TECHNISCHE UNIVERSITÄT DRESDEN

Fakultät Elektrotechnik und Informationstechnik
Fakultät Maschinenwesen
Fakultät Verkehrswissenschaften „Friedrich List“

Interdisziplinärer Studiengang

MECHATRONIK

- ECTS -

Studienablaufpläne

Lehrprogramme

(ab Immatrikulationsjahrgang 2003)

Herausgeber:
Technische Universität Dresden
Federführung und Gesamtredaktion:
Fakultät Elektrotechnik und Informationstechnik
Prof. Dr. techn. K. Janschek

Technische Universität Dresden

Studiengang M E C H A T R O N I K

Basic Courses

(Grundstudium)

Studienablaufplan valid from 2003

Topic		SWS	1.Sem. V Ü P	2.Sem. V Ü P	3.Sem. V Ü P	4.Sem. V Ü P
Basics	**Mathematics I** (Mathematik I)	6	4 2 0 F			
	Mathematics II (Mathematik II)	8		6 2 0 F		
	Mathematics III (Mathematik III)	7			2 2 0	2 1 0 F
	Physics (Physik)	8	2 2 0	2 1 0 K	0 0 1L,(F)	
	Computer Science I and II (Informatik)	6	2 1 0 K1	2 0 1 K2, (F), PVL		
	Microcomputer Engineering (Mikrorechentechnik)	6			2 0 1	1 0 2 PVL
Systems Engineering	**Systems Theory I, II** (Systemtheorie)	7			2 1 0	2 2 0 F
	Automation Engineering (Automatisierungstechnik)	3				2 1 0 F
Mechanical Engineering	**Engineering Mechanics 1** (Technische Mechanik 1)	4		2 2 0 F		
	Engineering Mechanics 2 (Technische Mechanik 2)	7			2 2 0	2 1 0 F
	Materials (Werkstoffe)	3	2 1 0 PVL			
	Mechanism Engineering (Mechanismentechnik)	3				2 1 0 F

Topic		SWS	1.Sem. V Ü P	2.Sem. V Ü P	3.Sem. V Ü P	4.Sem. V Ü P
	Manufacturing Engineering (Fertigungstechnik)	3	2 0 1 PVL			
Electrical Engineering	**Basic Electrical Engineering** (Grundlagen der Elektrotechnik)	4	2 2 0 F			
	Electric and Magnetic Fields (Elektrische und magnetische Felder)	3		2 1 0 F		
	Dynamical Electrical Networks (Dynamische Netzwerke)	6			2 2 1 K	0 0 1L,(F)
	Electrical Power Engineering (Elektroenergietechnik)	3			2 0 0 K	0 0 1 L,(F)
	Electronics (Elektronik)	3				2 1 0 F
	Electromechanical Systems Design (Konstruktion der Elektronik und Mechanik)	8		2 1 0 K	3 1 0 K	0 1 0 L,(F)
	Non Technical Course (Nichttechnisches Fach / Studium generale)	2	2 0 0			
	Sum	**100**	**16/8/1 25**	**16/7/1 24**	**15/8/3 26**	**13/8/4 25**

SWS Semesterwochenstunden
V Ü P Vorlesungs-, Übungs-, Praktikumstunden
L Note aus Praktikum oder Beleg
(F) F Fachnote Fachnote, die sich aus mehreren Prüfungsleistungen zusammensetzt
K schriftliche Prüfungsleistung (Klausur)
PVL Prüfungszulassung

Technische Universität Dresden

Studiengang M E C H A T R O N I K

Main Courses

(Hauptstudium)

Mandatory Courses: valid from 2003

Topic	SWS	5.Sem. V/Ü/P A	6.Sem. V/Ü/P A
Field Theory (Feldtheorie)	4	2/2/0 F	
System dynamics of mechanic structures (Systemdynamik mech. Strukturen)	3	2/1/0 K1	
Numerical Analysis (Numerische Methoden (FEM/REM))	3	2/1/0 K2,	
Structural mechanics Laboratory (Praktikum Mechanische Strukturen)	1		0/0/1 L, (F)
Electric and Hydraulic Actuators (Antriebstechnik/Aktorik)	3	2/0/0	0/0/1 L,F (F)
Measurement techniques (Mess-/Sensortechnik)	3	2/0/0	0/0/1 L,F (F)
Power Electronics (Leistungselektronik)	3	2/1/0 F	
Control of Continuous-Time Processes I (Regelungstechnik)	4	3/1/0 K1	
Discrete Event Systems (Ereignisdiskrete Systeme)	3	2/1/0 K2	
Control Laboratory Praktikum Regelung/Steuerung	1		0/0/1 L, (F)
Embedded Controllers (Embedded Controller)	3		2/0/1 PVL, F
Sum	31	17 / 7 / 0	2 / 0 / 5

Optional Mandatory Module:
each module consists of 10 SWS, with 2 SWS laboratory (Labor, Komplexpraktikum, Projekt), specifically oriented to the module topics .

Group „Methods“	**Group „Applications“**
(1) Multi Body Systems (Mehrkörpersysteme)	(1) Automotive Vehicle Engineering (Kraftfahrzeugtechnik)
(2) Hydraulics / Pneumatics (Hydraulik / Pneumatik)	(2) Railway Vehicle Engineering (Schienenfahrzeugtechnik)
(3) Mechanical Construction (Maschinenkonstruktion)	(3) Combustion Engines (Grundlagen Verbrennungsmotoren)
(4) Automatic Control (Regelung / Steuerung)	(4) Electrical Drives (Elektrische Antriebstechnik)
(5) Motion Control (Bewegungssteuerung)	(5) Aerospace (Luft- und Raumfahrt)
(6) Information Processing (Informationsverarbeitung)	(6) Mobile Production Machines (Mobile Arbeitsmaschinen)
(7) Design Techniques (Entwurfstechniken)	(7) Motion Controlled Machine Systems (Bewegungsgeführte Maschinensysteme)
	(8) Robotics (Robotik)
	(9) Specific Production Methods (Spezielle Fertigungsmethoden)
	(10) Precision Engineering (Feinwerktechnik)
	(11) Microsystems Engineering (Mikrosystemtechnik)
	(12) Electromechanical Systems (Elektromechanische Systeme)
	(13) Biomedical Engineering (Biomedizinische Technik)

Free Optional Course: 3 SWS
Main Seminar: 2 SWS
Non Technical Course, Studium generale: 2 SWS
Foreign Language: 4 SWS

01 05 02	**Mathematics I** (Mathematik 1)				
Mat.Nat.	**W**	**4 2 0**			**9.0 cr**
The course provides basic mathematical knowledge: - Complex numbers - Linear algebra - Differential and integral calculus for functions of one variable					
examination:	written			language:	German
prerequisites:	no				
lecturer:	Prof. Dr. C. Grossmann				

01 05 02	**Mathematics II** (Mathematik 2)				
Mat.Nat.			**S**	**6 2 0**	**12.0 cr**
The course provides basic mathematical knowledge: - Applications of differential and integral calculus in geometry and mechanical engineering - Ordinary differential equations and systems of differential equations - Differential calculus for functions of two and more variables - Elements of complex analysis - Numerical Methods and Software particularly for linear systems of equations, least squares problems, singular-value decomposition					
examination:	written			language:	German
prerequisites:	Mathematics I				
lecturer:	Prof. Dr. C. Grossmann				

01 05 02	**Mathematics III** (Mathematik 3)				
Mat.Nat.	**W**	**2 2 0**	**S**	**2 1 0**	**10.5 cr**
The course provides basic mathematical knowledge: - Integral calculus for functions of two and more variables - Introduction to partial differential equations - Probability theory and statistics					
examination:	written			language:	German
prerequisites:	Mathematics I+II				
lecturer:	Prof. Dr. A. Fischer				

	Physics (Physik)				
- under construction- -					
examination:				language:	
prerequisites:					
lecturer:					

	Computer Science I and II (Informatik I und II)				
- under construction- -					
examination:				language:	
prerequisites:					
lecturer:					

12 10 14 **Microcomputer Engineering**
12 01 03 (Mikrorechentechnik)

EI EPL **W 2 0 1** **S 1 0 2** **9.0 cr**

- under construction- -

examination: certificate language: German
prerequisites:
lecturer: Prof.Dr.-Ing. R. Lehnert, Dr.-Ing. L. Urbas

12 09 01 **Systems Theory I, II**
(Systemtheorie I, II)

EI LASC **W 2 1 0** **S 2 2 0** **10.5 cr**

This course of lectures provides basic knowledge of mathematical description and modelling of dynamic processes. Special emphasis is on uniform methods of mathematical description of various systems on the basis of some fundamental principles (transform methods, state variables, etc.) The arrangement of the contents concerning as well discrete and continuous time as well as discrete and continuous signal values leads to a clear classification of systems, at which in each class static and dynamic behaviour will be distinguished. In exercises, knowledge provided in the lectures is practised and increased.

examination: written language: German
prerequisites: mathematics, electrical engineering
lecturer: Prof. Dr.-Ing. habil. R. Hoffmann

12 01 01	**Automation Engineering** (Automatisierungstechnik)				
EI IfA	**S**	**2 1 0**			**4.5 cr**

This course aims to study basic principles and methods for the automatic control of technical processes.

Lectures include:

- elementary systems modelling concepts
- quantitative description (mathematical models, linear time-invariant (LTI) systems, block and signal flow diagrams, Laplace-transformation, transfer function, impulse/step response, manipulation of block diagrams, frequency response, BODE-diagrams)
- time behaviour and stability (LTI-system properties, BIBO-stability, closed loop systems, Hurwitz-criterion, Nyquist-criterion, stationary/ transient behaviour)
- control system design in frequency domain (open loop and feedback properties, controller synthesis with BODE-diagrams)
- digital control (sampling, aliasing, hold device, discrete frequency response, digital controllers, design of digital controllers with Bode-diagrams)
- industrial standard controllers (PID, corrective properties, realization variants, selected controller tuning rules)
- discrete event control (basic properties of discrete event systems, signal models, binary systems, combinatorial automata, sequential automata, signal-based design of a discrete event controller, realization aspects)
- problem solving control structures (direct/model-based measurement, observer, model-based failure detection, open-loop / feedback / cascade / adaptive / redundant control)
- automation technologies (trends, process control structures, industrial control languages - standard IEC 1131, real-time aspects, serial bus systems, internet in automation)

Complementary exercises on selected automation and control problems augmented by Matlab/Simulink models allow to train practical skills on modelling, analysis and design.

examination:	written	language:	german
prerequisites:	system theory		
lecturer:	Prof. Dr. techn. K. Janschek, Dr.-Ing. E. Giebler		

13 01 01/03	**Engineering Mechanics 1** (Technische Mechanik 1)				
MW IFKM	**S**	**2 1 0**			**4.5 cr**

This course deals with rigid body statics and fundamentals of the strength of elastic bodies. Basic concepts: rigid body, concentrated loads (force, couple), cut principle, Cartesian frames of reference. Forces and couples in plane statics: equivalent loads, equilibrium, plane structures, internal loads of beams, plane assembled structures. Center of gravity: bodies, areas, lines. Strength of materials: elementary concepts, stress, strain, Hooke's law, tension, compression, shear. Simple fields of stresses and strains: torsion of circular shafts, bending of beams with symmetric cross sections, failure hypotheses, buckling of columns.
Exercises: solution of problems.

examination:	written	language:	German
prerequisites:	mathematics, physics, materials		
lecturer:	Prof. Dr.-Ing. habil. H. Balke / Prof. Dr.-Ing. habil. V. Ulbricht		

13 01 01/03	**Engineering Mechanics 2** (Technische Mechanik 2)				
MW IFKM	**W**	**2 2 0**	**S**	**2 1 0**	**10,5 cr**

This course deals with the fundamentals of rigid body kinetics and continues the strength of elastic bodies.
Part 1: Kinematics of points and rigid bodies. Kinetics of rigid bodies in translational motion. Kinetics of rigid bodies in general motion: balance of momentum, balance of moment of momentum, cut principle, plane motion, static interpretation of the balance laws.
Vibrations: degrees of freedom f=1 and f=2. Lagrange's equations. Motion of rotors: inertia tensor, fixed axis of rotation, moving axis of rotation, Euler's equations.
Part 2: Statics in three dimensions. Supplements to symmetric bending. Unsymmetric bending. Fundamentals of strength: stress vector, stress tensor, displacement, strain tensor, Hooke's law, Castigliano's theorem. Axially symmetric stress distributions: circular cylinders, disks, plates. Résumé of basic equations of elasticity: global and local balance laws, jump conditions, general linear-elastic constitutive equations.
Exercises: analytical solution of problems.

examination:	Written	language:	German
prerequisites:	mathematics, physics, materials, engineering mechanics 1		
lecturer:	Prof. Dr.-Ing. habil. H. Balke / Prof. Dr.-Ing. habil. V. Ulbricht		

	Materials (Werkstoffe)				
- under construction-					
examination:				language:	
prerequisites:					
lecturer:					

13 01 07	**Mechanism Engineering** (Mechanismentechnik)				
MW IFKM	**S**	**2 1 0**			**4,5 cr**
The course of Mechanism Engineering focuses on the following topics: - Systematics of joints and mechanisms - Classification of mechanisms - Fundamental elements of planar kinematics - Kinematical analysis - Basics of mechanism dynamics					
examination:	written			language:	german
prerequisites:					
lecturer:	Prof.Dr.rer.nat.habil.Modler				

13 06 03 **Manufacturing Engineering**
(Fertigungstechnik)
MW PT W 2 1 0 **4,5 cr**

This course introduces the fundamentals of manufacturing techniques and process planning. The course enables the students to realise analyses and synthesis of production processes regarding the kind of processes, the process parameters and the machinery and equipment in consideration of the main business objectives like cost effectiveness, demands on quality and other.

The main content of the lectures are

- the manufacturing methods (basics, classification, casting, forming, cutting, joining, assembling, coating, changing of material properties)
- the fundamentals of process planning for the manufacturing of components and for assembly (process and system modelling, sequence planning, equipment planning, optimisation)
- additional components of production processes (transport and storage, handling, quality assurance, maintenance, CIM)

The course includes exercises with demonstrations of the main manufacturing methods (casting, forming, cutting, joining, coating and other). The course include also exercises which presents the main steps of the industrial engineering (evaluation of the design - suitable for production, selection of manufacturing processes, calculation of parameters, process and equipment planning)

examination: written language: german
prerequisites:
lecturer Prof. Dr.-Ing. habil. U. Füssel

12 08 01	**Basic Electrical Engineering** (Grundlagen der Elektrotechnik)				
EI IEE	**W**	**2 2 0**			**6.0 cr**
Basic Variables (Electrical Charge, Electrical Current, Voltage, Energy and Power) Resistive One-Ports (Definition, Sources, Linear One-Ports, Circuits with One-Ports) Active and Passive One-Ports (Power consumption and delivery, Equivalent circuits) Network Theorems (Superposition, Equivalent circuits, Telegen Theorem), Controlled Sources Network Analysis (Node Analysis, Mesh Analysis) Electro-Thermal Analogies (Heat Flow, Temperature, Basic Laws, Analogies, Heat Transmission, Thermal circuits) The exercises provide training of practical skills in modelling, analysis and design of DC-Circuits					
examination:	written			language:	german
prerequisites:	Mathematics, physics (college level)				
lecturers:	Prof. Dr.-Ing. habil. W. Schwarz Prof. Dr.-Ing. habil. R. Merker Dr.-Ing. A. Mögel				

12 08 01	**Electric and Magnetic Fields** (Elektrische und magnetische Felder)				
EI IEE	**S**	**2 1 0**			**4,5 cr**
Introduction (Fields, Coulombs Law, Field Strength, Potential) Electric Current Field (Current Density, Field Stregnth, Elementary Fields, Power dissipation, Resistance, Conductance) Electrostatic Field (Displacement Flux, Field Strength, Polarization, Capacity, Elementary Fields, Displacement Current, Capacitor, Energy, Force Actions) Magnetic Field (Field Strength, Induction, Ampere's Law, Elementary Fields, Biot-Savart's Law, Magnetic Flux, Magnetic Circuits, Faraday's Law, Inductance, Inductors, Energy, Force Actions) The exercises provide training of practical skills in the elementary computation of electric and magnetic fields and the analysis of field-based devices.					
examination:	written			language:	german
prerequisites:	Basic Electrical Engineering and Mathematics (1st Semester)				
Lecturer :	Prof. Dr.-Ing. habil. R. Merker				

12 08 01	**Dynamical Electrical Networks** (Dynamische Netzwerke)				
EI IEE	**W**	**2 2 1**	**S**	**0 0 1**	**9.0 cr**

Introduction (Dynamical Networks, Network Equations)
AC-Analysis of RLCM-Networks (Complex Network Analysis, Impedance, Admittance)
AC Power (Effective, Reactive and Apparent Power, Complex Power, Impedance Matching, Passive Device Models)
Frequency Response (Nyquist Plots, Bode Plots)
Resonant Circuits (Series and parallel Resonance Circuits, Characteristics, Frequency response)
Electrical Two-Ports (Voltage-Current-Relations, Parameters, Equivalent Circuits)
Transformers (Transformer Equations, Equivalent Circuits, Power Transfer, Frequency Response)
Periodic Excitation (Periodic Signals, Characteristics, Fourier Series, Analysis of Networks with periodic excitation)
Transient Network Behavior (Network ODEs, Continuity Conditions, Transient Network Analysis)
The exercises provide training of practical skills in modelling, analysis and design of AC and switching Circuits.
The Laboratory exercises introduce to practical measurements and analysis of electrical networks and systems. They cover the content of Basic Electrical Engineering, Electric and magnetic fields and Dynamical Networks.

examination:	written	language:	german
prerequisites:	Mathematics (1rst, 2nd and 3d Semester), Basic Electrical Engineering, Electric and magnetic Fields		
lecturers:	Prof. Dr.-Ing. habil. W. Schwarz Prof. Dr.-Ing. habil. R. Merker Dr.-Ing. A. Mögel		

12 04 01	**Electrical Power Engineering** (Elektroenergietechnik)				
EI IEEH	**W**	**2 0 0**	**S**	**0 0 1**	**4.5 cr**

As a link between basic and main studies this course deals with the engineering principles of power engineering. The lecture starts with the generation, transmission and distribution of electric power and the necessary elements are described. The following topics are discussed in detail:
Three-phase-system with balanced and unbalanced loads; Voltage stresses of the equipment; Partial discharge, breakdown and flashover; Rating and co-ordination; Protection measures against electric shock; Three-phase-transformer and asynchronous machine.
For better understanding a lot of practical exercises are part of the lecture.

examination:	written	language:	german
prerequisites:	physics, mathematics, electrical engineering		
lecturer:	Doz. Dr.-Ing. H. Bauer		

12 08 07	**Electronics** Elektronik (für Studiengang MT)					
EI LCS	**S**	**2 1 0**			**4.5 cr**	
The course of lectures provides basic knowledge of configuration, electronic characteristics And areas of application of the most important semiconductor components. Easy models for the circuitry are given. Matters in the lectures are: - principles of physics and electrical engineering, - pn-junction, - bipolar transistor, - MIS structure, - MOS transistor, - optoelectronical detectors						
examination:	written				language:	German
prerequisites:	Courses in Electrical Engineering, Physics, Mathematics of first year					
lecturer:	Prof. Dr.-Ing. habil. Schröter, Dr.-Ing. Komarow					

12 10 21	**Electromechanical Systems Design** (Konstruktion der Elektronik und Mechanik)				
EI IFTE	**S/W/S**	**2 1 0 / 3 1 0 / 0 1 0**			**12.0 cr**
This course deals with the design and development of up-to-date electromechanical devices and systems by focusing on both electronic systems and mechanical elements at the interface of electronic devices. Emphasis is placed on the main aspects and constraints of the development and design process of these basic components of modern electronic devices.					
examination:	written			language:	German
prerequisites:					
lecturer:	Prof. Dr.-Ing. habil. J. Lienig, Prof.Dr.-Ing. B. Schlecht				

	Non Technical Course (Nichttechnisches Fach/Studium generale)				
- under constructrion –					
examination:				language:	
prerequisites:					
lecturer:					

13 01 01	**Field Theory** (Feldtheorie)				
MW IFKM	**W**	**2 2 0**			**6.0 cr**

This course deals with the modeling of mechanical, thermal, electrical, magnetic, and coupled phenomena in deformable bodies as a basis for the use of commercial software. Kinematics of material continua: motion, deformation, mass density, charge density. Field variables: displacement, strain, stress vector, stress tensor, temperature, internal energy, heat flux density, electric field, electric displacement, electric current density, magnetic induction, magnetic field. Balance laws: balance of momentum, balance of moment of momentum, balance of energy, Maxwell's equations, jump and boundary conditions. Constitutive equations: theory of constitutive equations, elasticity, viscoelasticity, plasticity, heat conduction, electric conduction, polarization, magnetization, thermoelasticity, piezoelectricity, pyroelectricity. Mixed boundary value problems: unsteady, harmonic and steady fields, analytical examples, analogies.
Exercises: modeling and solution of problems.

examination:	written	language:	German
prerequisites:	prerequisites: mathematics, physics, engineering mechanics 1 and 2, electrical engineering		
lecturer:	Prof. Dr.-Ing. habil. H. Balke		

13 01 03	**System Dynamics of ;Mechanic Structures** (Systemdynamik mechanischer Strukturen)				
MW IFKM	**W**	**2 1 0**			**4.5 cr**

The aim of the course is to give an understanding of analytical mechanics, in order to to be able to understand its role as a background for system mechanics of discrete mechanical structures.
The course includes crank mechanisms with one degree of freedom, their differential equation and the derivated primary tasks (given force – seeked motion, given motion – seeked force). Additional tasks: speed drop, balancing of masses. Survey of theory of multi degree-of-freedom systems. Free and fixed torsional systems of propulsion systems with focus on system matrices, bending vibrations with gyroscopic effects and special methods for the estimation of lower bounds of eigenfrequencies.
Relations of system observation functions in time and frequency domain and basics of modal analysis.

- Lecture:
  - Set up differential equations
  - Computation of mechanical systems
  - Solution of inverse problem of machine dynamics
  - Calculation of eigenvalues and eigenvectors eg. of torsion systems
  - Bending vibrations
  - Difference equation model of mechanical systems
- Seminar:
  - Set up differential equations
  - Computation of impulse response and frequency response of mechanical systems
  - Solution of inverse problem of machine dynamics
  - Calculation of eigenvalues and eigenvectors eg. of torsional systems
  - Bending vibrations

Difference equation model of mechanical systems

examination:		language:	
prerequisites:	Technical mechanics, Laplace- and Fourier-Transform		
lecturer:	Prof. Dr.-Ing. habil. H.-J. Hardtke		

130103	**Numerical Analysis** (Numerische Methoden)				
MW IFKM	**W**	**2 1 0**			**4.0 cr**
The course communicates fundamentals in numerical approximation procedures and their application to solid mechanics. Emphasis is placed on the mathematical basis for solving boundary value problems by approximation. Methods of weighted residuals as well as weak and inverse formulation are introduced. Basics of the Finite Element Method (FEM), e.g. element formulation, shape functions, numerical integration, application of boundary conditions and assembly of the global stiffness matrix, are illustrated considering the one dimensional case. They are then generalised to two and three dimensions. Advanced topics as locking, super elements and the handling of dynamic and nonlinear problems are discussed. Furthermore, the construction of fundamental solutions for the Boundary Element Method (BEM) is explained for the one- and two-dimensional case. For the latter, the focus is set on treatment of singular integrals and discretisation of the boundary.					
examination:	written			language:	German
prerequisites:	Mathematics, Engineering Mechanics 1, 2 and 3				
lecturer:	Prof. Dr.-Ing. habil. V. Ulbricht				

13 01 03	**Structural Mechanics Laboratory** (Praktikum Mechanische Strukturen)				
MW IFKM			**S**	**0 0 1**	**1.5 cr**

The students should learn to handle modern measurement systems as well as the finite element code ANSYS. These methods allow the identification of the behaviour of mechanical systems exposed to static and dynamic loads. It is necessary to attend 2 of 3 complexes.

Complex 1:
Introduction into optical field measurement methods and their application to mechatronics (2 demonstration lessons for all students).
Laboratory 1: Application of digital Speckle-Interferometry to measure the displacement field of a homogeneous orthotropic shell and calculation of stress level.
Laboratory 2: Application of grey value correlation method to measure the displacement field of a plate and estimation of material parameters.

It is necessary to keep the minutes for each laboratory.

Complex 2:
Experimental identification of inertia and damping parameters as basic characteristics of mechanic structures. Introduction in modern measurement methods of vibration measurement to estimate eigenfrequencies and eigenvectors of differenbt mechanical systems.
In preparation for the laboratories it is possible to get teaching material in the internet.
Laboratory 1: Estimation of inertia parameters (centre of mass, moment of inertia), it is necessary to keep the minutes.
Laboratory 2: Procedure to estimate damping parameters.
Laboratory 3: Experimental modal analysis.
Laboratory 4: Non-contact vibration measurements by laser-doppler-vibrometry.

Complex 3: Introduction into handling of ANSYS finite element code with focus on consolidation of theoretical knowledge of structural mechanics. It is necessary to solve an individual assigned task.
3 x practical training in desktop-PC-pool with 4 problems (bending beams, shells, plates, vibration of plates) with teaching material.
1 x consultation to support solving individual task.

examination:		language:	
prerequisites:	Technical mechanics		
lecturer:	Prof. Dr.-Ing. habil. H.-J. Hardtke, Prof.Dr.-Ing.habil. V. Ulbricht		

12 02 03	**Electric and Hydraulic Actuators** (Antriebstechnik/Aktorik)				
EuI ETI + MW IfD	**W**	**1/1/0**	**S**	**0/0/1**	**4,5 cr**

Electric and hydraulic actuators generate motion and allow the controlling of the power flow from the mostly electric power source to different mechanical equipment. This compulsory course introduces to the typical tasks for actuators.

Part 1: Electric drives and the drive system
Different types of motion, embedding of the actuator in the environment,
fast generation of torque in rotating electrical machines or force in linear motors,
natural and controlled speed-torque-behavior, principles of drive control,
thermal and mechanical design of drives

Part 2: Hydraulic drives and their control
Principles and structure of valve-controlled hydraulic drives, introduction into the behavior of hydraulic valves, design of continuous changeable hydraulic valves and servo-cylinders for controlled hydraulic actuators, controlled system for electro-hydraulic control, closed loop control of hydraulic actuators
Numerical exercises complement the lectures in both parts.
Four laboratory tasks allow the students to see electric and hydraulic actuators working.

examination:	written	language:	German
prerequisites:	basic course of mechatronics		
lecturer:	Prof. Dr. P. Büchner/Prof. Dr. S. Helduser		

12	**Measuring and Sensor Technology** (Mess- und Sensortechnik)				
EI LCS	**W**	**2 1 0**	**S**	**0 0 1**	**?? cr**

This course introduces the fundamentals of generic and in particular electronic measuring systems. The following topics will be covered: fundamental principles, terms and definitions (e.g. SI-units, measuring error and measurement uncertainty), recapitulation of basic statistics, error propagation, information content (Shannon, Fisher), noise (shot noise, thermal noise, quantization noise, SNR), limits of measurability (Heisenberg, Cramer-Rao-bound), analog electrical metrology (measurement of current, voltage and power, bridge circuits), digital measurement techniques (A/D- and D/A-conversion, time and frequency measurement, counters), measuring automation (computer-aided measurement processes, interfaces, virtual instruments, eigen-calibration), discussion of selected resistive, inductive, capacitive, piezoelectric, ultrasonic and optical measurement techniques for measuring time-of-flight, position, distance, velocity, rotation rate, flow rate, pressure, mechanical load, expansion and temperature (e.g. resistance thermometers, rotary encoders, SONAR, RADAR, GPS)

examination:	written	language:	German
prerequisites:	intermediate examination or Bachelor degree in Electrical Engineering or Mechatronics		
lecturer:	Prof. Dr.-Ing. J. Czarske		

12 02 01	**Power Electronics I** (Leistungselektronik 1)				
EuI ETI	**W**	**2 1 0**			**4,5 cr**
This course of lectures provides basic knowledge of power semiconductor devices (Power Diodes, BJT, Power MOSFET, Thyristor, GTO-Thyristor, IGBT, MCT, SIT), converter configurations (line-frequency phase-controlled rectifiers and inverters, PWM-inverters, dc-chopper) and firing-control systems. In exercises and a practical, the various power electronic components and converter configurations will be examined and analysed.					
examination:	written, 3 hours			language:	german
prerequisites:	mathematics, basics in electrical engineering				
lecturer:	Prof. Dr.-Ing. habil. H. Güldner				

12 03 01	**Control of Continuous-Time Processes I** (Regelungstechnik I)				
EI RST	**W**	**3 1 0**			**6.0 cr**
The course provides knowledge and skills for the analysis and design of continuous time linear single-loop control systems by treating mathematical methods for their representations, stability and parameter sensitivity, as well as controller design approaches. Topics covered include: aims of control theory, mathematical description of linear transfer elements in both time and frequency domain, description of the behaviour and analysis of linear simple loops, algebraic stability criteria (Bézout, Hermite, Routh-Hurwitz, Michailov-Leonhard-Cremer, Strecker-Nyquist, Charitonov), analysis of parameter sensitivity and sensitivity functions, and controller design (loop shaping, root locus methods and their generalizations, Youla parameterization of all stabilizing controllers, trajectory planning and control). Computational exercises concentrate on topics supporting the acquisition of capabilities and applicable knowledge and motivate deeper understanding through the solution of problems by MATLAB based simulations.					
examination:	written			language:	german
prerequisites:					
lecturer:	Prof. Dr.-Ing. Dr.rer.nat. K. Reinschke				

12 01 01	**Discrete Event Systems** (Ereignisdiskrete Systeme)				
EI IfA	**W**	**2 1 0**			**4.5 cr**
This course aims to study basic methods for modelling and analysis of discrete event automation systems. Lectures introduction to discrete event systems, signal oriented modelling, combinatorial automata, sequential automata, Petri-nets, time stamped Petri-nets (max-plus algebra notation), discrete event control systems design, realization aspects Complementary exercises on hands-on examples allow to train pratical skills in modelling, analysis and design. Note: this course covers actually the winter term of the course Control of Discrete Processes					
examination:	written			language:	german
prerequisites:	system theory				
lecturer:	Prof. Dr. techn. K. Janschek, Dr.-Ing. D. Hofmann, Dipl.-Ing. E. Koycheva				

12 01 01	**Control Laboratory** (Praktikum Regelung / Steuerung)				
EI RST/IfA			**S**	**0 0 1**	**1.5 cr**
Design and implementation of control schemes and algorithms for feedback and discrete event control of mechatronic laboratory systems. Feedback control: - DC-motor speed control - 2-link pendulum (state feedback, parameter estimation, controller design) Discrete event control - Entrance door control					
examination:	Oral, written lab report			language:	german
prerequisites:	Control of Continuous-Time Processes I, Discrete Event Systems				
lecturer:	Prof. Dr.-Ing. Dr. rer. nat. K. Reinschke, Prof. Dr. techn. K. Janschek,				

16 01 01	**Embedded Controllers** Embedded Controller				
VW IAD			**S**	**2 0 1**	**4.5 cr**
Based on fundamental knowledge about (Micro-)computer science continuative knowledge about basic principles and applications of embedded controller architectures is imparted in this course. The interaction between controller kernels and peripheral devices are presented for different controller architecture concepts. Methods to identify the potential of different controller concepts, to design embedded controller systems and to program embedded controllers are given. Practice : With the help of a C167 embedded controller (Infineon) the programming of I/O units is adressed (ADC, DAC, serial and parallel interfaces, timer and counter units). C is used as programming language.					
examination:	written			language:	german
prerequisites:	computer science, C programming skills				
lecturer:	Prof. Dr.-Ing. B. Bäker				

Studiengang MECHATRONIK

Main Courses – Optional Mandatory Modules "METHODS"

valid from 2003

Topic	SWS	5. Sem.	6. Sem.	7. Sem.	8.Sem.	Lecturer
Module: MULTI BODY SYSTEMS **Gruppe: Mehrköpersysteme**						**(Prof. Beitelschmidt)**
Kinematics and Kinetics of Multi Body Systems (Kinematik und Kinetik der MKS)	4			2/2/0		VW - Beitelschmidt
Elastic Structures within Multi Body Systems (Einbindung eleastischer Strukturen)	1			1/0/0		MW – Hardtke, Schmidt
Reglerentwurf für aktive Elemente	1			1/0/0		N.N.
Coupled Simulation/Real-Time Simulation (Gekoppelte Simulation/Echtzeitsimulation)	2				2/0/0	VW - Beitelschmidt
Simulation of Multi Body Systems *(Praktikum Mehrkörpersysteme)*	2				0/0/2	VW – Beitelschmidt, Quarz
Module: HYDRAULICS/PNEUMATICS **(Gruppe Hydraulik/Pneumatik)**						**(Prof. Helduser)**
Fundamentals of Fluid Power Drives and Controls (Grundlagen der fluidtechnischen Antriebe und Steuerungen)	3			2/1/0		MW - Helduser
Electrohydraulic Drive Systems (Elektrohydraulische Antriebssysteme)	3				2/1/0	MW – Helduser / Feuser
Pneumatic Control Systems (Steuerungstechnik und Regelungstechnik pneumatischer Antriebe)	2		1/1/0			MW - Helduser
Practical course Fluid Power Control *(Praktikum Fluidtechnik)*	2				0/0/2	MW - Helduser
Module: MECHANICAL CONSTRUCTION **Gruppe Maschinenkonstruktion**						**(Prof. Stelzer)**
Konstruktionswerkstoffe	3		2/1/0			MW - Zouhar
Engineering development process (KEP) (Konstruktiver Entwicklungsprozess (KEP))	2	2/0/0 [1)]		2/0/0 [1)]		MW - Stelzer
Design with 3D-CAD-Systems (3DK) (3D-Konstruktion)	1		0/1/0			MW - Steger
Product Data Management (PDM) (Produktdatenmanagement)	2				2/0/0	MW - Stelzer
Complex traineeship *Komplexpraktikum* Konstruktionsseminar Virtuelle Techniken in der PE	2				0/0/1 0/0/1	MW - Stelzer/Platz

Studiengang MECHATRONIK

Main Courses – Optional Mandatory Modules "METHODS"

valid from 2003

Topic	SWS	5. Sem.	6. Sem.	7. Sem.	8.Sem.	Lecturer
Module: AUTOMATIC CONTROL **Gruppe Regelung/Steuerung**					**(Prof. Reinschke)**	
Stochastic Signals and Systems (System Theory III) (Stochastische Signale und Systeme)	3	2/1/0*		2/1/0**		EuI- Hoffmann
Control of Continuous-Time Processes II (Regelungstechnik II)	3		2/1/0			EuI - Reinschke
Nonlinear Control Systems (Nichtlineare Regelungssysteme)	2			2/0/0		EuI - Reinschke
Komplexpraktikum	2				0/0/2	EUI - Reinschke, Janschek
Module: MOTION CONTROL **Gruppe Bewegungssteuerung**					**(Prof. Büchner)**	
Electric Drives (Elektrische Antriebe)	3		2/1/0			EuI - Büchner
Power Electronics II (Leistungselektronik II)	3		2/1/0			EuI - Güldner
Stellmotoren	2			1/1/0		EuI - Liese
Complex Lab Work Motion Control *Komplexpraktikum*	2			0/0/2		Büchner, Güldner, Liese
Module: INFORMATION PROCESSING **Gruppe Informationsverarbeitung**					**(N.N.)**	
Prozessinformationsverarbeitung	2	2/0/0 [1)]		2/0/0 [1)]		EuI – N.N.
Echtzeitverarbeitung	2		2/0/0			EuI – N.N.
Serial Bus Systems in Automobiles and Industry (Bussysteme in der Automatisierungstechnik)	2			2/0/0		VW – Prof. Bäker
SPS und Kompaktregler	2			2/0/0		EuI – N.N.
Praktikum	2				0/0/2	N.N.
Module: DESIGN TECHNIQUES **Gruppe Entwurfstechniken**					**(Prof. Janschek)**	
Simulation Techniques (Simulationstechnik)	2	2/0/0 [1)]		2/0/0 [1)]		EuI - Janschek
Systems Design (Systementwurf)	2	2/0/0 [1)]		2/0/0 [1)]		EuI - Janschek
Product Design potly. Development (Produktentwicklung)	2		2/0/0			EuI - Schulze
Quality Management (Qualitätssicherung)	2		2/0/0			EuI - Wolter
Praktikum	2		0/0/2 [1)]		0/0/2 [1)]	Janschek, Wolter

1) optional 5. oder 7. Semester bzw. 6. oder 8. Semester
2) wird ab 2006 angeboten

Studiengang MECHATRONIK

Main Courses – Optional Mandatory Modules "APPLICATIONS"

valid from 2003

Topic	SWS	5. Sem.	6. Sem.	7. Sem.	8. Sem.	Lecturer
Module: AUTOMOTIVE VEHICLE ENGINEERING **Gruppe Kraftfahrzeugtechnik**					**(Prof. Mischke)**	
Längsdynamik	2				2/0/0	VW – Mischke
Quer- und Vertikaldynamik	2				2/0/0	VW – Mischke
Konstruktion und Berechnung von KFZ	1			1/0/0		VW – Mischke
Simulation Automobiles (Simulation Kraftfahrzeuge)	2			1/1/0		VW - Beitelschmidt
IT and Electronics of Combustion Engines (Elektronik und Informationstechnik im KFZ)	2				1/0/1	VW - Bäker
Laborpraktikum Kraftfahrzeugtechnik	1				0/0/1	VW – Mischke
Module: RAILWAY VEHICLE ENGINEERING **Gruppe Schienenfahrzeugtechnik**					**(Dr. Jaenichen)**	
Rolling stock and braking systems (Schienenfahrzeugtechnik/Bremstechnik)	2				2/0/0	VW - Jaenichen *)
Electric Railways (Elektrische Bahnen)	2			2/0/0		VW - Biesenack
Multi Body Dynamics Railway Vehicles (Mehrkörperdynamik)	2			1/1/0		VW - Beitelschmidt
Railway Signalling Systems (Bahnsicherungssysteme)	2				2/0/0	VW - Trinckauf
Rolling Stock *Komplexpraktikum*	2				0/0/2	Biesenack, Jaenichen, Maschek
Module: COMBUSTION ENGINES **Gruppe Grundlagen Verbrennungsmotoren**					**(Prof. Zellbeck)**	
Principles of combustion engines (Grundlagen Verbrennungsmotoren)	2			2/0/0		VW - Zellbeck
Simulation of internal combustion engines (Simulation Verbrennungsmotoren)	3				2/1/0	VW - Zellbeck
Dynamics of Piston Engines (Dynamik der Kolbenmaschinen)	2			1/1/0		VW - Beitelschmidt
IT and electronics of Vehicles (Elektronik und Informationstechnik am Verbrennungsmotor)	2				1/0/1	VW - Bäker
Practical laboratory course of internal combustion engines *Laborpraktikum Verbrennungsmotoren*	1				0/0/1	VW - Zellbeck
Module: ELECTRIC DRIVE TECHNOLOGY **Gruppe Elektrische Antriebstechnik**					**(Prof. Büchner)**	
Closed Loop Control of Drives (Antriebsregelungen)	2				1/1/0	Eul- Büchner
Design of Drive Systems (Entwurf von Antriebssystemen)	3			2/1/0		Eul - Müller
Application-oriented Real-time controllers (Anwendungsspezifische Echtzeitregler)	3				2/1/0	Eul - Geitner
Complex Lab Work Electric Drive Technology *Komplexpraktikum*	2			0/0/2		All involved chairs

Studiengang MECHATRONIK

Main Courses – Optional Mandatory Modules "APPLICATIONS"

valid from 2003

Topic	SWS	5. Sem.	6. Sem.	7. Sem.	8. Sem.	Lecturer
Module: AEROSPACE **Gruppe Luft und Raumfahrt**						**(Prof. Wolf)**
Spacecraft Attitude and Orbit Control (Lageregelung für Raumfahrzeuge)	2		2/0/0 [1)]		2/0/0 [1)]	Eul- Janschek
Space Stations (Raumstationen)	2	2/0/0 [1)]		2/0/0 [1)]		MW - Fasoulas
Aircraft Design (Luftfahrzeugkonstruktion I)	2	2/0/0 [1)]		2/0/0 [1)]		MW – Wolf
Design of Composite Aerospace Structures (Faserverbundkonstruktion von Luft- und Raumfahrzeugen)	2		1/1/0 [1)]		1/1/0 [1)]	MW - Wolf
Komplexpraktikum	2				0/0/2	Janschek, Fasoulas
Module: MOBILE PRODUCTION MACHINES **Gruppe Mobile Arbeitsmaschinen**						**(Prof. Kunze)**
Konstruktive Gestaltung typ. Baugruppen von Förder-, Bau- und Landmaschinen	4	2/2/0 [1)]		2/2/0 [1)]		MW - Marquardt, Kunze,Bernhard
Modellbildung und Simulation mobiler Arbeitsmaschinen	4			2/2/0		MW - Marquardt, Kunze,Bernhard
Analyse und exp. Simulation des Maschineneinsatzes unter Beachtung der Mensch-Maschine-Interaktion	2				0/0/2	MW - Marquardt, Kunze,Bernhard
Module: MOTION CONTROLLED MACHINE SYSTEMS **Gruppe Bewegungsgeführte Maschinensysteme**						**(Prof. Großmann)**
System Character and Components of Motion-controlled Processes and Systems (Systemcharakter und Komponenten bewegungsgeführter Prozesse)	3			2/1/0		MW - Großmann
Functionally Relevant System Behaviour and Examples of Mechatronic Applications (Funktionell relevantes Systemverhalten und Beispiele mechatronischer Anwendungen)	7				4/1/2	MW - Großmann
Module: ROBOTICS **Gruppe Robotik**						**(Prof. Modler)**
Räumliche Kinematik	2		2/0/0			Mat.Nat. - Bär
Control of Robot Manipulators (Steuerungen für Robotersysteme)	2			1/1/0		Eul - Janschek
Robotic Mechanisms (Roboterführungsgetriebe)	2			1/1/0		MW - Modler
Laserrobotik/Lasertronik	4				1/1/2	MW - Beyer
Module: SPECIFIC PRODUCTION METHODS **Gruppe Spezielle Fertigungsmethoden**						**(Prof. Beyer)**
Lasertechnik	2		2/0/0			MW - Beyer
Plasmatechnik	2			1/1/0		MW - Beyer/Schultrich
Oberflächen-, Nanotechnik	2			2/0/0		MW - Beyer/Schultrich
Rapid Prototyping	2				1/1/0	MW - Beyer
Praktikum	2				0/0/2	MW - Beyer/Kötter

Studiengang MECHATRONIK

Main Courses – Optional Mandatory Modules "APPLICATIONS"

valid from 2003

Topic	SWS	5. Sem.	6. Sem.	7. Sem.	8. Sem.	Lecturer
Module: ELECTROMECHANICAL **Gruppe Feinwerktechnik**						**(Prof. Lienig)**
Electromechanical networks (Elektromechanische Netzwerke)	3			2/1/0		Eul - Pfeifer
Precision Device Engineering (Präzisionsgerätetechnik)	2			2/0/0 [2)]		Eul - Lienig/Nagel
Technical Optics (Technische Optik)	3				2/1/0	Eul - Lakner
Practical Course in Electromechanical Design: Actors and Sensors *Prakt. FWT - Aktorik und Sensorik* [3)]	2				0/0/2	Eul -Lienig, Nagel
Prakt. FWT - Fertigung elektron. Geräte [3)]	2				0/0/2	Eul -Wolter
Prakt. FWT - Biomed. Gerätetechnik [3)]	2				0/0/2	Eul - Poll
Module: MICROSYSTEMS TECHNOLOGY **Gruppe Mikrosystemtechnik**						**(Prof. Fischer)**
Werkstoffe der Mikrosystemtechnik	2		2/0/0			Eul - Fischer (Adolphi)
Mikrosysteme	2			2/0/0 [1)]		Eul - Fischer
Entwurf in der Mikrosystemtechnik	3			2/1/0 [1)]		Eul - Fischer, Gerlach
Komplexpraktikum	3				0/0/3	Eul - Fischer (Adolphi)
Module: ELECTROMECHANICAL SYSTEMS **Gruppe Elektromechanische Systeme**						**(Prof. Pfeifer)**
Electromechanical network (Elektromechanische Netzwerke)	3		2/1/0			Eul - Pfeifer
Application of combined simulation (Anwendung kombinierter Simulation)	4			1/1/0	1/1/0	Eul - Pfeifer
Electromechanical measurement engineering (Elektromechanische Messtechnik)	1				1/0/0	Eul - Pfeifer
Praktikum Elektroakustik	2				0/0/2	Eul – Pfeifer/Starke

1) optional 5. oder 7. Semester bzw. 6. oder 8. Semester

2) ab Studienjahrgang 2003 im 6. Semester

3) aus diesen drei Praktika Wahl von je zwei Versuchen aus den drei Praktikumsteilen (entspricht insgesamt 2 SWS)

Module: BIOMEDICAL ENGINEERING **Gruppe Biomedizinische Technik**						**(Prof. Poll)**
Biomedical Engineering (Biomedizinische Technik)	3		2/1/0			Eul - Poll
Technologically-Significant Life Processes (Technikrelevante Lebensprozesse und -strukturen)	3			3/0/0		Eul - Poll
Therapeutical Engineering (Therapeutische Gerätetechnik)	3			1/1/0		Eul - Poll
Practical Course in Therapeutical Engineering *(Praktikum Therapeutische Gerätetechnik)*	2				0/0/2	Eul - Poll

Specialization Profiles

The four specialization profiles listed below must be understood as recommended combination of eligible modules out of he groups "Methods" and "Applications".
For the listed profiles (i.e. combination of modules) a high probability for class schedule without time conflicts is envisaged.

Profile: **VEHICLE MECHATRONICS**	
	Multi Body Systems
	Motion Control
	Combustion Engines
	Optional (1-out-of-2):
	Automotive Vehicle Engineering
	Railway Vehicle Engineering
Profile: **MECHATRONICS IN MECHANICAL ENGINEERING**	
	Mechanical Construction
	Hydraulics/Pneumatics
	Robotics
	Optional (1-out-of-3):
	Motion Controlled Machine Systems
	Mobile Production Machines
	Specific Production Methods
Profile: **MACRO-MECHATRONICS**	
	Motion Control
	Automatic Control
	Elektrical Drives
	Optional (1-out-of-3):
	Automotive Vehicle Engineering
	Railway Vehicle Engineering
	Aerospace
Profile: **MICRO-MECHATRONICS**	
	Information Processing
	Design Techniques
	Optional (2-out-of-4):
	Precision Engineering
	Microsystems Technology
	Electromechanical Systems
	Biomedical Engineering

Module: MULTI BODY SYSTEMS
(Mehrkörpersysteme)

16 07 01	**Kinematics and Kinetics of Multi Body Systems** (Kinematik und Kinetik der Mehrkörpersysteme)				
VW ITGF	**W**	**2 2 0**			**6.0 cr**
Modelling and simulation of mechatronic systems requires the ability to formulate equations of motion for the mechanical part of the system. Therefore vehicles, robots and other machines with large movements require the method of multi body systems. • Elements of MBS: rigid bodies, ideal joints, force elements, kinematical and kinetic excitations • Kinematics of free and constrained bodies • Equations of motion for unconstrained bodies • Equations of motion for multi body systems in descriptor form (DAE) • ODE-Formulation using Newton-Euler-Jourdain Method • O(n)-Algorithm for tree structured systems • Postprocessing of simulation results • Linearization of Models During the exercises the whole process of programming a simulation tool from pre-processing the parameters over choice of a suitable solver till postprocessing is trained.					
examination:	oral			language:	german
prerequisites:	Mathematics, applied mechanics				
lecturer:	Prof. Dr.-Ing. M. Beitelschmidt				

16 07 01	**Elastic Structures within Multi Body Systems** (Einbindung elastischer Strukturen)				
MW IFM	**W**	**1 0 0**			**1.5 cr**
The algorithms for multi body systems (MBS) can be extended to the treatment of elastic bodies within the structure. Elastic bodies can be modelled using an analytical approach for simple geometries or FEM-models. • Motivation, modelling of Systems with FEM and MBS • Description of elastic MBS • Reduction of FEM-models for the treatment within MBS • Coupling of FEM and MBS					
examination:	oral			language:	german
prerequisites:	Mathematics, applied mechanics, multi-body systems				
lecturer:	Dr.-Ing. habil. R. Schmidt, Dr. V. Quarz				

16 07 01	**Coupled Simulation/Real-Time Simulation** (Gekoppelte Simulation/Echtzeitsimulation)				
VW ITGF	**S**	**2 0 0**			**3.0 cr**
Mechatronical systems usually consist of subsystems coming from different physical domains e.g. mechanics, electro-technics, hydraulics, fluid-dynamics. Each domain has its established simulation technology. The methods of coupling these domains are introduced. • General description of simulation • Classification of simulation topics by the structure of underlying equations • Types of simulation couplings • Introduction into hydraulic systems modelling • Introduction into electric systems modelling • The concept of flow and difference variables for the coupling of any physical domain					
examination:	oral			language:	german
prerequisites:	Mathematics, applied mechanics, multi-body systems				
lecturer:	Prof. Dr.-Ing. M. Beitelschmidt				

16 07 01	**Simulation of Multi Body Systems** (Praktikum Mehrkörpersysteme)				
VW ITGF	**S**	**0 0 2**			**1.5 cr**
Application of knowledge imparted in the courses concerning multibody systems. Modelling and simulation of an active tilting train. The task is split into several exercises: • Definition of the simulation aims • Setting up models of the bogie, the tilting mechanism and the whole vehicle • Modelling of control elements • Simulation in time and frequency domain • Integration of an elastic carbody structure • Comparison of rigid and flexible MBS-models					
examination:	Introductory colloquium and term paper			language:	german
prerequisites:	Mathematics, applied mechanics, multi-body systems				
lecturer:	Dr. V. Quarz				

	I... (Reglerentwurf für aktive Elemente)				
- under construction-					
examination:				language:	
prerequisites:					
lecturer:					

Module: HYDRAULICS/PNEUMATICS
(Hydraulik/Pneumatik)

13 20 01	**Fundamentals of Fluid Power Drives and Controls** (Grundlagen der fluidtechnischen Antriebe und Steuerungen)				
MW IFD	**W**	**210**			**4.5 cr**

Aim of the course :

Hydraulic and pneumatic drive and control technology – summarised as fluid power – focuses on power and motion control in machines, plants and vehicles.

This course offers an introduction into the fundamentals of physics, the methodical layout and functioning of the basic components and also the basics of circuit engineering. Students will learn to identify the essential functions of fluid power systems. They will be able to design and calculate solutions for simple systems. Moreover, they will learn how to analyse complex machine controls and assess various possible solutions.

The lecture course is supported by a programme of tutorials and practical examples which deepen the subject matter taught in the lectures.

Lectures:

Hydraulics
- Hydromechanical fundamentals
- Hydraulic fluids
- Hydraulic devices for energy transformation (hydraulic pumps, motors and cylinders)
- Hydraulic devices for energy control (hydraulic valves for pressure and flow control)
- Hydrostatic transmissions
- Acessories for energy storage (accumulators) and fluid treatment
- Basic hydraulic systems for pressure, speed and position control

Pneumatics
- Thermodynamic fundamentals
- Compressed air supply unit
- Pneumatic components

examination:	written	language:	German
prerequisites:	Preliminary Diplom Degree		
lecturer:	Prof. Dr.-Ing. S. Helduser		

13 20 02	**Electrohydraulic Drive Systems** (Elektrohydraulische Antriebssysteme)				
MW IFD			**S**	**210**	**4.5 cr**

Aim of the course :

Electrohydraulic drives and controls rank among the most modern and efficient drive systems for linear and rotary motion control in machinery, vehicles and plant engineering. This course introduces students into the mechanical design, the static and dynamic performance and also the electronic components of closed loop electrohydraulic drive systems. The course starts with giving explanations about the design principles of the components (servovalves and servopumps). On this basis, mathematical methods of system analysis as well as those of closed loop control are explained. Furthermore, an introduction to advanced calculation of transmission characteristics and also optimisation by modern control methods is given.

Students learn how to use the design methods for electrohydraulic drives including electronic control. This includes the practical design of controlled electrohydraulic systems, their integration into the overall concept of a machine control system and the use of

computer simulation as a design tool.
The lecture course is supported by a programme of tutorials and practical examples to deepen the subject matter thaught in the lecture.

Lectures:

- Design of closed loop controlled hydraulic drives
- Components of servohydraulic systems
  (servovalves and Proportional Valves, servopumps and -motors, servo cylinders)
- Valve-contolled and pump controlled cylinder drive
  (static performance, linearisation and transmission functions of the drive system, open loop dynamic performance characteristics)
- Closed loop control of electrohydraulic drives
  (classic control, description of the state space and observer theory, fuzzy control for parameter adaptation, electronic units)
- Intelligent electrohydraulic actuators
- Simulation technology in hydraulics to predict performance characteristics

examination:	written or oral	language:	German
prerequisites:	Preliminary Diplom Degree Lecture Fundamentals of Fluid Power Drives and Controls		
lecturer:	Prof. Dr.-Ing. S. Helduser, Prof. Dr.-Ing. A. Feuser		

13 20 04	**Pneumatic Control Systems** (Steuerungs- und Regelungstechnik pneumatischer Antriebe)				
MW IFD			**S**	**110**	**3.0 cr**

Aim of the course :

The lecture is designed to provide fundamental knowledge of control technology with regard to its application in fluid power drives, in particular pneumatic drives. Thus students develop basic skills in the conception and design of controls. Signal processing is realised by electronic components, while power is controlled by fluid mechanics and in particular by pneumatics. Signal processing requires interfaces, i.e., power actuators and sensors. Their layout and functions are being described.
Digital computers have become an almost universal tool. Hence simulation is now a central development tool for the design of both the components of the control circuit and the performance characteristics of position, speed or force control loops. Therefore, the lecture focuses on the modelling of pneumatic drives in connection with simulation. As digital computers are also being used for the hardware realisation of the control structures of fluid power drives, the lecture will also include this issue.
The lecture course is supported by a programme of tutorials and practical examples which deepen the subject matter taught in the lectures.

Lectures:

- Pneumatic and hydraulic drives
  (design, servopneumatic drive)
- Thermodynamic fundamentals of controlled pneumatic drives
  (flow characteristics, change of state)
- Linearisation and simplification of the balance description
- Close loop Controlled pneumatic drive
  (concepts of the pneumatic closed loop position control)
- Design of position control

examination:	written	language:	German
prerequisites:	Preliminary Diplom Degree		
lecturer:	Prof. Dr.-Ing. S. Helduser		

13 20 03	**Practical course Fluid Power Control** (Praktikum Fluidtechnik)				
MW IFD			**S**	**002**	**3.0 cr**

Aim of the course :

During this practical course, students will undertake five experiments. They serve to deepen the contents of the lectures and tutorials. Students learn how to handle practically fluid power components practically as well as ectrohydraulic and electropneumatic, including systems electronic controls.

Practical course:

- Electromechanical devices for valve stroking
  (design of Proportional solenoid, torque motor ,etc., static and dynamic performance characteristics, electronic amplifier)
- Position-controlled hydraulic drive I
  (design, open loop static and dynamic performance characteristics)
- Position-controlled hydraulic drive II
  (closed loop performance characteristics)
- Electropneumatic handling systems
- Closed loop control of pneumatic drives

examination:		language:	German
prerequisites:	Preliminary Diplom Degree Lecture Fundamentals of Fluid Power Drives and Controls		
lecturer:	Prof. Dr.-Ing. S. Helduser		

Module: MECHANICAL CONSTRUCTION
(Maschinenkonstruktion)

13 12 02	**Engineering development process (KEP)** (Konstruktiver Entwicklungsprozess (KEP))				
IMM KTC	**W**	**2 0 1**	**-**	**-**	**4.5 cr**
This course aims to study methods of the systematic product planning. Not the detailed design of individual product elements with tools like CAD but the conception and decision process for complex products will be trained. This process starts with the business decision for one special product from the view of the company. Target management, technology scaling and selection are following steps. Special tools, like MTP, QFD or FMEA will be trained.					
examination:	written			language:	german
prerequisites:	basic knowledge of engineering design concepts				
lecturer:	Prof. Dr. R. Stelzer				

13 12 02	**Design with 3D-CAD-Systems (3DK)** (3D-Konstruktion)				
IMM KTC	**S**	**0 1 0**	**-**	**-**	**1.5 cr**
As an extension of the introduction in the work with CAD systems in the first semester, the students will learn to design complex parts and assemblies with special design concepts.					
examination:	written			language:	german
prerequisites:	computer science; CAD basics; engineering design basics				
lecturer:	Dr. W. Steger				

13 12 02	**Product Data Management (PDM)** Produktmanagement				
IMM KTC	**S**	**2 0 0**	**-**	**-**	**3 cr**
This course aims to study methods and models of the product data management, especially in the combination with CAD, ERP, Virtual Reality and other important IT tools in the engineering process. Students will discuss targets and architecture of PDM systems, methods and tools of document and product model management. This includes the handling of conventional documents in an IT driven enterprise (data capturing). One special topic are the interfaces of CAD systems, methods how to work with such interfaces. Special topics, like release and change management, workflow and will be discussed. In the second part the focus will be set to questions around the engineering collaboration restrictions – one of the large challenges of all global players. Here solutions for distributes models and data, security questions are the focus. As a summary, the selection and implementation of such strategies in an enterprise will be discussed.					
examination:	written			language:	german
prerequisites:	engineering design process; CAD; computer science				
lecturer:	Prof. Dr. R. Stelzer				

13 12 02	**Complex traineeship** (Konstruktionsseminar Virtuelle Techniken in der PE)				
IMM KTC	**S**	**0 0 2**	**-**	**-**	**3 cr**
The complex traineeship will train important components of the theoretical knowledge, the students learned during the complex "Machine design". So the traineeship is splited in two components - Part 1: Design seminar (001) analyzing and discussion of complex design solutions development of improved concepts Part 2: virtual technology (001) development of concepts and solutions to use CAD model data for other virtual tools, like PDM or VR					
examination:	written			language:	german
prerequisites:	engineering design concepts; 3D-CAD; PDM				
lecturer:	Prof. Dr. R. Stelzer / Dr. B. Platz				

	I... (Konstruktionswerkstoffe)				
- under construction -					
examination:				language:	
prerequisites:					
lecturer:					

Module: AUTOMATIC CONTROL
(Regelung/Steuerung)

12 09 01	**Stochastic Signals and Systems (System Theory III)** (Stochastische Signale und Systeme (Systemtheorie III))				
EI IAS	**W**	**2 2 0**			**6.0 cr**
The course is intended to give an introduction in the mathematical methods for describing stochastic signals and systems at engineering level. It includes the following chapters: • Stochastic signals • Static systems • Dynamic Systems The main content refers to theory and application of stochastic processes. The lectures are complemented by exercises. The complete course is available as textbook (Wunsch and Schreiber: Stochastische Systeme, 4th edition, Springer 2006, in German).					
examination:	written			language:	German
prerequisites:	System Theory I / II				
lecturer:	Prof. Dr.-Ing. habil. R. Hoffmann				

12 03 01	**Control of Continuous-Time Processes II** (Regelungstechnik II)				
EI RST	**S**	**2 2 0**			**6 cr**
Mathematical methods for the representation of linear multi-variable (MIMO) control systems and controller design for such systems are treated. The following topics are covered: time and frequency domain description, state and polynomial representations, controllability and observability and their consequences, controller design by pole assignment (via state or output feedback and observers), pole-zero concepts for MIMO systems, design of decoupling and disturbance attenuating controllers, trajectory planning and control, stability and design of sampled control systems, outlook on advanced topics. Computational exercises concentrate on topics supporting the acquisition of capabilities and applicable knowledge and motivate deepening independent solution of problems by MATLAB based simulations.					
examination:	written			language:	german
prerequisites:	Control of Continuous-Time Processes I				
lecturer:	Prof. Dr.-Ing. Dr.rer.nat. K. Reinschke				

12 03 01	**Nonlinear Control Systems** (Nichtlineare Regelungssysteme)				
EI RST	W	**2 1 0**			**4,5 cr**
Students are led to understand the fundamental concepts, notions and methods of nonlinear control theory. The topics are the following: investigating nonlinear 2nd order systems in the phase plane, harmonic balance and describing functions, Ljapunov stability theory, design of nonlinear control systems based on using Ljapunov functions, elementary introduction to some elements of the differential geometric theory of nonlinear systems, nonlinear observers, absolute stability (circle and Popov criteria). Computational exercises concentrate on topics supporting the acquisition of capabilities and applicable knowledge and motivate deeper understanding through the solution of problems by MATLAB based simulations.					
examination:	written			language:	german
prerequisites:	Control of Continouus-Time Processes I + II				
lecturer:	PD Dr.-Ing. habil. J. Rudolph				

Module: MOTION CONTROL
(Bewegungssteuerung)

12 02 03	**Electric Drives** (Elektrische Antriebe)				
Eul ETI	**S**	**2 1 0**			**4.5 cr**
Electric drives generate motion and allow to control the motion by influencing the power flow by means of open loop and closed loop control. This lecture belongs to the method-oriented module motion control and is completed in this module by lectures of power electronics and special servomotors. For all those lectures a common complex lab work with six tasks complements the students knowledge and experience in the following semester. Starting with description and modeling methods for motion, power flow and signal flow the electro-mechanic power conversion in different electrical machines, their speed-torque characteristics and the methods of speed and torque control are given. Using typical examples the thermal and mechanical design of drives is specified. The performance of uncontrolled and controlled dc-drives, interactions between the grid and the drive as well as between the motor and the mechanical part are investigated. AC drives connected to the mains and fed with frequency control by inverter systems are the main focus of the second part of the lectures. A number of special problems like servo-drives, stepper motor drives, multi-motor drives and electric traction drives show the broadness of the applications.					
examination:	written			language:	German
prerequisites:	Electric and Hydraulic Actuators				
lecturer:	Prof. Dr. P. Büchner				

12 02 02	**Power Electronics II** (Leistungselektronik 2)				
Eul LEPE	**S**	**2 1 (1)**			**4,5 cr**
The course provides a comprehensive knowledge of power electronic circuitry and systems. Various power converter topologies are presented including: Line frequency controlled Converters (continues and discontinuous mode, ripple, harmonic distortion), Direct Converters, Matrix Converters, Load commutated Converters, DC Chopper, Switch Mode Power Supplies (Buck, Boost etc), Resonant Converters, CSI/VSI (1 phase/3 phase, 2 level/3 level topology). Control strategies: pulse pattern (Natural sampling, Square Wave, Space Vector Modulation, Hysteretic Band). Special attention is given to power quality, utility disturbance and EMI. Practical design solutions utilizing microprocessors are shown as well as problems related to specific applications (electric vehicles, photovoltaics, railway converters). Analysis and design are supported by PSPICE, SIMPLORER, MATLAB Simulink. Laboratory tests: PV applications, power converters for traction, power conditioners etc. Final project: power converters in electric traction applications.					
examination:	oral			language:	german
prerequisites:	basic in power electronics, electrical drives				
lecturer:	Prof. Dr.-Ing. habil. H. Güldner				

	I... (Stellmotoren)				
- under construction-					
examination:				language:	
prerequisites:					
lecturer:					

12 02 02 **12 02 03** **12 02 04**	**Complex Lab Work Motion Control** (Komplexpraktikum Bewegungssteuerung)				
Eul ETI	**W**	**0 0 2**			**3.0 cr**
The lab belongs to the method-oriented module Motion Control consisting of the lectures electric drives, power electronics and servomotors. The students have to take in groups of three students six lab tasks from a list of tasks offered by the chairs of the electrical power engineering lab in the above mentioned three lectures. Each lab work lasts three hours of working at lab stands in the institute and the preparation of a written protocol for the group.					
examination:	belongs to the mark for the module			language:	German
prerequisites:	Lectures of the module Motion Control				
lecturers:	Assistants of the institute				

Module: INFORMATION PROCESSING
(Informationsverarbeitung)

16 10 01	**Serial Bus Systems in Automobiles and Industry** (Bussysteme in der Automatisierungstechnik)				
VW IAD	**W**	**2 0 0**			**3.0 cr**
This course gives an overview of serial bus systems used for automotive and industrial automation applications. Arcitectures and characteristics of selected bus systems (CAN, LIN, TTP, Flexray, MOST,...) are presented. Students are to get to know issues of designing and implementing bus system networks depending on design requirements and conditions for different (automotive) applications. Related topics like standardization of bus protocols, network management and network design tools complete this course.					
examination:	written			language:	german
prerequisites:	pre-diploma				
lecturer:	Prof. Dr.-Ing. B. Bäker				

	I... (Prozessinformationsverarbeitung)				
- under construction -					
examination:				language:	
prerequisites:					
lecturer:					

	I... (Echtzeitverarbeitung)				
- under construction -					
examination:				language:	
prerequisites:					
lecturer:					

	I... (SPS und Kompaktregler)				
- under construction-					
examination:				language:	
prerequisites:					
lecturer:					

Module: DESIGN TECHNIQUES
(Entwurfstechniken)

12 01 01	**Simulation Techniques** (Simulationstechnik)				
EI IfA	**W**	**2 1 0**			**4.5 cr**

This course aims to study basic principles and methods for computer-aided simulation of dynamic systems.
Lectures:

- Methods and techniques of the numerical integration (basic algorithms, stability, error estimation, step size control)
- Stiff system
- Modular systems
- Simulation of mixed systems (continuous/time sampled/discrete event systems)
- Discontinuities
- High order linear systems (discrete transition matrix)
- Differential-Algebraic Systems
- Object oriented modelling and simulation
- Hardware-in-the-loop simulation
- Random processes

Complementary problem-soving and practical exercises familiarize with state-of-the-art simulation tools (Matlab/Simulink).

examination:	Written	language:	german
prerequisites:			
lecturer:	Dr.-Ing. E. Giebler		

12 01 01	**Systems Design** (Systementwurf)				
EI IfA	**W**	**2 1 0**			**4.5 cr**

Aim of this course is to study basic methods and techniques for the system design of complex automation solutions including the evaluation of design options.
Lectures: methods for requirements analysis and specification, system modelling with structured analysis, object oriented analysis, project management, quality management, safety and reliability.
Complementary practical exercises familiarize with skills on the complete development cycle of an automation solution from the requirements analysis to the implementation by using the design methods (e.g. mobile robot control functions).

examination:	written	language:	german
prerequisites:	basics in process control systems		
lecturer:	Dr.-Ing. A. Braune		

12 05 12	**Product Design potly. Development** (Produktentwicklung)				
EI LEED	**S**	**2 0 0**			**3.0 cr**
This course focuses on the engineering and management tasks in product design. Emphasis is placed on the main aspects of the development process of a product in close relationship with the required methodological and management skills of an engineer.					
examination:	oral/written			language:	German
prerequisites:	undergraduate core courses				
lecturer:	Prof. Dr.-Ing. L. Schulze				

12 06 05	**Quality Management** (Qualitätssicherung)				
EI EPL	**S**	**2 1 0**			**4.5 cr**
Lectures and exercises - contents: • Description of quality parameters (discrete and continous parameters and their distributions) • Detection and computation of quality data • Statistical tests of parameters • Quality control cards and acceptance sampling plans • Reliability tests Interaction of parameters					
examination:	written			language:	German
prerequisites:	mathematics				
lecturer:	Prof. Dr.-Ing. habil. K.-J. Wolter, Dr.-Ing. H. Wohlrabe				

Module: AUTOMOTIVE VEHICLE ENGINEERING
(Kraftfahrzeugtechnik)

16 07 01	**Simulation Automobiles** (Simulation Kraftfahrzeuge)				
VW ITGF	**W**	**1 1 0**			**3.0 cr**

This course aims to study and train the application of the multi body systems method on motor vehicles.

- Analysis of vehicle structures with respect to mechanical behaviour
- Elements of a multi body model
- Introduction into the algorithms of multi body simulation
- vehicle specific parts and subassemblies (tyres, suspensions, …)
- Analysis and interpretation of simulation results
-

The exercises familiarize with the setup of vehicle models using the commercial simulation tool Simpack

examination:	Oral or written (dep. on # of participants)	language:	german
prerequisites:	Mathematics, applied mechanics		
lecturer:	Prof. Dr.-Ing. M. Beitelschmidt, Dr. V. Quarz		

16 10 01	**IT and Electronics of Combustion Engines** (Elektronik und Informationstechnik im KFZ)				
VW IAD			**S**	**1 0 1**	**3.0 cr**

Modern vehicles are unimaginable without electric and electronic components. Pollution is reduced and safety, economy, capability are increased on the basis of electronic controls in the region of engine, power train and chassis. Further on, improved driver information devices and comfort functions are realized by electric, electronic components in the region of passenger compartment and auto body. Structure, functionality and technology of electric, electronic and mechatronic automotive systems are presented in this course. The electrical powernet with generator, battery and consumers is introduced. The emphasis of this course is on mechatronic systems for the control of Otto and diesel engines. Attention is paid to important components (sensors, actors, electronic control units). An overview of automotive operating systems and diagnostics methods completes this course.

examination:	written	language:	german
prerequisites:	pre-diploma		
lecturer:	Prof. Dr.-Ing. B. Bäker		

	I... (Längsdynamik)					
- under construction -						
examination:					language:	
prerequisites:						
lecturer:						

	I... (Quer- und Vertikaldynamik)					
- under construction -						
examination:					language:	
prerequisites:						
lecturer:						

	I... (Konstruktion und Berechnung von KFZ))					
- under construction -						
examination:					language:	
prerequisites:						
lecturer:						

Module: RAILWAY VEHICLE ENGINEERING
(Schienenfahrzeugtechnik)

16 08 01	**Rolling stock and braking systems** (Schienenfahrzeugtechnik und Bremstechnik)				
VW IST	**S**	**2 0 0**			**3.0 cr**
Considering as example the train brake system, it should be shown the development from the pneumatic over the electropneumatic to the electronic control and the work together with the control and comunication System of the rail vehicle. The classic mechnismen of the brake system and the control system represents the base for the development of mechatronic systems in modern rail vehicles. By leading off the demands to the brake control, the basics will be arrange to design new mechatronic sytems for rail vehicles. Content of the Course: • General demands to the brakesystem • System structure and structuring of the brakes • Benchmark the collision stopping power • Mechanics to produce the brake force • Accepted techniques to adjust the brake force • Types of wheel slide protection • Mechatronis parts in rail vehicles • Simulation of the brake application					
examination:	Oral			language:	German
prerequisites:	Drive engineering / actuators				
lecturer:	Dr. D. Jaenichen				

16 04 01	**Electric Railways** (Elektrische Bahnen)				
VW EVS	**W**	**2 0 0**			**3.0 cr**
The course`s aim is to impart basic knowledge about design and mode of action of electric rail systems with a strong emphasis on system view and the multiple interactions between the sub-systems incorporated. Topics presented include general system requirements, identification of sub-systems of electric rail systems and the interactions between them. Design, operation constraints and operation conditions of the main components of both electric traction vehicles and rail power supply systems are presented as well as different approaches to estimate power requirement of a rail system and rail specific impacts on component design.					
examination:	oral			language:	German
prerequisites:	pre-diploma				
lecturer:	Prof. Dr.-Ing. habil. H. Biesenack				

16 07 01	**Multi Body Dynamics Railway Vehicles** (Mehrkörperdynamik Schienenfahrzeuge)				
VW ITGF	**W**	**1 1 0**			**3.0 cr**

This course aims to study and train the application of the multi body systems method on railway vehicles.

- Analysis of vehicle structures with respect to mechanical behaviour
- Elements of a multi body model
- Introduction into the algorithms of multi body simulation
- railway specific parts and subassemblies (rail-wheel contact, bogies, …)
- Analysis and interpretation of simulation results

The exercises familiarize with the setup of railway models using the commercial simulation tool Simpack

examination:	Oral or written (dep. on # of participants)	language:	german
prerequisites:	Mathematics, applied mechanics		
lecturer:	Prof. Dr.-Ing. M. Beitelschmidt, Dr. V. Quarz		

16 05 02	**Railway Signalling Systems** (Bahnsicherungssysteme)				
VW IVIS	**W**	**2 0 0**			**3.0 cr**

Safety of train and shunting movements in the railway system

Lectures

- basic principles of railway operation
- components of railway signalling
  + detection devices
  + switchable track elements
  + signals
  + train protection
- requirements of interlocking
- technologies of interlocking

examination:	Oral	language:	german
prerequisites:	principles of electrical engineering		
lecturer:	Prof. Trinkauf, Dr. Maschek		

16 08 01 **16 04 01** **16 05 02**	**Rolling Stock** (Schienenfahrzeugtechnik)				
VW	**S**	**0 0 2**			**3.0 cr**

The practical Training arranges Knowledge to :

- Train run simulation on a Trainsimulator
- Electric power supply for the railway system
- Design mechatronic brake systems (signal generation, signal transmission, signal processing)
- Mechatronic chassis
- Demonstration of workmechanics of available train control systems at a model railway.

examination:	Oral	language:	German
prerequisites:	principles of electrical engineering		
lecturer:	Dr. D. Jaenichen, Prof. H. Biesenack, Dr. Mascheck		

Module: COMBUSTION ENGINES
(Grundlagen Verbrennungsmotoren)

16 10 03	**Principles of combustion engines** (Grundlagen der Verbrennungsmotoren)				
VW IAD	**W**	**2 0 0**			**3.0 cr**
The lecture is aiming to mediate students of mechatronics a basic technical knowledge of combustion engines. Combustion engines have to meet standards such as a high reliability and efficiency regarding both manufacturing and life cycle expenses. Further more they need to meet emission laws and increasing customer requirements. During the course technical solutions to this end will be presented. High value will be set as well on the system performance. Introduction (Importance, Definition, Types of construction design) Thermo-dynamic considerations (Ideal processes, Calculation of heat input) Gas exchange cycle (valve timing four stroke engine, Scavenging and controls (two stroke engine) Real working process (Influence of the heat release on the working process, Heat transfer) Combustion Ignition Fuel-mixture generation and combustion (Otto and Diesel engine) Fuels and Lubricants Emissions Supercharging Controlling					
examination:	written			language:	german
prerequisites:	Pre-degree				
lecturer:	Prof. Dr.-Ing. Zellbeck				

16 10 01	**IT and electronics of Vehicles** (Elektronik und Informationstechnik am Verbrennungsmotor)				
VW IAD			**S**	**1 0 1**	**3.0 cr**
Modern vehicles are unimaginable without electric and electronic components. Pollution is reduced and safety, economy, capability are increased on the basis of electronic controls in the region of engine, power train and chassis. Further on, improved driver information devices and comfort functions are realized by electric, electronic components in the region of passenger compartment and auto body. Structure, functionality and technology of electric, electronic and mechatronic automotive systems are presented in this course. The electrical powernet with generator, battery and consumers is introduced. The emphasis of this course is on mechatronic systems for the control of driving dynamics with its sensors, actors, electronic control units. Further on, safety-related and comfort electronics as well as the man-machine-interface is adressed. An introduction in vehicle networks based on serial bus systems and is given.					
examination:	written			language:	german
prerequisites:	pre-diploma				
lecturer:	Prof. Dr.-Ing. B. Bäker				

16 10 03	**Simulation of internal combustion engines** (Simulation der Verbrennungsmotoren)				
VW IAD			**S**	**2 1 0**	**4.5 cr**

Aim of the lecture
Description of the simulation methods for the optimization of internal combustion engines as well as the usage on the PC
lecture (contents)
Introduction, connection to lecture of internal combustion engine fundamentals
Targets of development, limiting values
connection to ideal models of engine processes
classification numbers
in-cylinder process
Single-Zone-Model
Energy- , mass conservation law, thermal state equation
Heat transfer, burn rate
gas exchange processes, filling and emptying method, valve geometry
One-dimensional flow through pipes
Supercharging and turbocharging
Dynamics, friction losses, control
hydraulic diesel-injection systems
Practical course
Simulation on PC
Software Matlab/Simulink®

examination:	written	language:	german
prerequisites:	Preliminary diplom examination, lecture of internal combustion engines fundamentals		
lecturer:	Prof. Dr.-Ing. Zellbeck		

16 07 01	**Dynamics of Piston Engines** (Dynamik der Kolbenmaschinen)				
VW ITGF	**W**	**1 1 0**			**3.0 cr**

This course introduces the mechanical behaviour of piston engines.

- Kinematics of the crank mechanism
- Forces and torques of inertia
- Effect of the gas force
- Calculation of forces and torques in the frequency domain
- balancing of forces and torques
- Torsional Vibrations of drive trains
- Torsional Vibrations of the crankshaft
- Damping and insulation of unwanted torsional vibrations

The exercises familiarize with the calculation of dynamic behaviour of the engines, including paperwork and computer tasks.

examination:	written	language:	german
prerequisites:	Mathematics, applied mechanics		
lecturer:	Prof. Dr.-Ing. M. Beitelschmidt		

16 10 03	**Practical laboratory course of internal combustion engines** (Laborpraktikum Verbrennungsmotoren)				
VW IAD	**W**	**0 0 1**			**1.5 cr**

Aim of the lecture :
Consolidation and practical utilization of the knowledge of internal combustion engines. Get to know of test-bench and measuring technique for the analyses of internal combustion engines.

Practical laboratory course (contents)
Spark-ignition engines:
Specific properties, classification numbers, fundamentals of engine control, fuel consumption and emissions, performing of parameter variations at the test-bench, evaluation and interpretation of measurement results

Compression-ignition engines:
Specific properties, classification numbers, fuel consumption and emissions, fundamentals of exhaust gas measuring techniques, performing of parameter variations at the test-bench, evaluation and interpretation of measurement results

Analysis of processes:
Fundamentals of indicating systems, optical measuring techniques for process analysis, demonstration on the test-bench, performing of burn rate calculations

test-bench for high dynamic:
Fundamentals of engine test-benches, components, field of application, turbocharged spark-ignition engines, demonstration at the high dynamic test-bench

examination:	written	language:	german
prerequisites:	Preliminary diplom examination, successful passed lecture of internal combustion engines fundamentals		
lecturer:	Prof. Dr.-Ing. Zellbeck		

Module: ELECTRIC DRIVE TECHNOLOGY
(Elektrische Antriebstechnik)

12 02 03	**Design of Drive Systems** (Entwurf von Antriebssystemen)				
Eul ETI	**W**	**2/1/0**			**4.5 cr**
The lecture is a part of the application-oriented module Electric Drive Technology which consists additionally of the lectures closed loop control of drives and Application-oriented Real-time controllers. The module is completed by a lab work with six tasks. The participants of this lecture get to know methods of simulation and computer-aided design of in the field of electrical drives. Using the knowledge of modeling in electrical engineering this lecture can focus on tools and principles of simulation techniques to solve typical design tasks. Starting with simulation studies the single steps of the design procedure up to hardware implementation of the control structures will be presented. An introduction into the hard- and software structure of a digital drive control unit as an essential basis for a successful implementation will close the course. A number of numerical and design exercises complete the course.					
examination:	oral			language:	German
prerequisites:	Electric Drives, Motion Control				
lecturer:	PD Dr. V. Müller				

12 02 03	**Closed Loop Control of Drives** (Antriebsregelungen)				
Eul ETI	**W**	**1/1/0**			**3.0 cr**
The lecture belongs to the application-oriented module Electric Drive Technology which consists additionally of the lectures design of drive systems and Application-oriented Real-time controllers. The module is completed by a lab work with six tasks. Using the knowledge of the lecture Electric Drives, this lecture can focus on the modeling of the drive system, the off-line and on-line parameter estimation and the design of various control structures. Starting with the cascaded configuration of torque, speed and position control especially the description and the design of digital control loops are explained. A central problem is the modern realization of the field-oriented current control in ac-motors, where especially the problems of practical realization are investigated. Besides the hardware solutions, the tasks of modern set-in run and technological software for drives are introduced. The influence of typical non-linearities at the behavior, some information about parameter adaptation and self-tuning of drive systems together with a number of numerical and design exercises close the course.					
examination:	oral			language:	German
prerequisites:	Electric and Hydraulic Actuators, Electric Drives				
lecturer:	Prof. Dr. P. Büchner				

12 02 03	**Application-oriented Real-time controllers** (Anwendungsspezifische Echtzeitregler)				
Eul ETI	**S**	**2/1/0**			**4.5 cr**
The lecture belongs to the application-oriented module Electric Drive Technology which consists additionally of the lectures Closed Loop Control of Drives and Design of Drive Systems. The module is completed by a lab work with six tasks. Using the knowledge of the lectures Electric Drives and Closed Loop Control of Drives, this lecture can focus on and delve into the digital control of electric drives. The main focus is given to methods and tools for design and implementation of application-oriented digital real-time controllers. The concept of the lecture is changeable. To instance some present focal points: difference equations, modelling in Z-domain, Sample-Signal-Flow-Diagram method, Digital Amplitude optimum, possibilities of Finite-time Settling design, graphical programming of controllers and anti-limitation solutions or Bond Graphs. Exercises regarding to typical design tasks ensure the practical use of the knowledge. Thereby the MATLAB freeware toolbox BOD version 2.0 is used. The lecture aims at the qualification of the participants for an effective solution of topical interest tasks of student research projects and diploma thesis's.					
examination:	written			language:	German
prerequisites:	Electric Drives, Basic knowledge MATLAB / SIMULINK, Laplace- and Z-transformation				
lecturer:	Priv.-Doz. Dr. G.-H. Geitner				

12 02 03	**Complex Lab Work Electric Drive Technology** (Komplexpraktikum Elektrische Antriebstechnik)				
Eul ETI	**S**	**0/0/2**			**3.0 cr**
The lab belongs to the application-oriented module Electric Drive Technology consisting of the lectures Closed-loop Control of Drives, Design of Drive Systems and Application-oriented Real-Time Control. The students have to take in groups of three students six lab tasks given by the chair. Each lab work lasts three hours of working at lab stands in the chair and the preparation of a written protocol for the group.					
examination:	belongs to the mark for the module			language:	German
prerequisites:	Lectures of the module Electric Drive Technology				
lecturers:	Assistants of the institute				

Module: AEROSPACE
(Luft- und Raumfahrt)

12 01 01	**Spacecraft Attitude and Orbit Control** (Lageregelung für Raumfahrzeuge)				
EI IfA	**S**	**2 1 0**	**-**	**-**	**4.5 cr**
This course aims to study basic principles and system concepts for attitude and orbit control of spacecraft with the main focus on earth orbiting satellites. Lectures: Introduction (missions, spacecraft types, requirements, typical control problems); Orbit Dynamics (Keplerian orbits, orbit types, perturbations, orbit maintenance); Attitude Kinematics (coordinate frames, attitude representations: direction cosine matrix, Euler angles, quaternions); Attitude Dynamics (Euler equations, environmental disturbance torques); Attitude Determination (vector measurements, state propagation, filtering); Attitude Sensors (optical, inertial, magnetic); Attitude Control Concepts (including discussion of basic actuation hardware): Spin Stabilization, Gravity Gradient Stabilization, Magnetic Control (magnetic torques), Bias Momentum Control (momentum/reaction wheels) , Thruster Control; System Engineering Elements. Complementary exercises on selected attitude control problems augmented by Matlab/Simulink models allow to train practical skills on modelling, analysis and design.					
examination:	written			language:	german
prerequisites:	physics, mathematics, basics of control theory				
lecturer:	Prof. Dr. techn. K. Janschek, Dr.-Ing. S. Dyblenko				

13 19 03	**Space Stations** (Raumstationen)				
MW ILR	**W**	**2 0 0**	**-**	**-**	**3.0 cr**
In this course the specific requirements for manned space systems are introduced, for example special environmental conditions, life support systems, energy generation and storage systems, attitude and orbit control systems, or maintenance and logistics. Besides the specific engineering knowledge of subsystems, also a more general „systems engineering“ is taught, for example for the total system design, the utilisation of synergisms and the integration of human factors. Finally, an overview of the different utilisation disciplines in manned space missions and an introduction of the International Space Station ISS are given.					
Examination:	Written			language:	German
Prerequisites:	Physics, mathematics, basics of space systems (recommended)				
Lecturer:	Prof. Dr.-Ing. S. Fasoulas				

13 19 02	**Aircraft Design** (Luftfahrzeugkonstruktion 1)				
MW ILR	**W**	**2 0 0**	**-**	**-**	**3 cr**
The aim of this course is to provide the fundamental principles and methods of aircraft layout and design in combination with an introduction to the basics of aeronautics. The course starts with a brief history of aircraft and an overview of the different types of aeroplanes, their general layout and the function of their different parts. Further issues discussed in the first part of the course are the major phases of an aircraft development as well as the valid airworthiness requirements. The main part of the course deals with the conceptual design process as synthesis of aerodynamics, flight mechanics, structural mechanics, propulsion and weight analysis. Techniques for initial sizing and design layout are provided as well as methods applicable to analyse aircraft weights and to estimate the operating costs. The main emphasis of this part is on commercial transport aeroplanes.					
examination:	Written			language:	German
prerequisites:	Structural mechanics, flight mechanics, aerodynamics				
lecturer:	Prof. Dr.-Ing. K. Wolf				

13 19 02	**Design of Composite Aerospace Structures** (Faserverbundkonstruktion von Luft- und Raumfahrzeugen)				
MW ILR	**S**	**1 1 0**	**-**	**-**	**3 cr**
The main aim of this course is to provide basic knowledge on the use of composite materials in aerospace structures. This includes fundamentals of the mechanics of fibrous composites, design principles and applications. The course includes following topics: Introduction to composite materials, aerospace applications, micro mechanics, classical laminate theory, failure criteria, stress concentrations, buckling, damage tolerance, design procedures. Also a design problem has to be solved. After the course the student should be able to understand the difference in the mechanical behaviour of anisotropic and classical materials used in aerospace structures, to design and analyse composite laminates based on given requirements and to apply more complex design tools which include analysis methods such as advanced failure and damage tolerance criteria as well as models to predict stability failure.					
examination:	Written			language:	German
prerequisites:	Structural mechanics, Materials				
lecturer:	Prof. Dr.-Ing. K. Wolf				

Module: Mobile Production Machines
(Mobile Arbeitsmaschinen)

	I... (Konstruktive Gestaltung typ. Baugruppen von Förder-, Bau- und Landmaschinen)					
- under construction -						
examination:					language:	
prerequisites:						
lecturer:						

	I... (Modellbildung und Simulation mobiler Arbeitsmaschinen)					
- under construction -						
examination:					language:	
prerequisites:						
lecturer:						

	I... (Analyse und exp. Simulation des Maschineneinsatzes unter Beachtung der Mensch-Maschine-Interaktion)					
- under construction -						
examination:					language:	
prerequisites:						
lecturer:						

Module: MOTION CONTROLLED MACHINE SYSTEMS
(Bewegungsgeführte Maschinensysteme)

13 07 03	**System Character and Components of Motion-controlled Processes and Systems** (Systemcharakter und Komponenten bewegungsgeführter Prozesse und Systeme)				
MW IWM	**W**	**2 1 0**			**4.5 cr**
This course is designed to introduce students into the subject-related tasks, objects and problems by providing them with the knowledge about characteristic functions, demands and technical solutions of motion-controlled machine systems in production technology for the realisation of forming and cutting machining processes and also of handling processes with regard to tools and workpieces. The course works out the mechatronic system character and explains the development potential that is based on it. The main assembly groups are used to demonstrate typical partial functions and the interaction of their mechanical, electrical and information-processing components.					
examination:	written			language:	German
prerequisites:	pre-degree				
lecturer:	Prof. Dr.-Ing. habil. K. Großmann				

13 07 53	**Functionally Relevant System Behaviour and Examples of Mechatronic Applications** (Funktionell relevantes Systemverhalten und Beispiele mechatronischer Anwendungen)				
MW IWM	**S**	**4 1 2**			**10.5 cr**
Based on "System Character and Components of Motion-controlled Processes and Systems", students will be provided with the fundamental knowledge, the methodical abilities and the practical skills on the following issues: causes and effects, model description and calculation and also targeted influence and correction of the behaviour which has an effect on productivity and the accuracy of the manufacturing systems. Well-chosen examples of mechatronic applications in machine tools are used to demonstrate above all the necessary integrated and consequent approach to problem solving in exercises and in practical classes.					
examination:	written			language:	German
prerequisites:	System Character and Components of Motion-controlled Processes and Systems				
lecturer:	Prof. Dr.-Ing. habil. K. Großmann				

Module: ROBOTICS
(Robotik)

12 01 01	**Control of Robot Manipulators** (Steuerung von Robotersystemen)				
EI IfA	**W**	**2 0 0**			**3.0 cr**
This course aims to study basic methods for modelling and control of robot manipulation systems. The topics covered comprise: introduction to industrial robots, direct (forward) kinematics, inverse kinematics, trajectories, differential kinematics (Jacobi-matrix), manipulator dynamics, position control, force control. Accompanying exercises augmented by Matlab models familiarize with practical modelling, analysis and design skills.					
examination:	written			language:	german
prerequisites:	automation and control, mechanics (dynamics)				
lecturer:	Prof. Dr. techn. K. Janschek, Dipl.-Ing. St. Reimann				

13 01 07	Robotic Mechanisms (Roboterführungsgetriebe)				
MW IFKM	**W**	**1 1 0**			**cr**
The lecture of Robotic Mechanisms deals with the basic knowledge of generating planar and spatial nonlinear movements and its application to robot structure in mechanism theory. The main topics of the course include: - Planar structures - Spatial structures - Gripper systems					
examination:	written			language:	german
prerequisites:	Mechanism Engineering				
lecturer:	Prof.Dr.rer.nat.habil.Modler				

	I... (Räumliche Kinematik)				
- under construction -					
examination:				language:	
prerequisites:					
lecturer:					

	I... (Laserrobotik/Lasertronik)				
- under construction -					
examination:				language:	
prerequisites:					
lecturer:					

Module: SPECIFIC PRODUCTION METHODS
(Spezielle Fertigungsmethoden)

	I... (Lasertechnik)					
- under construction -						
examination:					language:	
prerequisites:						
lecturer:						

	I... (Plasmatechnik)					
- under construction -						
examination:					language:	
prerequisites:						
lecturer:						

	I... (Oberflächen-, Nanotechnik)					
- under construction -						
examination:					language:	
prerequisites:						
lecturer:						

	I... (Werkstoffe)					
- under construction -						
examination:					language:	
prerequisites:						
lecturer:						

Module: ELECTROMECHANICAL
(Feinwerktechnik)

12 09 03	**Electromechanical networks** (Elektromechanische Netzwerke)				
EI IAS	**W**	**2 1 0**			**4.5 cr**
The course presents techniques for the effective analysis of the dynamic properties of elementary mechanical and coupled mechanical-electrical systems using network methods. Translatory and rotatory mechanical systems as well as acoustical ones are modelled as networks. Their dynamic complex transfer function is calculated by means network theory methods . In particular both, the frequency and the dynamic response of mechanical resonance systems can be investigated with these methods. The coupling of electrical and mechanical networks treated is exemplified for electrodynamic transducers and the piezoelectric acceleration sensors.					
examination:	written			language:	german
prerequisites:	pre-degree in electrical engineering or mechatronics				
lecturer:	Prof. Dr.-Ing. habil. G. Pfeifer				

12 05 03	**Precision Device Engineering** (Präzisionsgerätetechnik)				
EI IFTE	**W**	**2 0 0**			**3.0 cr**
This course introduces dimensioning and construction of modern precision devices while taking into consideration general construction principles. Precision mechanical systems located at the interface to the electronic systems are studied in depth. The following topics are covered in this lecture: construction principles, accuracy and malfunctioning, precision mechanical systems, characteristics of the micromechanics, ecological constraints.					
examination:	written/oral			language:	German
prerequisites:	undergraduate core courses				
lecturer:	Prof. Dr.-Ing. Th. Nagel				

12 12 41	**Technical Optics** (Technische Optik)				
EI IHM	**S**	**210**	**W**	**002**	**7.5 cr**
This course offers fundamental knowledge about Technical Optics : Geometrical Optics, Wave Optics (propagation, diffraction, polarization and interference), Quantum Optics (light generation and detection), Light sources and detectors, Lens aberrations, Materials for optics, Wave guides and integrated optics, Microoptics and MOEMS (Micro-Opto-Elektro-Mechanical Systems), Wave Front Correction, Adaptive Optic and light processing, Optical Systems and detectors					
examination:	oral			language:	german
prerequisites:	mathematics, physics				

lecturer:	Prof. Dr.-Ing. H. Lakner

12 05 03	**Practical Course in Electromechanical Design: Actors and Sensors** (Praktikum Feinwerktechnik: Aktorik und Sensorik)				
EI IFTE	**S**	**0 0 2**			**3.0 cr**
This practical course provides students with the necessary knowledge about actor and sensor systems within the framework of electromecanical engineering. Computer-aided methods are implemented in order to investigate, control, evaluate and optimize actor and sensor devices and systems.					
examination:	written/oral			language:	German
prerequisites:	undergraduate core courses				
lecturer:	Prof. Dr.-Ing. Th. Nagel				

Module: MICROSYSTEMS ENGINEERING
(Mikrosystemtechnik)

	I... (Werkstoffe der Mikrosystemtechnik)					
- under construction -						
examination:					language:	
prerequisites:						
lecturer:						

	I... (Mikrosysteme)					
- under construction -						
examination:					language:	
prerequisites:						
lecturer:						

	I... (Entwurf in der Mikrosystemtechnik)					
- under construction -						
examination:					language:	
prerequisites:						
lecturer:						

Module: ELECTROMECHANICAL SYSTEMS
(Elektromechanische Systeme)

12 09 03	**Electromechanical networks** (Elektromechanische Netzwerke)				
EI IAS	**W**	**2 1 0**			**4.5 cr**
The course presents techniques for the effective analysis of the dynamic properties of elementary mechanical and coupled mechanical-electrical systems using network methods. Translatory and rotatory mechanical systems as well as acoustical ones are modelled as networks. Their dynamic complex transfer function is calculated by means network theory methods . In particular both, the frequency and the dynamic response of mechanical resonance systems can be investigated with these methods. The coupling of electrical and mechanical networks treated is exemplified for electrodynamic transducers and the piezoelectric acceleration sensors.					
examination:	written			language:	german
prerequisites:	pre-degree in electrical engineering or mechatronics				
lecturer:	Prof. Dr.-Ing. habil. G. Pfeifer				

12 09 03	**Application of combined simulation** (Anwendung kombinierter Simulation)				
EI IAS	**S**	**1 1 0**	**W**	**1 1 0**	**6.0 cr**
The lecture connects the advantages of network simulation of electromechanical systems with Finite Elements Modeling. This enables a design-oriented and hence more efficient optimization of the dynamic behavior of electromechanical systems. The lecture comprises the following chapters: - Calculation of electromechanical networks using the circuit analysis tool PSPICE - Modeling of mechanical subsystems with the finite elements simulation tool ANSYS - Methodology of the combination of the procedures by means of virtual sub-elements - Application examples: piezoelectric transducers, magnetic systems and ultrasonic transducers					
examination:	written			language:	german
prerequisites:	electromechanical networks				
lecturer:	Prof. Dr.-Ing. habil. G. Pfeifer				

12 09 03	**Electromechanical measurement engineering** (Elektromechanische Messtechnik)				
EI IAS	**S**	**1 0 0**			**1.5 cr**
The course offers problems of the electromechanical measurements, especially the error correction. A general model of measurement system with non-linearity effects, dynamic and stochastic disturbed elements is presented. Furthermore, the lecture is treating: measurements for calibration and control, transducer characterization (linearity, null balance, hysteresis, creep, noise level) and dynamic correction of sensors.					
examination:	oral			language:	german
prerequisites:	electromechanical networks				
lecturer:	Prof. Dr.-Ing. habil. G. Pfeifer				

12 09 03	**Lab work electroacoustics** (Praktikum Elektroakusitk)				
EI IAS	**S**	**0 0 2**			**3.0 cr**
The aim of this practical course is the application of the topics dealt with in the lecture electromechanical networks. Therefore laboratories about - the measurement of sound pressures and - the determination of parameters of electrodynamical loudspeakers will be carried out. In addition, aspects concerning the examination of measurement results, error discussion and the use of standards are treated.					
examination:	oral			language:	german
prerequisites:	electromechanical networks				
lecturer:	Prof. Dr.-Ing. habil. G. Pfeifer				

Module: BIOMEDICAL ENGINEERING
Biomedizinische Technik

12 07 01	**Biomedical Engineering** (Biomedizinische Technik)				
EI IBMT	**W**	**2 1 0**			**4,5 cr**
The course gives a systematic overview of electrical and electronical devices for diagnosis and therapy in medicine. Electrophysiological foundations are introduced. Design and operation of biomedical systems are tought concerning electrostimulation, electromyography, high frequency electrotherapy and high frequency surgery. Electronic cardiac pacemakers are discussed in detail. Complementary exercises aims to train operations conditionings and parameterization of these devices.					
examination:	written			language:	german
prerequisites:	undergraduate examinations				
lecturer:	Prof.Dr.med.habil.Dipl.-Ing. R. Poll				

12 07 02	**Technologically-Significant Life Processes** (Technikrelevante Lebensprozesse und -strukturen)				
EI IBMT	**S**	**3 0 0**			**4,5 cr**
The lecture deals with anatomical, physiological and pathological facts of heart, lung and kidneys as far as they are required for design, implementation and use of biomedical devices. The principles of therapeutical systems are tought assisting the function of the above mentioned organs. Measuring methods and problems of man-machine interface are stressed.					
examination:	oral			language:	german
prerequisites:	biomedical engineering				
lecturer:	Prof.Dr.med.habil.Dipl.-Ing. R. Poll				

12 07 03	**Therapeutical Engineering** (Therapeutische Gerätetechnik)				
EI IBMT	**W**	**1 1 0**			**3.0 cr**
This course introduces the principles of therapeutical devices considered as mechatronical systems. The technical equipment for therapeutic treatment of patients is addressed which is used in the operating room and at the intensive care unit. Their common use and their mutual interference demand a matched design. The special mechanical, electronic and computional implementation has to be deduced from this conception. The construction and the function of the following devices are stressed in detail: Robotic surgical systems, surgical manipulators, devices for endoscopy and minimally invasive surgery, devices for mechanical ventilation.					
examination:	written			language:	german
prerequisites:	Biomedical engineering, technologically-significant life processes				
lecturer:	Prof.Dr.med.habil.Dipl.-Ing. R. Poll				

	PD Dr.-Ing. U. Morgenstern

12 07 04	**Practical Course in Therapeutical Engineering** (Praktikum Therapeutische Gerätetechnik)				
EI IBMT	**S**	**0 0 2**			**3.0 cr**
This training course will give the opportunity to obtain practical knowledge about the application and parameterization of the following medical equipment : - electronic cardiac pacemakers - devices for mechanical ventilation - dialysis equipment - ergometer - short-wave therapy - ultrasound therapy					
examination:	inclused in written examination «Therapeutical Engineering»			language:	german
prerequisites:	biomedical engineering, technologically-significant life processes, therapeutical engineering				
lecturer:	Prof.Dr.med.habil.Dipl.-Ing. R. Poll				

12 07 05	**Mechatronics aspects in Biomedical Engineering** (Oberseminar Biomedizinische Technik)				
EI IBMT	**S/ W**	**0 2 0**			**3.0 cr**
The course introduces the design of biomedical devices considering the fact that mechanical, electronic and computational aspects form an integrated whole. Medical robotics, computer assisted surgery, robotic surgery and minimally invasive procedures are stressed in detail.					
examination:	written (homework)			language:	german
prerequisites:	biomedical engineering, technologically-significant life processes				
lecturer:	Prof.Dr.med.habil.Dipl.-Ing. R. Poll				