC. Layout exercises. SPICE-simulations.
Grading / Examination:	Oral test (20 minutes) at end of lecture period
Literature:	Weste, Eshragian: *Principles of CMOS VLSI Design*, Addison Wesley, 1994 S. M. Sze: *VLSI Technology*, John Wiley, New York, 1990

MF: Technical Electives

Program:	**Master's Program in Electrical Engineering and Information Technology**
Module / Course Title:	**Operational Amplifier Circuit Design Project**
No:	**MF03**
Semester:	EIT M1-3 (summer term)
Coordinator / Responsibility:	Prof. Dr. W. A. Mayr
Teacher:	Prof. Dr. W. A. Mayr
Language:	English
Position in Curriculum:	Technical elective course in the EE/IT Master's program. Requires Operational Amplifier Circuit Design 1 (MF02).
Course Type / Weekly Hours:	Project, 4 hours per week
Workload:	Duration 1 semester Project/class presence: 4 hours x 15 weeks = 60 hours Project/lab work: 80 hours Preparation of presentation: 10 hours Total workload: 150 hours
Credits:	5
Prerequisites:	Operational Amplifier Circuit Design 1 (MF02). Familiarity with DC and AC circuit analysis at an advanced level. Advanced knowledge of circuit design and linear control theory.
Goals / Learning Objectives:	**Learning Objectives** at the end of this course, students shall be able to: • Obtain an improved awareness of project phases • Draw circuit diagrams and generate layouts using a professional tool • Assemble and debug circuits • Integrate the individual circuits into a complete system • Presentation of an advanced level technical subject **Goals** To give the students the opportunity to get real project experience and enable them to develop operational amplifier circuits by their own at a professional level
Topics:	Theory of operation of the complete system. Detailed presentations of theoretical calculations, simulation results, design considerations etc. for sub-systems. Circuit diagram drawing and layout. Sub-system implementation and test. System integration.
Grading / Examination:	Practical work results (50%), project documentation (40%) and final presentation (10%)

Material:	• System description including theory of operation, requirements and functional specification • Components (op amps and logic ICs, passive components, wires, connectors etc.) • Experimental printed circuit boards • PCs with the necessary development tools (PSpice full version, Eagle), assembly, measurement and test equipment (available in lab)
Literature:	Franco, Sergio: *Design with Operational Amplifiers and Analog Integrated Circuits*, Mc Graw Hill Science, 3rd ed., 2001; ISBN-0-0723-2084-2 Tietze, U., Schenk, C.: *Halbleiter-Schaltungstechnik*, 11. Auflage, Springer Verlag, 1999; ISBN 3-540-64192-0 Wupper, Horst: *Professionelle Schaltungstechnik mit Operationsverstärkern*, Franzis Verlag, 1994, ISBN-3-7723-6732-1 Jung, Walt (Editor): *Op Amp Applications*, Analog Devices Inc., 2002; ISBN-0-916550-26-5

Program:	**Master's Program in Electrical Engineering and Information Technology**
Module / Course Title:	**CNC- and IPC-Control**
No:	**MF05**
Semester:	EIT M1-3 (winter term)
Coordinator / Responsibility:	Prof. Dr. W. Schittenhelm
Teacher:	Prof. Dr. W. Schittenhelm
Language:	English
Position in Curriculum:	Technical elective course in EE/IT Master's program
Course Type / Weekly Hours:	75% lectures, 25% lab class, 4 hours per week
Workload:	Duration 1 semester Lecture/class presence: 4 hours x 15 weeks = 60 hours Lecture follow-up: 25 hours Lab class preparation/follow-up: 40 hours Examination preparation: 25 hours Total workload: 150 hours
Credits:	5
Prerequisites:	'Classical' control theory in time and frequency domain. Familiarity with PLC-Programming.
Goals / Learning Objectives:	**Learning Objectives** at the end of this course, students will be able to: • Understand the function and structure of computerized numerical controls • Apply CNC in manufacturing systems • Know PC-based controls and their special features **Goals** To enable students to work with PC-based numerical controls
Topics:	What is a control ? Examples of computer-controlled machines, structure of a control, history, market-situation, development costs. PC-based control: Reasons for using PCs for control, industrial PC, interfaces of controls, features of fieldbus-systems, market-overview, Ethernet in automation. PC-Operating Systems: Real-time processing techniques, Operating Systems for PC based Controls, examples for existing applications Logical functions: PLC based on PC, PLC-programming languages, example of a PLC-program, PLC from Siemens Geometrical functions: CNC-Functions, interpolation, point to point control, continuous path control, closed loop algorithms, CNC-programming, part program preparation, CNC from Siemens
Grading / Examination:	Written test (60 minutes) at end of lecture period
Material:	Lecture notes available as PDF download files
Literature:	Rexroth Indramat: *MTC200 NC Programming Instructions*, Application Manual, Lohr, 2000

Program:	**Master's Program in Electrical Engineering and Information Technology**
Module / Course Title:	**DRAM Design, Technology and Diagnosis for Automation Systems**
No:	**MF08**
Semester:	EIT M1-3 (summer term)
Coordinator / Responsibility:	Prof. Dr. M. Versen
Teacher:	Prof. Dr. M. Versen
Language:	English
Position in Curriculum:	Technical elective course in EE/IT Master's program
Course Type / Weekly Hours:	100% lecture with integrated exercises and optional lab practice, 4 hours per week
Workload:	Duration 1 semester Lecture/class presence: 4 hours x 15 weeks = 60 hours Lecture follow-up: 15 hours Lab class preparation/follow-up: 40 hours Examination preparation: 25 hours Excursion to Siemens, Amberg 10 hours Total workload: 150 hours
Credits:	5
Prerequisites:	Solid State Electronics, Microcomputers
Goals / Learning Objectives:	Understanding of the basics of a dynamic random access memory and concepts of DRAM systems in computing applications and in automation systems.
Topics:	1. Introduction 2. External function of different DRAM technologies 3. DRAM internal operation 4. Circuit design on block level and transistor level 5. Physical layout and construction of cell arrays 6. Process steps and possible problems 7. Manufacturing processes and their effects on reliability 8. Introduction to reliability of semiconductors 9. Oxide Ffailure Modes 10. Leakage Paths 11. Leakage Path Testing 12. Test Flow and Test Specifications 13. Parametric Tests 14. Functional Parametric Tests 15. Functional Tests 16. Array Diagnostics – Bitmapping 17. Array Periphery Diagnostics
Grading / Examination:	Oral exam (30 minutes) at end of lecture period
Material:	Lecture notes and problem sheets
Literature:	K. Itoh: *VLSI Memory Chip Design*, Springer, 2001. K. Itoh, M. Horiguchi, H. Tanaka: *Ultra-Low Voltage Nano-Scale Memories*, Springer, 2007. J. Segura, C. F. Hawkins, CMOS Electronics, 2004. Technical Specifications and Data Sheets: Promos Technologies, V73CAG01808RA Rev.1.0 December 2010, http://www.promos.com.tw/website/html/english/product/V73/V73CAG01808RA.pdf (last downloaded 27.09.11)

MF: Technical Electives

Program:	**Master's Program in Electrical Engineering and Information Technology**
Module / Course Title:	**Channel Coding**
No:	**MF09**
Semester:	EIT M1-3 (winter term)
Coordinator / Responsibility:	Prof. Dr. Markus Stichler
Teacher:	Prof. Dr. Markus Stichler
Language:	English
Position in the Curriculum:	Technical elective course in EE/IT Master's program
Course Type / Weekly Hours:	75% lectures with integrated exercises, 25% lab course, 4 hours per week
Workload:	Duration 1 semester Lecture/class presence: 4 hours x 15 weeks = 60 hours Lecture follow-up: 25 hours Lab class preparation/follow-up: 40 hours Examination preparation: 25 hours Total workload: 150 hours
Credits:	5
Prerequisites:	Advanced Digital Communications, MV07
Goals / Learning Objectives:	Channel coding as key technology in information era Applications for data storage media Applications in communication systems
Topics:	**Lecture** Basics of information theory, basics of digital communication, discrete-time channel model (AWGN, BSC), block codes, convolutional codes, concatenated codes, applications. **Lab Course** Investigation of block- and convolutional codes using MatLab
Grading / Examination:	Written examination
Material:	Lecture notes, lab class problem descriptions
Literature:	John G. Proakis: *Digital Communications*, McGraw Hill, 2001; ISBN 0-07-232111-3 B. Friedrichs: *Kanalcodierung*, Springer, 1996 V. Kühn: *Vorlesungsskript Kanalcodierung*, Stand 2002, http://uni-bremen.de

Program:	**Master's Program in Electrical Engineering and Information Technology**
Module / Course Title:	**Microelectronics Packaging**
No:	**MF10**
Semester:	EIT M1-3 (winter term)
Coordinator / Responsibility:	Prof. Dr. Wolfgang Radlik
Teacher:	Prof. Dr. Wolfgang Radlik
Language:	English
Position in the Curriculum:	Technical elective course in EE/IT Master’s program
Course Type / Weekly Hours:	Lecture, 2 hours per week
Workload:	Duration 1 semester Lecture/class presence: 2 hours x 15 weeks = 30 hours Lecture follow-up: 15 hours Examination preparation: 15 hours Total workload : 60 hours
Credits:	2
Prerequisites:	
Goals / Learning Objectives:	**Learning Objectives** Common technologies for mounting semiconductor components on carriers and for providing electrical interconnections. Technologies for substrate configuration, component assembly, high density interconnection and encapsulation including relevant application examples. The students should be able to identify and to assess the interdependencies between circuit design, miniaturization issues, system performance and packaging technology. **Goals** Students shall be enabled to select appropriate packaging technologies to implement functional hardware and to assess its impact on system performance.
Topics:	Challenges and definitions of microelectronics packaging, IC backend manufacturing mrocesses, first-level packaging: Integrated circuit packaging and interconnection • Lead frames, die bonding • Wire bonding • Tape automated bonding • IC plastic packages Second-level packaging: substrates • Wiring capacity, Rent’s rule, impedance control • Single and multilayer printed circuit boards • Multilayer cofired ceramic technology • Thin film technology Second-level packaging: board assembly processes • Through Hole Technology (THT) • Surface Mount Technology (SMT) Area array packages • Ball Grid Arrays (BGA) • Chip Size Packages (CSP) • Flip Chip Technology (FC)

Grading / Examination:	Written test (60 minutes) at end of lecture period
Material:	Lecture notes, multimedia presentations
Literature:	R. Tummala: *Microelectronics Packaging Handbook*, 2nd edition, Kluwer Academic Publishers; ISBN 0412084511 C. Harper: *Electronic Packaging and Interconnection Handbook*, 3rd edition, Mc Graw Hill; ISBN 0071347453

Program:	**Master's Program in Electrical Engineering and Information Technology**
Module / Course Title:	**Satellite Navigation**
No:	**MF12**
Semester:	EIT M1-3 (winter term)
Coordinator / Responsibility:	Prof. Dr. Birger Mysliwetz
Teacher:	Dr. Hans L. Trautenberg (EADS Astrium GmbH)
Language:	English
Position in Curriculum:	Technical elective for EE/IT- and INF-Master's program.
Course Type / Weekly Hours:	50% lectures, 50% exercises, 4 hours per week
Workload:	Duration 1 semester Lecture/class presence: 4 hours x 15 weeks = 30 hours Exercises: 2 hours x 15 weeks = 30 hours Lecture follow-up/homework assignments: 60 hours Examination preparation: 30 hours Total workload: 150 hours
Credits:	5
Prerequisites:	Basic linear algebra, analysis and statistics. Basics of electrodynamics (wave propagation). Proficiency in a programming language to solve homework problems (mostly linear algebra problems)
Goals / Learning Objectives:	**Learning Objectives** at the end of this course, students will: • Understand the principles of satellite navigation • Know the limitations of satellite navigation **Goals** To enable students to assess the applicability of satellite navigation for a given problem
Topics:	History of satellite navigation, positioning methods, description of orbits, range measurements with CDMA techniques, signal propagation in ionosphere and troposphere, multi path and interference problems, user equivalent range error budget and link budgets, system architecture of satellite navigation systems, GPS overview, Galileo overview, integrity of position solutions, integrity of navigation systems, implementation of navigation algorithms.
Grading / Examination:	Written test (60 minutes) at end of lecture period
Material:	Lecture notes
Literature:	Elliott D. Kaplan: *Understanding GPS Principles and Applications*, Artech House Publisher Bradford W. Parkinson, James J. Spliker: *Global Positioning System: Theory and Applications*, American Institute of Aeronautics and Astronautics Gilbert Strand, Kai Borre: *Linear Algebra, Geodesy, and GPS*, Willesly-Cambridge Press B. Hofmann-Wellenhof, H. Lichtenegger, J. Collins: *GPS Theory and Practice*, Springer

Program:	**Master’s Program in Electrical Engineering and Information Technology**
Module / Course Title:	**Programming of Communication Applications using LabVIEW**
No:	**MF13**
Semester:	EIT M1-3 (summer term)
Coordinator / Responsibility:	Prof. Dr. H. Stahl
Teacher:	Prof. Dr. H. Stahl
Language:	English
Position in Curriculum:	Technical elective course in EE/IT Master’s program
Course Type / Weekly Hours:	30% lectures, 70% lab class, 4 hours per week
Workload:	Duration: 1 semester Lecture: 4 hours x 15 weeks = 60 hours Lab class preparation: 25 hours Lecture follow-up: 40 hours Examination preparation: 25 hours Total workload: 150 hours
Credits:	5
Prerequisites:	Basic experience with any graphical programming language, e.g. Matlab/Simulink, LabVIEW, or HP/Agilent VEE
Goals / Learning Objectives:	**Learning Objectives** This seminar first gives an introduction into some basics and essentials of LabVIEW programming. The main focus then are applications in the field of communication systems. **Goals** Ability to design and program key applications for measurement automation, digital signal acquisition / processing and data communication.
Topics:	• Getting started with LabVIEW. • Programming fundamentals. • Grouping data using arrays, clusters, and strings. • Formula nodes. data visualization. • Measurement automation applications. • Signal processing applications. • Data communication applications
Grading / Examination:	Concluding course work project & oral test (30 minutes) at end of lecture period
Material:	Lecture notes, exercises, and additional material available in digital form
Literature:	R. Bishop: *LabVIEW 8 Student Edition*, Prentice Hall, , Upper Saddle River, NJ, USA W. Georgi: *Einführung in LabVIEW*, Hanser Fachbuchverlag Leipzig, Germany Software Manual: *LabVIEW Fundamentals*, National Instruments, Austin, TX, USA

Program:	**Master's Program in Electrical Engineering and Information Technology**
Module / Course Title:	**Power Electronics Circuit Design**
No:	**MF14**
Semester:	EIT M1-3 (summer term)
Coordinator / Responsibility:	Prof. Dr. Norbert Seliger
Teacher:	Prof. Dr. Norbert Seliger
Language:	English
Position in Curriculum:	Technical elective course in EE/IT Master's program
Course Type / Weekly Hours:	80% lectures, 20% lab class, 2 hours per week
Workload:	Duration 1 semester Lecture/class presence: 2 hours x 15 weeks = 30 hours Lecture follow-up: 20 hours Lab class preparation/follow-up: 20 hours Examination preparation: 20 hours Total workload: 90 hours
Credits:	3
Prerequisites:	Knowledge in power electronics, electrical circuits, semi-conductor devices, Matlab/PSPICE basics
Goals / Learning Objectives:	Design of complex power electronic circuits based on specifications. Ability to select the proper topology and calculate and simulate (Matlab, PSPICE) voltage and current transients in power semiconductor elements and passive components. Layout rules for power electronic circuits. Cooling solutions, thermal management. Interfacing with digital signal processing.
Topics:	Electrical Design - Topology Selection - Circuit Design - Losses in Power Semiconductors - Power Passives (Inductors, Transformers, Capacitors) - Simulation (MatLab, PSPICE) - Layout, Isolation Coordination Thermal Design - Thermal Impedance - Thermal Management - Reliability Issues - Case studies and Lab experiments
Grading / Examination:	Written examination (90 minutes) in examination period
Material:	Lecture notes, worksheets available as PDF downloads
Literature:	Mohan: *Power Electronic Circuits*, Wiley 2003. Schlienz: *Schaltnetzteile*, Vieweg 2009. Shaffer: Fundamentals *of Power Electronics with Matlab*, Charles River Media, 2007. Attaway: *MatLab - A Practical Introduction to Programs and Program Solving*, Elsevier, 2009. Yang: *Circuit Systems with MatLab and PSPICE*, Wiley 2008. Batarseh: *Power Electronic Circuits*, Wiley 2004. Erickson: *Fundamentals of Power Electronics*, 2001.

MF: Technical Electives

Program:	**Master's Program in Electrical Engineering and Information Technology**
Module / Course Title:	**Automotive Software Engineering - AUTOSAR**
No:	**MF16**
Semester:	EM1-3 (winter term)
Coordinator / Responsibility:	Prof. Dr. Birger Mysliwetz
Teacher:	Dr. Peter Schiele (BMW AG)
Language:	English
Position in Curriculum:	Technical elective for EE/IT- and INF-Master's program.
Course Type / Weekly Hours:	70% lectures, 30% exercises, 2 hours per week
Workload:	Duration: 1 semester Lecture/class presence: 2 hours x 15 weeks = 30 hours Lecture follow-up/homework assignments: 30 hours Examination preparation: 30 hours Total workload: 90 hours
Credits:	3
Prerequisites:	Knowledge of programming principles
Goals / Learning Objectives:	**Goals** Knowledge of software technologies for development of automotive embedded electronic control units **Learning Objectives** Understanding the methods and the development processes. Understanding the modeling principles of UML. Understanding Autosar and its technologies.
Topics:	• Phases of structured software development processes with with an emphasis on the specification phase • Modeling principles and application of UML elements for different development phases • Understanding the motivation and advantage of AUTOSAR and its underlying software architecture • Usage of AUTOSAR specification elements.
Grading / Examination:	Written test (60 minutes) at end of semester.
Material:	Lecture Notes, excercise problem descriptions.
Literature:	G. Booch, J. Rumbaugh, I. Jacobson: *The Unified Modeling Language User Guide*, Addison-Wesley Longman, Amsterdam, 2. Auflage, 2005 O. Kindel, M. Friedrich: *Softwareentwicklung mit AUTOSAR*, dpunkt.verlag, Heidelberg, 1. Auflage, 2009 J. Schäuffele, T. Zurawka: *Automotive Software Engineering: Grundlagen, Prozesse, Methoden und Werkzeuge effizient einsetzen*, Vieweg+Teubner, Wiesbaden, 4. Auflage, 2010

Program:	**Master's Program in Electrical Engineering and Information Technology**
Module / Course Title:	**Basic Concepts of Requirements Engineering and Requirements Management (for Software-Projects)**
No:	**MF17**
Semester:	EM1-3 (winter & summer term)
Coordinator / Responsibility:	Prof. Dr. Reiner Schell
Teacher:	Dr. Franco Miralles
Language:	English
Position in Curriculum:	Technical elective for EE/IT-Master’s program.
Course Type / Weekly Hours:	70% lectures and classroom exercises, 30% team and lab exercises, 2 hours per week
Workload:	Duration: 1 semester Lecture/class presence: 2 hours x 15 weeks = 30 hours Lecture follow-up: 15 hours Practice preparation/follow-up: 20 hours Examination preparation: 15 hours Total workload: 80 hours
Credits:	3
Prerequisites:	Basic understanding of object oriented principles and modeling with UML is helpful but not strictly necessary
Goals / Learning Objectives:	**Goals** To enable students to understand the role of requirements engineering and management within a project and the common pitfalls and errors that can and do occur in the beginning of many projects and the possibilities, but also limits, of a well-thought and encompassing methodology, adequate organization and associated technologies applied. Based on concrete examples the students will learn best practices, concepts and principles of requirements engineering, management and modeling. **Learning objectives** At the end of this course students will be able to: 1. Have a good handle of the usefulness and limits of a technological approach to requirements engineering to reduce the risk of failure in projects. 2. Understand the basic principles and approaches to capture, organize and document the requirements and to enable traceability throughout the project all the way down to customer sign-off. 3. Understand the importance of a methodological approach and the role of requirements engineering and management therein. 4. Understand the basic principles of modeling and analysis using UML (focus on requirements engineering).

	5. Understand the basic concepts and best practices of requirements engineering.
Topics:	Understanding, capturing and organizing requirements in the initial phase of a project; building a first team; communication with the stakeholders; common pitfalls and mistakes and how to avoid them; introduction to requirements engineering and management; introduction to object oriented modeling using UML (focus on use cases); requirements and methodology taking RUP as an example.
Grading / Examination:	Written test (45 minutes) at the end of the semester.
Material:	Lecture notes and slides on paper, several pdf-files about special topics to download.
Literature:	Rupp, C., Pohl, K.: *Requirements Engineering Fundamentals*, dpunkt.Verlag, 2011 Pilobe, D., Pitman, N.: *UML in a Nutshell. A Desktop Quick Reference*, O'Reilly, 2005 Ferrari, R.: *Interaction between Requirements Engineering and Systems Architecting*, Lambert Academic Publishing, 2011

Program:	**Master's Program in Electrical Engineering and Information Technology**
Module / Course Title:	**Advanced Topics of Requirements Engineering and Requirements Management (for Software-Projects)**
No:	**MF18**
Semester:	EM1-3 (summer term)
Coordinator / Responsibility:	Prof. Dr. Reiner Schell
Teacher:	Dr. Franco Miralles
Language:	English
Position in Curriculum:	Technical elective for EE/IT-Master's program.
Course Type / Weekly Hours:	60% lectures, 40% team and lab exercises, 2 hours per week
Workload:	Duration: 1 semester Lecture/class presence: 2 hours x 15 weeks = 30 hours Lecture follow-up: 15 hours Practice preparation/follow-up: 20 hours Examination preparation: 15 hours Total workload: 80 hours
Credits:	3
Prerequisites:	Course MF17, Basic Concepts of Requirements Engineering and Requirements Management, or equivalent knowledge
Goals / Learning Objectives:	**Goals** To enable students to understand in-depth the techniques to capture, document, validate and structure requirements. To make the relationship with the rest of a project clear. To learn how to create an effective organization and methodology around requirements. To deepen the use of UML for requirements engineering. Based on an ongoing example the students will learn how to apply this knowledge. To understand the relationship and usefulness of requirements engineering and management disciplines with the rest of a project. To learn basic estimation techniques. **Learning objectives** At the end of this course students will be able to: 1. Understand in depth the techniques to capture, organize, document and validate requirements. 2. Understand how to solve conflicts defining and reviewing requirements. 3. Understand the relationship between requirements engineering and all the other disciplines in a project (from project management to test). 4. Be able to use advanced UML features and linguistic approaches to document requirements. 5. Understand how to organize a project, assign roles and create an effective methodology to handle re-

	quirements engineering and requirements management. 6. Have a good handle of the transition from a first vision and requirements engineering to architecture, design and implementation all the way down to deployment and acceptance tests. 7. Understand the basic principles and best practices of effort estimation in the initial phases of a project.
Topics:	Capturing, documenting, validating and organizing requirements; Exploring the context of a system; Linguistic issues; Quality features for requirements; Solving conflicts with the stakeholders; Requirements and agile methodologies; Requirements verification, acceptance tests; Requirements and Architecture; Advanced Use Cases Modeling, Class diagrams, Sequence diagrams, Activity diagrams and State transition diagrams to document requirements; Requirements management; Organizing an effective requirements management: Roles and Tools, the skills of a Requirements Engineer; Transition to Design; Simple techniques to estimate efforts during the initial phases of a project; A full-blown UML and textual framework for requirements engineering from (from Vision and goals to Deployment and Customer Acceptance).
Grading / Examination:	Written test (45 minutes) at the end of the semester.
Material:	Lecture notes and slides on paper, several pdf-files about special topics to download.
Literature:	Rupp, C., Pohl, K.: *Requirements Engineering Fundamentals*, dpunkt.Verlag, 2011 Pilobe, D., Pitman, N.: *UML in a Nutshell. A Desktop Quick Reference*, O'Reilly, 2005 Aurum, A., Wohlin, C. (Editors): *Engineering and Managing Software Requirements*, Springer (Collection), 2010

Program:	**Master's Program in Electrical Engineering and Information Technology**
Module / Course Title:	**Project Management**
No:	**MP01**
Semester:	EIT M1-3 (winter term)
Coordinator / Responsibility:	Prof. Dr. Birger Mysliwetz
Teacher:	LB Franz Kies
Language:	English
Position in Curriculum:	Mandatory course in EE/IT Master's program
Course Type / Weekly Hours:	40% lecture, 60% integrated exercises, block seminar over 4 days
Workload:	Duration 1 semester Lecture/class presence: 26 hours Lecture follow-up: 17 hours Examination preparation: 17 hours Total workload: 60 hours
Credits:	2
Prerequisites:	None
Goals / Learning Objectives:	**Learning Objectives** • Basics of project management (PM) • Project organisation types • Project initiating sources, creativity methods • Project planning and controlling instruments • Conflict management **Goals** Project management as a core competence of global research and development work. Utilization of creativity-, planning and controlling methods.
Topics:	**Lecture** Project definition, development of project management (PM), applications of PM, project types and classes, definition of PM, project targets, project finding, target conflicts within PM, entirety project management. Basics, rules, specific circumstances of project work. Types of project organisation, project organs, project functions (tasks, competences), team forming, leading of project teams, project initiating sources, creativity methods. Structuring, life cycle, planning and steering instruments, time plan, milestone plan, MTA-, Gantt-Diagram, network plan, capacity planning, reporting, controlling, problem solving cycle, optimization of project meetings, practical problems with PM, conflict management. **Exercises** Team building; applying MS Project; handling of conflicts.
Grading / Examination:	Written examination (90 minutes) in examination period
Material:	Lecture notes
Literature:	Franz Kies: *Scriptum Project-Management, 2011* Eric Verzuh: *The fast forward MBA in Project Management*; John Wiley & Sons, Inc., Hoboken, New Jersey, USA, 2008, ISBN 978-0-470-24789-1 Ed. P.W.G. Morris, J. K. Pinto: *The Wiley Guide to Manag-*

	ing Projects; John Wiley & Sons, Inc., Hoboken, New Jersey, USA, 2008, ISBN 0-471-23302-1 Tom Kendrick: *The Project Management Tool Kit: 100 Tips and Techniques for Getting the Job Done Right*; Amacom, USA; 2010; ISBN 978-0814414767 *A Guide to the Project Management Body of Knowledge*, PMBOK® guide; Project Management Institute, Inc., USA; 2008; ISBN 978-1933890517 Software: ganttproject from http://www.ganttproject.biz/, Open Workbench from http://www.openworkbench.org or Microsoft Project

Program:	**Master's Program in Electrical Engineering and Information Technology**
Module / Course Title:	**Master's Project**
No:	**MP02**
Semester:	EIT M1-3 (winter or summer term)
Coordinator / Responsibility:	2 professors as advisors
Teacher:	
Language:	English / German
Position in Curriculum:	Mandatory project in EE/IT Master's program
Course Type / Weekly Hours:	Team project, 4 hours per week
Workload:	Duration 1 semester In lecture period Project coordination: 4 hours x 15 weeks = 60 hours Lab work: 6 hours x 15 weeks = 90 hours In semester break Lab work: 5 hours x 6 weeks = 90 hours Total workload: 240 hours
Credits:	8
Prerequisites:	--
Goals / Learning Objectives:	To learn to apply project management methods and to train team working skills; in a 'close-to-real-life' situation students shall experience what it means to systematically analyze and plan a project, to organize themselves and to cooperate in a team and to deliver results within the planned deadline
Topics:	Case study project that typically deals with a real-world problem assigned by industry; project is carried out by a team of 4-6 students coached by one or two professors.
Grading / Examination:	Based on project documentation and final project presentation (about 30 minutes)
Material:	--
Literature:	--

Program:	**Master's Program in Electrical Engineering and Information Technology**
Module / Course Title:	**Master's Thesis**
No:	**MP03**
Semester:	EIT M2 at the earliest (winter or summer term)
Coordinator / Responsibility:	2 professors as advisors
Teacher:	--
Language:	English / German
Position in Curriculum:	Mandatory final thesis in EE/IT Master's program
Course Type / Weekly Hours:	Project
Workload:	Duration 6 months (regular) 6.5 hours/day x 5 days/week x 4 weeks/month x 6 months = 780 hours Preparation of final presentation: 30 hours Total workload: 810 hours
Credits:	27
Prerequisites:	--
Goals / Learning Objectives:	Final project at an engineer's qualification level; carried out by an individual student on his/her own with two professors as advisors either at Rosenheim University of Applied Sciences or at an industrial company
Topics:	Depending on student's selection and availability
Grading / Examination:	Master thesis report and final presentation (about 45 minutes)
Material:	--
Literature:	--