AMTLICHE BEKANNTMACHUNG RWTH AACHEN UNIVERSITY

NUMMER 2013/046 **SEITEN** 1 - 46 **DATUM** 06.06.2013 **REDAKTION** Sylvia Glaser

2. Ordnung

zur Änderung der Prüfungsordnung[1]

für den Masterstudiengang Combustion Engines

der Rheinisch-Westfälischen Technischen Hochschule Aachen

vom 03.06.2013

Aufgrund der §§ 2 Abs. 4, 64 des Gesetzes über die Hochschulen des Landes Nordrhein-Westfalen (Hochschulgesetz – HG) vom 31. Oktober 2006 (GV. NRW S. 474), zuletzt geändert durch Artikel 1 des Gesetzes zur Änderung des Hochschulgesetzes und des Kunsthochschulgesetzes vom 18. Dezember 2012 (GV. NRW. S. 669), hat die Rheinisch-Westfälische Technische Hochschule Aachen (RWTH) folgende Prüfungsordnung erlassen:

[1] Prüfungsordnung Nr. 1127 vom 02.06.2010; geändert durch die 1. ÄO Nr. 2012/005 vom 04.01.2012

HERAUSGEGEBEN IM AUFTRAGE DES REKTORS VON DER ABTEILUNG 1.1 DES DEZERNATES 1.0 DER RWTH AACHEN
Templergraben 55, 52056 Aachen | Tel. +49 241 80-99087 | Fax. +49 241 80-92664 | akad@zhv.rwth-aachen.de

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Artikel I

Die Prüfungsordnung für den Masterstudiengang Combustion Engines der Rheinisch-Westfälischen Technischen Hochschule Aachen vom 02.10.2006 (Amtliche Bekanntmachung der RWTH Aachen, Nr. 1127) wird wie folgt geändert:

1. § 26 wird wie folgt geändert:

§ 26 Inkrafttreten, Veröffentlichung ; Abs. 3 – 8 werden neu eingefügt:

(3) Die Prüfungsordnung findet auf alle Studierenden Anwendung, die sich ab dem Wintersemester 2007 erstmalig für den Masterstudiengang Combustion Engines an der RWTH Aachen eingeschrieben haben. Änderungen im Studienverlaufsplan bzw. im Modulkatalog, welche mit Änderungsordnungen vom 04.01.2012 sowie mit Änderungsordnung vom 03.06.2013 vorgenommen wurden, gelten ab dem Zeitpunkt des Inkrafttretens der jeweiligen Änderungsordnung.

(4) Module, die vor dem Inkrafttreten der Änderungsordnungen begonnen wurden, können noch in der bis zu diesem Zeitpunkt geltenden Form zu Ende geführt werden.

(5) Einschreibungen in den Masterstudiengang Combustion Engines waren letztmalig im Wintersemester 2011/12 möglich.

(6) Prüfungen werden letztmalig im Sommersemester 2014 durchgeführt.

(7) Die Masterarbeit sowie sämtliche Prüfungen einschließlich der Wiederholungen müssen bis spätestens zum Ende des Sommersemesters 2014 erfolgreich absolviert sein.

(8) Nach Ablauf des Sommersemesters 2014 ist ein Studienabschluss im Masterstudiengang Combustion Engines nicht mehr möglich. Ausnahmen regelt der Prüfungsausschuss.

2. Der Modulkatalog wird durch die beiliegende Fassung ersetzt.

3. Der Studienverlaufsplan wird durch die beiligende Fassung ersetzt.

Artikel II

Diese Ordnung tritt zum Wintersemester 2012/13 in Kraft und wird in den Amtlichen Bekanntmachungen der RWTH veröffentlicht.

Ausgefertigt aufgrund des Beschlusses des Fakultätsrates der Fakultät für Maschinenwesen vom 9. April 2013.

Der Rektor
der Rheinisch-Westfälischen
Technischen Hochschule Aachen

Aachen, den 03.06.2013

gez. Schmachtenberg
Univ.-Prof. Dr.-Ing. E. Schmachtenberg

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Anlage 1

Modulkatalog

Dieser Modulkatalog gibt den aktuellen Stand gemäß dem Tag der Beschlussfassung der Prüfungsordnung wieder, nachfolgende Änderungen, die sich nicht auf die Prüfungsformen beziehen, werden unter dem Link www.maschinenbau.rwth-aachen.de bekannt gegeben.

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Modul: Internal Combustion Engine Fundamentals and Energy Conversion Machinery

MODUL TITEL: Internal Combustion Engine Fundamentals and Energy Conversion Machinery

ALLGEMEINE ANGABEN

Fachsemester	Dauer	Kreditpunkte	SWS	Häufigkeit	Turnus Start	Sprache
1	1	5	3	1	WS 11/12	Englisch
1	1	5	3	1	WS 11/12	Englisch

INHALTLICHE ANGABEN

Inhalt	Lernziele
• Introduction • Kinematics and forces of combustion engines • Thermodynamic fundamentals • Characteristic numbers of combustion engines • Spark-Ignition Engines • Compression-Ignition Engines • Emission formation and exhaust gas aftertreatment	The students are able to systematically analyze the various principles of fuel conversion and the main requirements of combustion engines. They are capable to transfer the basic thermodynamic fundamental calculation procedures to the related combustion process by means of ideal models of engine cycles. With these fundamentals the students are capable to calculate and evaluate the various efficiencies and important characteristic numbers of internal combustion engines. The students are able to systematically differentiate the various combustion engines by the different combustion systems with its particular heat release, the ignition process and the kinematics of valve train and crank train and to relate them to current engine developments. Due to the increasing environmental pollution the students are given the ability to comprehend the emission formation and to find best suited solutions for the exhaust gas after treatment for different types of engines.
Voraussetzungen	**Benotung**
• Thermodynamics • Machine Dynamics	Written examination

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	Prüfungs-dauer (Minuten)	CP	SWS
Prüfung Internal Combustion Engine Fundamentals	120	5	
Prüfung Energy Conversion Machinery	120	5	
Vorlesung Internal Combustion Engine Fundamentals	0	0	2
Übung Internal Combustion Engine Fundamentals	0	0	1
Vorlesung Energy Conversion Machinery	0	0	2
Übung Internal Combustion Engine Fundamentals	0	0	1

Modul: Energy Economics

MODUL TITEL: Energy Economics

ALLGEMEINE ANGABEN

Fachsemester	Dauer	Kreditpunkte	SWS	Häufigkeit	Turnus Start	Sprache
2	1	5	3	1	SS 12	Englisch

INHALTLICHE ANGABEN

Inhalt	Lernziele
• Energy economics (the energy supply in the world/ Europe/ Germany, resources). • Evaluation sizes, demand of electric energy, load courses, (efficiency, cumulated energy demand, payback period). • Ecological aspect. • Fossil energy source (extraction of hard coal, lignite, natural gas, crude oil). • Steam cycle plants (concept, efficiency, coal gasification improvement, emission und flue gas cleaning). • Gas cycle plants (thermodynamic basics, technical details, improvement). • Combined cycle plants (gas and steam cogeneration plant). • Combined heat and power (principle, operating figures, technical variation). • Nuclear power plant (fission, nuclear fuel cycle, concepts of the nuclear power plants, safety). • Regenerative energy (overview, potential). • Solar energy, (thermal use, photovoltaic solar power plant). • Heat pumps. • Hydropower (river, storage lake, OTEC). • Wind energy. • Biomass. • Geothermic energy. • Fuel cell. • Energy transport. • Energy storage (compressed-air store, battery, hydrogen storage). • Questions of economical efficiency in the energy engineering (cost assessments and parameters, questions of optimization). • Technical Energy Services. • Annual Duration Curve. • The Energy Demand of Technical Energy Systems. • Calculation of a Building´s Annual Heat Requirement. • Thermodynamic Evaluation of Energy Transformation. • Exergetic Analysis • Transformation of Primary Energy into Work. • Process Enhancements for the Transformation of Primary Energy into Technical Work. • Heat Generation. • Exergetic Analysis of Cogeneration. • Economic Analysis of Energy Systems. • Calculation of Profitability. • Emission Trading.	• The lecture "Energy Economics" gives an introduction to the energy industry as well as to the economy and efficiency of energy systems. • The students are able to systematically analyse and assess different energy systems regarding their efficiency as well as economic issues. • They are theoretically capable of choosing and designing the best suited energy system to a given energy demand taking into account both conventional fossil fuelled energy systems including nuclear power as well as regenerative energy sources. • The students know the basic theories of the thermodynamic evaluation and optimisation of energy conversion into heat and mechanical power.

• Exercise concerning Emission Trading.	
Voraussetzungen	**Benotung**
• Previous Degree of Engineering or Physics recommended: • Module Thermodynamics (e.g. from B.Sc. Mechanical Engineering) or equivalent knowledge	Oral or written examination

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	Prüfungs-dauer (Minuten)	CP	SWS
Prüfung Energy Economics		5	0
Vorlesung Energy Economics	0	0	2
Übung Energy Economics	0	0	1

Modul: Combustion I

MODUL TITEL: Combustion I						
ALLGEMEINE ANGABEN						
Fachsemester	**Dauer**	**Kreditpunkte**	**SWS**	**Häufigkeit**	**Turnus Start**	**Sprache**
2	1	5	5	1	SS 12	Englisch

INHALTLICHE ANGABEN

Inhalt	**Lernziele**
• Mass and Energy Balance in Combustion Systems • Elementary gas phase kinetics • Systematic Reduction of Reaction Kinetics for Hydrogen and Methane Flames • Ignition and extinction in Homogeneous Systems • Fluid Dynamics and Basic Equations for Flames • Laminar Premixed Flames: laminar and turbulent burning velocities • Laminar and turbulent Diffusion Flames	The students know the basic differences between premixed and non-premixed combustion. They have the ability to transfer the acquired knowledge in elementary gas phase chemistry to ignition in combustion engines and explosions in general. They know the basic theories of laminar flame propagation for one-step and four step kinetics. They are able to use laminar flamelet models in non-premixed combustion.
Voraussetzungen	**Benotung**
• Thermodynamics • Fluidmechanics	Oral or written examination

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	**Prüfungs-dauer (Minuten)**	**CP**	**SWS**
Prüfung Combustion I		5	0
Vorlesung Combustion I	0	0	3
Übung Combustion I	0	0	2

Modul: Heat and Mass Transfer

MODUL TITEL: Heat and Mass Transfer

ALLGEMEINE ANGABEN

Fachsemester	Dauer	Kreditpunkte	SWS	Häufigkeit	Turnus Start	Sprache
1	1	8	5	1	WS 11/12	Englisch

INHALTLICHE ANGABEN

Inhalt	Lernziele
Introduction Mechanisms of heat transport • Radiation • Heat conduction • Convection **Heat radiation** Radiation properties • Wave/Quantum characteristics • Stefan-Boltzmann law • Planck´s distribution law • Reflection, Absorption, Transmission • Kirchhoff´s law • Radiation from a diffuse surface and direction-dependent radiation Radiation transfer • Radiation flux -radiosity • Radiation transfer between two bodies • Radiation between two grey surfaces • Radiation transfer between two infinitely long grey plates • Radiation transfer between two self-enclosed grey bodies **Heat conduction** Differential equation of the temperature field Steady state, one-dimensional heat conduction without heat sources • Plane walls with given surface temperatures • Thick-walled tube with constant temperatures on the inner and outer walls • Plane walls with convective heat transfer • Tube wall with convective heat transfer • Heat conduction in fins • Rod and plane fins • Circular fins Steady state, one-dimensional heat conduction with heat sources	Students are capable of identifying the different heat and mass transfer mechanisms radiation, conduction, diffusion and convection in engineering problems. They are able to name the underlying parameters influencing these mechanisms and to formulate them as non-dimensional numbers. They are aware of the analogy between heat and mass transfer. The students know criteria needed to judge the permissibility of different means of simplification applicable to technical systems. They are proficient in the mathematical description of and analytic solution to these problems as well as in the interpretation of the results with respect to the application.

Steady state, multi-dimensional heat conduction without heat sources Unsteady state heat conduction without heat sources • Bodies with high values of thermal conductivity • One-dimensional, unsteady state heat conduction examples • Semi-infinite plate with given temperatures • Semi-infinite plate with non negligible heat transfer resistance • Semi-infinite plate with time-dependent surface temperatures • Dimensionless coefficients and diagrams used to describe heat conduction processes • Graphical and numerical approximation methods for unsteady state heat conduction • The Binder-Schmidt method **Convection** Conservation laws for laminar, steady state, two-dimensional flow • Equation of continuity • Momentum equations (equations of motion) • Equation of energy conservation Forced convection Boundary layer equations for laminar, steady state flow • Exact solutions of the boundary layer equations • Analogy between momentum and heat exchange • A simple approximation method for the boundary layer equations Natural convection Boundary layers equations for laminar, steady state flow Heat transfer for turbulent flow Application of the analogy theory for heat transfer **Heat transfer laws** Introductory remarks Summary of heat transfer correlations • Heat transfer laws for forced convection, flows around bodies • Forced convection in tubes • Natural convection, flow along bodies • Natural convection **Heat Transfer with boiling and condensation** Heat Transfer in condensation • Condensation of pure vapours - film condensation • Condensation of pure vapours - dropwise condensation • Condensation of pure mixtures	

Heat transfer in boiling • Boiling in vessels • Evaporation in tubes **Mass transfer** Mass transfer by diffusion Mass transfer in a flowing medium Diffusive mass transfer on a surface Analogy between the heat and mass transfer Evaporation on a liquid surface **Literature** **Appendix** Appendix A - Material properties Appendix B - Functions Mathematical summary	
Voraussetzungen	**Benotung**
• HM I to HM III	Oral or written examination

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	Prüfungs-dauer (Minuten)	CP	SWS
Prüfung Heat and Mass Transfer		8	0
Vorlesung Heat ans Mass Transfer	0	0	3
Übung Heat and Mass Transfer	0	0	2

Modul: Fluid Dynamics

MODUL TITEL: Fluid Dynamics

ALLGEMEINE ANGABEN

Fachsemester	Dauer	Kreditpunkte	SWS	Häufigkeit	Turnus Start	Sprache
2	1	5	4	1	SS 12	Englisch

INHALTLICHE ANGABEN

Inhalt

- Fundamental Equations of Fluids
- The objective is to understand the conservation laws of mass, momentum and energy which describe the flow of a continuum mechanics (gas, liquid).
- Hydrostatics
- Derivation of the equation of hydrostatics and application of different examples.
- Continuity Equation and Bernoulli Equation
- Derivation of the continuity and mechanical energy conservation equations on the streamline plus applications.
- Momentum Equation
- Derivation and application of the momentum equation. The student will be able to transfer the basic calculation procedures to related topics.
- Laminar Viscous Flows
- Viscosity, viscous flows, steady flows between parallel plates, couette flows, steady flows in pipes are discussed; students are able to understand complete pipe systems.
- Turbulent Pipe Flow
- Turbulent shear stresses, friction and drag are discussed. Students understand the difference between laminar and turbulent flows.
- Dynamic Similarity
- The Buckingham Pi Theorem is presented and similarity laws are derived and applied to industrial problems.
- Irrotational Flow
- The Laplace Equation is derived and the singularity solutions are discussed and applied to blunt body problems.
- Boundary Layer Theory
- Laminar and turbulent boundary layers are discussed and its application to industrial problems is presented.
- Compressible Flows
- Speed of sound, Hugoniot equation and normal and oblique shock relations are derived and related topics of supersonic flows in nozzles are discussed.

Lernziele

The students acquire knowledge of fluid mechanics. That is explicated theoretically as well as with practical examples.

Voraussetzungen

- An adequate knowledge of mathematics

Benotung

Oral or written examination

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN			
Titel	**Prüfungs-dauer (Minuten)**	**CP**	**SWS**
Prüfung Fluid Dynamics		5	0
Vorlesung Fluid Dynamics	0	0	2
Übung Fluid Dynamics	0	0	2

Modul: Internal Combustion Engines I and II

MODUL TITEL: Internal Combustion Engines I and II

ALLGEMEINE ANGABEN

Fachsemester	Dauer	Kreditpunkte	SWS	Häufigkeit	Turnus Start	Sprache
2	1	5	4	1	SS 12	Englisch
3	1	5	4	1	WS 12/13	Englisch

INHALTLICHE ANGABEN

Inhalt

- Introduction
- Fuels

Classification, manufacturing processes, chemical structure and physical properties of fuels based on mineral oil

Energy reserves, consumption and energy industry

- Alternative fuels based on coal, natural gas and non-fossil sources of energy
- Energy flow in the combustion engine process

Open cycle simulation

Energy balance and definition of losses

- Heat flow in combustion engines

Mechanisms of heat transfer

Calculation methods of heat transfer coefficients in the combustion chamber, conduction and heat transfer to the coolant

Temperatures and thermal stresses of engine components

- Layout of combustion engines

Rules of geometrical, mechanical and thermal similarity

Indices and mechanical power limits

Engine base data, typical plan of an engine development process

- Forces and moments in engines

Gas forces and inertia forces, excitation by forces in crank drive mechanism

Engine balancing

Torsional vibration of crankshafts

- Engine components

Requirements on crankshaft, connecting rod, piston, crankcase, cylinder head and liner

Materials, concepts and specific design features

Cooling and lubrication systems

- Introduction
- Load exchange and valve train
- Supercharging
- Heat flow in combustion engines
- Mixture preparation for gasoline and Diesel engines
- Exhaust emissions
- Engine Acoustics

Lernziele

The students are able to systematically analyze the various types of fuels as energy resources. They are capable to transfer the basic thermodynamic fundamental calculation procedures to the related combustion process by means of ideal models of engine cycles and simulations. The students are capable to systematically apply calculation methods of heat transfer, heat conduction and thermal stresses based on the principal mechanisms of heat flux. They are able to assess similarity rules and indices to transfer this knowledge in order to layout engines and to estimate mechanical power limits. The students are also capable to determine forces and moments in engines resulting from crank drive mechanism and are able to assess the requirement of engine components as well as the layout of the cooling and lubrication systems with subsequent components.

By the end of this lecture the students are able to systematically analyze the the load exchange of the different types of combustion engines (4-stroke engine, rotary engine, 2-stroke engine). They are capable to comprehend the basic physical mechanisms of the load exchange, such as wave effects, and to relate its influence on constructive characteristics by the acoustic theory. Given this ability the students are ready to asses the tasks, types and dynamic effects of valve trains and recommendations for construction. They are able to differentiate between the different methods of supercharging as well as mixture formation, e.g. port fuel injection and direct injection of gasoline engines as well as direct injection of Diesel engines, and to relate them to their influences on performance and efficiency. Due to the increasing environmental pollution the students are given the ability to comprehend the emission formation and to find best suited solutions for controlling measures and exhaust gas after treatment for different types of engines.

Voraussetzungen	Benotung
• Internal Combustion Engine Fundamentals • Thermodynamics • Fluid Dynamics • Machine Dynamics	Written examination

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	Prüfungs-dauer (Minuten)	CP	SWS
Prüfung Internal Combustion Engines I	120	5	0
Prüfung Internal Combustion Engines II	120	5	0
Vorlesung Internal Combustion Engines I	0	0	2
Übung Internal Combustion Engines I	0	0	2
Vorlesung Internal Combustion Engines II	0	0	2
Übung Internal Combustion Engines II	0	0	2

Modul: Combustion II

MODUL TITEL: Combustion II

ALLGEMEINE ANGABEN

Fachsemester	Dauer	Kreditpunkte	SWS	Häufigkeit	Turnus Start	Sprache
3	1	3	2	1	WS	Englisch

INHALTLICHE ANGABEN

Inhalt	Lernziele
• Turbulent Combustion: Introduction and Overview • Laminar Flamelet Models for Non-Premixed Turbulent Combustion • Turbulent Diffusion Flames: Experiments and Modelling Aspects • Laminar Flamelet Models for Premixed Turbulent Combustion • Turbulent Burning Velocities: Experiments and Correlation of Data • Partially Premixed Combustion: Lifted Flames • (Quelle: http://www.itv.rwth-aachen.de/index.php?id=42&L=5)	
Voraussetzungen	**Benotung**
•	

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	Prüfungs-dauer (Minuten)	CP	SWS
Prüfung Combustion II		3	0
Vorlesung Combustion	0	0	1
Übung Combustion II	0	0	1

Modul: Alternative and Electrified Vehicle Propulsion Systems

MODUL TITEL: Alternative and Electrified Vehicle Propulsion Systems

ALLGEMEINE ANGABEN

Fachsemester	Dauer	Kreditpunkte	SWS	Häufigkeit	Turnus Start	Sprache
2	1	4	3	1	SS 12	Englisch

INHALTLICHE ANGABEN

Inhalt	Lernziele
• Introduction • Alternative drive systems • Alternative fuels • Variable transmissions and power split drive train • Regenerative drives • Drive concepts • Control Strategies	After having successfully passed this lecture the student is able to systematically analyze alternative concepts for vehicle power trains. He/she are theoretically capable to comprehend the different purposes of alternative drive systems, such as unconventional types of combustion engines with the consideration of alternative fuels (alcohol, natural gas, hydrogen), gas turbines, Stirling engines and fuel cells as well as electric drives. Furthermore, the student has the ability to link the knowledge about alternative power trains to the different types of variable transmissions and power split drive trains. The main skill of the student is the transfer of basic calculation procedures of power train efficiencies. He/she is able to assess regenerative drives e.g. electric, flywheel and hybrid drives. Beside this the student is able to find the most suitable control strategies (integrated engine-transmission management) according to the various drive concepts.
Voraussetzungen	**Benotung**
• Internal Combustion Engine Fundamentals • Internal Combustion Engines I + II • Automotive Engineering I • Thermodynamics	Written examination

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	Prüfungs-dauer (Minuten)	CP	SWS
Prüfung Alternative and Electrified Vehicle Propulsion Systems	120	4	0
Vorlesung Alternative and Electrified Vehicle Propulsion Systems	0	0	2
Übung Alternative and Electrified Vehicle Propulsion Systems	0	0	1

Modul: Automotive Engineering I

MODUL TITEL: Automotive Engineering I

ALLGEMEINE ANGABEN

Fachsemester	Dauer	Kreditpunkte	SWS	Häufigkeit	Turnus Start	Sprache
1	1	4	3	2		Englisch

INHALTLICHE ANGABEN

Inhalt	Lernziele
• Introduction • Traffic System Motor Vehicle • Power and Energy Demand • Wheel Resistance • Power and Energy Demand • Aerodynamic Drag • Power and Energy Demand • Resistance due to Gradients • Acceleration Resistance • Overall Resistance • Powertrain • Energy Accumulators • Propulsion Units (Engines) • Powertrain • Propulsion Units (Engines) • Comparison of Propulsion Units • Powertrain • Speed Converters (Clutches) • Powertrain • Torque converters (transmission) • Powertrain • Differential (Transfer Gearbox) • Powertrain • Brakes • Vehicle Dynamics • Driving Performance • Vehicle Dynamics • Driving Performance • Drivetrain Layouts • Vehicle Dynamics • Drivetrain Layouts • Vehicle Dynamics • Driving Limits	The emphasis of the lecture is the longitudinal dynamic of vehicles. The students should understand the functional charateristics of different components of the vehicle longitudinal dynamic and be able to assess these component concerning operating behaviour, economics and influence on environment.
Voraussetzungen	**Benotung**

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	Prüfungs-dauer (Minuten)	CP	SWS
Prüfung Automotive Engineering I	120	4	0
Vorlesung Automotive Engineering I	0	0	2
Übung Automotive Engineering I	0	0	1

Modul: Pumps and Compressors

MODUL TITEL: Pumps and Compressors

ALLGEMEINE ANGABEN

Fachsemester	Dauer	Kreditpunkte	SWS	Häufigkeit	Turnus Start	Sprache
2	1	4	3	1	SS 12	Englisch

INHALTLICHE ANGABEN

Inhalt

- Introduction
- General feeding principles
- Classification of piston compressors by constructive aspects
- Calculation of compressors
  - Input power
  - Delivery rate
  - Loss distribution
  - Multi-stage compression
- Control of compressors
- Calculation of piston pumps
  - Power
  - Mass flow
  - Oscillations of mass flow, maximum suction head

Lernziele

The students are able to systematically classify the numerous number of piston compressors by constructive aspects, e.g. piston movement, piston guidance, change in working volume or control of openings of working volume. They are transfer the history to the variety of today's existing examples of piston compressors as well as the calculation of input power and delivery rate of the different compressor types related on thermodynamic principles. With these fundamentals the students are capable to calculate and evaluate the static and dynamic calculations of pumps.

Voraussetzungen

- Internal Combustion Engine Fundamentals
- Internal Combustion Engines I + II
- Thermodynamics

Benotung

Written examination

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	Prüfungs-dauer (Minuten)	CP	SWS
Prüfung Pumps and Compressors	120	4	0
Vorlesung Pumps and Compressors	0	0	2
Übung Pumps and Compressors	0	0	1

Modul: Engine Acoustics

MODUL TITEL: Engine Acoustics

ALLGEMEINE ANGABEN

Fachsemester	Dauer	Kreditpunkte	SWS	Häufigkeit	Turnus Start	Sprache
2	1	5	4	1	SS 12	Englisch

INHALTLICHE ANGABEN

Inhalt	Lernziele
• Introduction • Physical fundamentals • Physiological recognition • Problems and causes • CAE-prediction of sound and vibrations • Acoustic conception of the drive assembly	The student is able to comprehend the today's aspects acoustic sound optimization processes in combustion engines. He/she are capable to assess the basic of sound recognition and sound generation. The students are theoretically capable of choosing and applying different suitable measurement and analysis techniques for a skilful sound optimization. They are able to interpret modern calculation methods of virtual engine development (FEM, MKS, BEM), supporting the acoustic optimization process. Under these aspects the students are capable to systematically analyze the principal details of the acoustic conception of the drive train.
Voraussetzungen	**Benotung**
• Internal Combustion Engine Fundamentals • Internal Combustion Engines I + II	Written (20 minutes) and oral (30 minutes) examination

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	Prüfungs-dauer (Minuten)	CP	SWS
Prüfung Vehicle Acoustics	50	5	0
Vorlesung Vehicle Acoustics	0	0	2
Übung Vehicle Acoustics	0	0	2

Modul: Advanced Software Engineering

MODUL TITEL: Advanced Software Engineering

ALLGEMEINE ANGABEN

Fachsemester	Dauer	Kreditpunkte	SWS	Häufigkeit	Turnus Start	Sprache
3	1	5	4	1	WS 2011/12	Englisch

INHALTLICHE ANGABEN

Inhalt	Lernziele
Within the first part of the lecture the steps from problem description to the hard and software solution are illustrated. This covers the topics modelling, problem analysis, program design (e.g. by means of Unified Modeling Language (UML), implementation in C++ and binary logic. Also the basics of agile processes are explained, in special extreme programming. Parallel to the lecture a software reengineering project is offered. A given historically grown software is taken and the students try to add additional functions. For this they have to understand the use and function of the software in first place. Second they have to refractor the code, so the software does the same as before but now the code is nice and clear. With that they can start to add additional functions. To master this difficult task they get additional training in C++, a Concurrent Versions System (CVS), UML and a documentation system for C++ (doxygen).	The students know the most important elements of a computer and its functionality as well as the approach for software development. They comprehend for what purposes, under which conditions and with which consequences computer systems are used for the solution of problems related to Mechanical Engineering. They have the ability to transfer the acquired knowledge in object oriented design to different engineering problems and understand the general structure and the functionality of software.
Voraussetzungen	**Benotung**
• Recommended: Basic knowledge in a programming language (e.g. C, C++)	Written or oral examination

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	Prüfungs-dauer (Minuten)	CP	SWS
Prüfung Advanced Software Engineering	120	5	0
Vorlesung Advanced Software Engineering	0	0	2
Übung Advanced Software Engineering	0	0	2

Modul: Automotive Engineering II

MODUL TITEL: Automotive Engineering II						
ALLGEMEINE ANGABEN						
Fachsemester	**Dauer**	**Kreditpunkte**	**SWS**	**Häufigkeit**	**Turnus Start**	**Sprache**
3	1	4	3	2	SS	Englisch

INHALTLICHE ANGABEN

Inhalt	**Lernziele**
• demands on suspension systems • road excitations • vertical tire characteristics • body springs • body springs • shock absorbers • seats • influence of vertical excitations on the human body • single mass suspension model • double mass suspension model • parametric study of suspension properties • single track suspension model • two-track suspension model • roll springing • stabalizer and compensating spring • influence of torsional weakness on suspension properties • demands on lateral dynamics and vehicle behavior • lateral tire characteristics • dynamic lateral tire characteristics • single track vehicle model • analysis of stationary vehicle behavior • analysis of dynamic vehicle behavior • four wheel vehicle model • dynamic wheel load distribution • changes in wheel position due to camber and toe angle • parametric study of inluences on lateral vehicle dynamics • influence of longitudinal on lateral vehicle dynamics • steering systems • kinematics of wheel suspensions • elastokinematics of wheel suspensions • requirements to be met by wheel suspensions • examples of wheel suspension types	The first part of the lecture is vertical vehicle dynamic. Students are supposed to understand the requirements on the components of the suspension system and should be able to calculate the vehicle vertical dynamics using different suspension models. The driving stability (lateral dynamic) is discussed in the second part of the lecture. Students will gain understanding of tyres and steering system and should be able to analyse the influence of different vehicle parameters on the driving stability.
Voraussetzungen	**Benotung**
Automotive Engineering I	Oral or written examination

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN			
Titel	**Prüfungs-dauer (Minuten)**	**CP**	**SWS**
Prüfung Automotive Engineering II	120	4	0
Vorlesung Automotive Engineering II	0	0	2
Übung Automotive Engineering II	0	0	1

Modul: Automotive Engineering III

MODUL TITEL: Automotive Engineering III

ALLGEMEINE ANGABEN

Fachsemester	Dauer	Kreditpunkte	SWS	Häufigkeit	Turnus Start	Sprache
3	1	5	4	1	WS	Englisch

INHALTLICHE ANGABEN

Inhalt	Lernziele
• Demands on the Automobile Engineer • The Environment of the Automobile Industry • Introduction into vehicle safety • Accident Analysis • Lighting Equipment • View and Control Conception • Air Conditioning, Glass • Practical Course: Driver Assistance • Systems for Driver Assistance – Introduction • Systems for Driver Assistance - Sensors and Actuators • Systems for Driver Assistance – Applications • Longitudinal and Transverse Dynamics Control • Biomechanics • Pedestrian Protection • Restraint Systems • Pre-Crash / Post-Crash • Demands on System Integrity	During the course student gain an understanding for safety related vehicle systems. The theoretical considerations of these systems in the lecture are discussed in practical exercises with realistic examples of modern vehicle technology.
Voraussetzungen	**Benotung**
Automovtive Engineering I Automotive Engineering II	Oral or written examination

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	Prüfungs-dauer (Minuten)	CP	SWS
Prüfung Automotive Engineering III	120	5	0
Vorlesung Automotive Engineering III	0	0	2
Übung Automotive Engineering III	0	0	2

Modul: Dynamics of Machines II

MODUL TITEL: Dynamics of Machines II

ALLGEMEINE ANGABEN

Fachsemester	Dauer	Kreditpunkte	SWS	Häufigkeit	Turnus Start	Sprache
2	1	5	4	1	SS	Englisch

INHALTLICHE ANGABEN

Inhalt

- Introduction
- Basic Principles and Plane Motion of Rigid Bodies
- Dynamic Force Analysis of Plane Mechanisms with Rigid Links: Graphical Technique
- Dynamic Force Analysis of Plane Mechanisms with Rigid Links: Analytical Approach
- Dynamic Motion Analysis of Plane Mechanisms with Rigid Links
    - Systems without Friction
    - Systems with Friction
- Dynamics of Slider-Crank Mechanism
- Analytical Expressions for Kinematic Parameters
- Dynamical Equivalence of Connecting Rod
- Turning Moment in Single Cylinder Engines
- Dynamics of Mechanisms Considering Link Elasticity
- Balancing of Inertial Forces and Moments for Single Slider Reciprocating Machines
    - Determination of Inertial Forces
    - Balancing of Inertia Forces
    - Determination of Inertial Moments
    - Balancing of Inertial Moments
- Balancing of Inertial Forces and Moments for Multi Slider Reciprocating Machines (In-Line Configuration)
    - Inertia Forces by Analytical Approach
    - Inertia Forces by Graphical Approach
    - Analysis of Inertial Moments
- Balancing of Inertial Forces and Moments for Multi Slider Reciprocating Machines (V and Radial Configuration)
    - Inertial Forces in V-Configuration
    - Inertial Forces in Radial Configuration
- Balancing of Planar Linkages
- Power Smoothening in Machines
- Power balance
- Power balancing in the field of piston engines
- Equations of Motion
    - External Forces and Moment
    - Kinetic Energy
    - Potential Energy
- General Solution of Equation of Motion
- Solution of Equation of Motion for Constant Inertia
- Solution of Equation of Motion for Constant Speed
- Solution of Equation of Motion for Specified Instantaneous Speed and Acceleration
- Solution of Equation of Motion for Constant Energy
- Fluctuation of Angular Velocity
- Non uniformity factor
- Control of Speed Fluctuation by Flywheels
- Determination of Flywheel Inertia (graphical approach)
- Determination of Flywheel Inertia (analytical approach)
- Wittenbauer's Method of Flywheel Analysis

Lernziele

The students have the ability of describing mathematically any mechanical system with its inherent physical effects like balancing inertial forces and torques, and power smoothing especially of piston engines.

The students have the ability to perform an analysis of the motion behaviour and dynamics of rigid bodies. They are able to evaluate the impact of the different model parameters on inertial forces and to derive measures for the improvement of balancing and power smoothing.

Voraussetzungen	Benotung
	Oral or written examination

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	Prüfungs-dauer (Minuten)	CP	SWS
Prüfung Dynamics of Machines II	120	5	0
Vorlesung Dynamics of Machines II	0	0	2
Übung Dynamics of Machines II	0	0	2

Modul: Manufacturing Technology I

MODUL TITEL: Manufacturing Technology I

ALLGEMEINE ANGABEN

Fachsemester	Dauer	Kreditpunkte	SWS	Häufigkeit	Turnus Start	Sprache
1	1	5	4	1	SS 2012	Englisch

INHALTLICHE ANGABEN

Inhalt	Lernziele
• Introduction to manufacturing technology • Measuring and testing in manufacturing technology • Principles of machining with geometrically defined cutting edges • Cutting materials and cutting tools • Cutting materials, tools and lubricants • Cutting criteria • Manufacturing processes with geom. defined edges • Applications of processes with defined cutting edge • Principles of cutting with undefined cutting edges • Grinding tools and grinding wheel preparation • Processes and application examples (grinding) • EDM • ECM and Rapid Prototyping (RP)	The students possess comprehensive knowledge of the cutting technologies with geometrically defined and undefined cutting edges, electro discharge and electro-chemical machining and rapid prototyping. Beside the fundamental principles of the techniques the student are familiar with the parameters taking influence on the process design and can derive measures for a process optimization. Furthermore the students are able to solve problems concerning the field of measuring and testing of produced parts
Voraussetzungen	**Benotung**
	Oral or written examination

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	Prüfungs-dauer (Minuten)	CP	SWS
Prüfung Manufacturing Technology I	90	5	0
Vorlesung Manufacturing Technology I	0	0	2
Übung Manufacturing Technology I	0	0	2

Modul: Manufacturing Technology II

MODUL TITEL: Manufacturing Technology II

ALLGEMEINE ANGABEN

Fachsemester	Dauer	Kreditpunkte	SWS	Häufigkeit	Turnus Start	Sprache
2	1	5	4	1	WS 2011/12	Englisch

INHALTLICHE ANGABEN

Inhalt	Lernziele
• Casting • Powder Metallurgy • Bulk Forming I • Bulk Forming II • Sheet Metal Forming I • Sheet Metal Forming II • Process Design • Fine Blanking • Manufacturing Sequences and Process Design	The students possess comprehensive knowledge of forming (casting and powder metallurgy) and reforming (bulk forming, sheet metal forming and blanking) processes. Beside the fundamental principles of the elasto-plastic material behaviour the student are familiar with the parameters taking influence on the process design and can derive measures for a process optimization. Furthermore the students are able to design process chains for complex parts.
Voraussetzungen	**Benotung**
	Oral or written examination

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	Prüfungs-dauer (Minuten)	CP	SWS
Prüfung Manufacturing Technology II	90	5	0
Vorlesung Manufacturing Technology II	0	0	2
Übung Manufacturing Technology II	0	0	2

Modul: Tribology

MODUL TITEL: Tribology

ALLGEMEINE ANGABEN

Fachsemester	Dauer	Kreditpunkte	SWS	Häufigkeit	Turnus Start	Sprache
1	1	5	4	1	WS 2011/12	Englisch

INHALTLICHE ANGABEN

Inhalt

- Basics of Tribology:
- The Tribosystem in general and its analysis, its wear and friction processes and their test methods, also reasonable test and substitute systems
- Interactions between base and contact Bodies:
- Contact processes and geometries, material strain, Hertzian theory, contact mechanics
- Interactions between base and contact Bodies:
- Frictional processes and the results and influence on the tribosystem, wear processes and methods to avoid wear and losses
- Properties of base and contact Bodies:
- Tribomaterials and the analysis of technical surfaces, roughness, hardness definitions and test methods
- Properties of base and contact Bodies:
- Coating types and methods and their technical application, systematical methods and examples for the correct choice of material
- Properties of intermediate medium:
- Basic properties, dependencies and test methods for the viscosity
- Properties of intermediate medium:
- Classification, properties and application examples for different lubricants (oils, greases and solid lubricants)
- Bascis of hydrodynamics and elastohydrodynamics:
- Fundamentals and principles of flow mechanisms, derivation of Navier-Stokes and Reynolds equations and continuity equation
- Bascis of hydrodynamics and elastohydrodynamics:
- Application of the hydrodynamic equations regarding the calculation of bearings, Basics of the elastohydrodynamics
- Tribosystem Journal Bearings:
- Functionality and calculation of *hydrodynamic* axial and radial journal bearings, different occurring damages and failures and the choice of suitable lubricants
- Tribosystem Journal Bearings:
- Functionality and calculation of *hydrostatic* axial and radial journal bearings, different occurring damages and failures and the choice of suitable lubricants
- Tribosystem gear wheels:
- Lubricants and materials for gears and their influence and application, application of the EHD-theory for gear stages
- Tribosystem gear wheels:
- Damages and failures on gear wheels and suitable test methods for the analysis of gear stages
- Tribosystem roller bearings:
- Design, materials, friction and lubrication of roller bearings, damages and failures and test methods for the analysis of roller bearings
- Tribosystem seals:
- Different types and designs, specialties and application of different seals and materials for seals

Lernziele

The students are able to find and localize and systematically analyze tribo systems in general mechanical systems. They are theoretically capable of choosing and applying different suitable measuring- and test systems for journal bearings, roller bearings and gear wheels and they are capable of estimating the quality of the Tribosystem according to the test results and to optimize it with the background knowledge of a considerably large action catalogue. The students know the basic theories of hydrodynamics and of elastic material deformations and are able to use them in the calculation and analysis of tribological issues in a reasonable way.

Voraussetzungen	Benotung
• Machine Elements • Mechanics • Advanced Mathematics	Oral or written examination

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	Prüfungs-dauer (Minuten)	CP	SWS
Prüfung Tribology	120	5	0
Vorlesung Tribology	0	0	2
Übung Tribology	0	0	2

Modul: Machine Tools I

MODUL TITEL: Machine Tools I

ALLGEMEINE ANGABEN

Fachsemester	Dauer	Kreditpunkte	SWS	Häufigkeit	Turnus Start	Sprache
1	1	5	4	1	WS 2011/12	Englisch

INHALTLICHE ANGABEN

Inhalt	Lernziele
L1: Introduction to machine tool manufacture, metal-forming and casting machines E1: Metal-forming machines L2: Metal-cutting machines with geometrically defined and undefined cutting edges E2: Tour around the shop floor of WZL and IPT L3: Metal removing machines, gear cutting machines E3: Gear cutting machines L4: Multi-machine systems, equipment components, pick-and-place robots, industrial robots E4: Use of industrial robots; types of construction and mechanical components L5: Layout of mounts and mount components concerning the static behaviour E5: Design of structural components and software tools for the design of machine tools L6: Layout of mount components concerning the dynamic and thermic behaviour E6: Design of an auxiliary mass damper L7: FEM, machine beds, acoustic machine behaviour E7: Application of the Finite-element-method (FEM) L8: Hydrodynamic slideways and plain bearings, hydrostatic and aerostatic plain bearings, magnetic bearings E8: Calculation of hydrostatic slideways L9: Anti-friction guideways, bearings, spindle-bearing systems, covers E9: Spindle-bearing systems, bearings, roller bearings L10: Motors, gears E10: Motors, characteristic curves, basic equations, running-up L11: Measuring instruments, geometric and kinematic behaviour of machine tools E11: Transmission drives / design of clutches L12: Metrological analysis of the static and thermic machine behaviour E12: Geometrical, static and thermical characteristics of machine tools L13: Metrological analysis of the dynamic behaviour of machine tools E13: Dynamic behaviour of machine tools L14: Metrological analysis of the kinematic and dynamic behaviour of feed drives, noise behaviour E14: Principles of noise measurement and rating	The students know the most important types of production machinery, their properties and their most relevant parameters. They are able to determine and calculate the corresponding mechanical and electrical properties. They are also able to transfer the basic calculation procedures to related topics.

Voraussetzungen	Benotung
• Mathematics • Mechanics • Physics • English	Oral or written examination

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	Prüfungs-dauer (Minuten)	CP	SWS
Prüfung Machine Tools I	90	5	0
Vorlesung Machine Tools I	0	0	2
Übung Machine Tools I	0	0	2

Modul: Fundamentals of Light Weight Design

MODUL TITEL: Fundamentals of Lightweight Design

ALLGEMEINE ANGABEN

Fachsemester	Dauer	Kreditpunkte	SWS	Häufigkeit	Turnus Start	Sprache
1	1	4	3	1	SS 12	Englisch

INHALTLICHE ANGABEN

Inhalt	Lernziele
• Introduction to Lightweight Design • Motivation, Definitions, Concepts • Special Aspects of Light Structures • Materials used in Lightweight Design • Basic equations of Continuum Mechanics • Idealization of structures • Equilibrium conditions • Statically determined support of 2-dim and 3-dim structures • Determination of external and internal forces • 2-dim and 3-dim truss type structures • General equations • Design concepts • Beams loaded in bending and shear • General equations • Differential equation of shear rigid beams • Matrix formulations: transfer matrix, stiffness matrix • Shear flexible beam • Matrix formulation • Shear deformation • Shear flow in thin walled beams • Open cross section • Closed cross section • Shear center • Plastic bending • Combined normal and bending load • Torsion of beams (st. Venants Torsion) • Solid sections • Closed thin walled sections • Open thin walled sections • Bending Torsion • Introduction to shear panel theory • Open and closed section beams • 2-dim shear panel structures • rectangular, parallelogram, trapezoidal and general 4node panels • 3-dim shear panel structures	The students are able to realize special aspects of thin-walled lightweight structures and to design them properly. They know methods to design structures at the beginning and are thus able to find sufficient solutions. Further, they achieve knowledge, allowing to check the correctness of results of numerical simulation software.
Voraussetzungen	**Benotung**
	Oral or written examination

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN			
Titel	**Prüfungs-dauer (Minuten)**	**CP**	**SWS**
Prüfung Fundamentals of Lightweight Design	120	4	0
Vorlesung Fundamentals of Lightweight Design	0	0	2
Übung Fundamentals of Lightweight Design	0	0	1

Modul: Production Management I

MODUL TITEL: Production Management I						
ALLGEMEINE ANGABEN						
Fachsemester	**Dauer**	**Kreditpunkte**	**SWS**	**Häufigkeit**	**Turnus Start**	**Sprache**
1	1	5	4	1	WS 2011/12	Englisch

INHALTLICHE ANGABEN

Inhalt	**Lernziele**
• Technology Management I • Technology Management II • Product Planning & Engineering • Variant Management • Process Planning • Planning for Manufacture & Assembly • Operations Management • Materials Management • Lean Production - Production Systems • Production Strategies • Buisness Modelling • Process Modelling • The Industrial History: From Taylorism To Virtual Factory	Markets and manufacturing conditions are frequently changing. This imposes the necessity of long-range and intensive planning in enterprises of the manufacturing industry, as only early accommodation of actual conditions guarantees competitiveness. Students will gain knowledge which topics have to be considered in this context and how the gained knowledge can be transferred to daily business of a company. For the purposes of manufacturing engineering, Students know the following tasks that have to be carried out: • Elaboration and application of planning methods. • Analysis of problems in all enterprise domains which are involved in the manufacturing process. • Demonstration of possibilities for rationalisation and automation. • Elaboration of rationalisation methods and tools. These tasks are elucidated concerning the manufacturing domains design, operations planning and scheduling, production and assembly as well as the superior domains cost accounting, E.D.P., overall organisation etc. Students will be able to understand the problems of producing companies and will find solutions best suited for the investigated subject.
Voraussetzungen	**Benotung**
	Oral or written examination

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	**Prüfungs-dauer (Minuten)**	**CP**	**SWS**
Prüfung Production Management I	90	5	0
Vorlesung Production Management I	0	0	2
Übung Production Management I	0	0	2

Modul: Quality Management

MODUL TITEL: Quality Management

ALLGEMEINE ANGABEN

Fachsemester	Dauer	Kreditpunkte	SWS	Häufigkeit	Turnus Start	Sprache
1	1	5	4	1	WS 2011/12	Englisch

INHALTLICHE ANGABEN

Inhalt

- Introduction:
- Deming Chain, Target-Management, Continues Improvement etc.
- Quality Programs:
- Total Quality management, EFQM-Model, Six Sigma etc.
- Quality Management Methods:
- Documentation of Quality Management Systems, Auditing and Certification, Quality Management and Norm etc.
- Quality and Economics:
- Controlling of Quality, Quality Cost Accounting, Cost Categories, Target Costing, Balanced Scorecard etc.
- Quality Management During Field Operations:
- Analyses of Field Data, Weibull-Analyses, Isochron-Diagram, MIS-Diagram etc.
- Quality Management in the Production:
- Statistical Process Control, 5S, Value Stream Mapping etc.
- Quality Management in the Early Phases - Focus Product:
- Kano-Model, Quality Function Deployment, House of Quality, TRIZ etc.
- Quality Management in the Early Phases - Focus Process:
- Design for Six Sigma, Fault Tree Analyses, Failure-Mode- and Effects-Analyses, Risk Management etc.
- Quality Management in the Early Phases - Focus Faults and Defects:
- Ishikawa-Diagram, Process and Product Optimisation, Design of Experiments etc.
- Quality Management in the Procurement:
- Procurement Strategies, Supplier selection, Incoming Inspection, Accepted Quality Level, Inspection and Release of the First Sample etc.
- Quality and Information:
- Quality Control Loops, Quality Daten Basis und Product Data Basis, IT-Systems in Enterprises (ERP, PPS, BDE, MDE),Computer Aided Quality Management, CAx-Techniques (CAQ; CAD; CAE; CAP), Relation of Quality- and Knowledge Management etc.
- Quality Management in Service Industries:
- Service Engineering, Service Level Agreement, Service Blueprinting, ServQual, Vignette Technique, Service FMEA, Conjoint Analyses etc.
- Case Study KAIZEN:
- Damages and failures on gear wheels and suitable test methods for the analysis of gear stages etc.
- Quality and Law:
- (only German Law and in German language) etc.

Lernziele

Considering the growing importance of quality assurance in industrial production, the lecture of "Quality Management" was initiated at the Faculty of Production Engineering. Quality issues of industrial applications and necessary underlying theories are emphasised in this lecture. The core of this lecture lies thus in the organisation of quality systems and quality management methods. A broader perspective can also be given via discussions about more advanced topics such as quality planning, quality costs and quality legal questions.

• Practical Computer Training: Continuous Improvement, Value Added and Waste, Optimizing the Production Process etc	
Voraussetzungen	**Benotung**
	Oral or written examination

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	**Prüfungs-dauer (Minuten)**	**CP**	**SWS**
Prüfung Quality Management	120	5	0
Vorlesung Quality Management	0	0	2
Übung Quality Management	0	0	2

Modul: Industrial Engineering, Ergonomics and Work Organisation

MODUL TITEL: Industrial Engineering, Ergonomics and Work Organisation

ALLGEMEINE ANGABEN

Fachsemester	Dauer	Kreditpunkte	SWS	Häufigkeit	Turnus Start	Sprache
1	1	4	3	1	WS 2011/12	Englisch

INHALTLICHE ANGABEN

Inhalt	Lernziele
Work as a Scientific Field of Research • Fundamentals of industrial engineering • Trends and challenges in the field of industrial engineering Industrial Organization and Work Organization • Basics and classification of industrial organization and work organization in modern industries • Basics and modelling options of structure organization and process organization • Principles of function and object oriented order processing • traditional industrial organizations and trends • Methods for activity planning and scheduling Work Organization within Direct and Indirect Departments • The phenomenon “organization” • Characteristics of direct and indirect departments • Types of work organization in direct and indirect departments Work and Time Study I • The operational purpose of time data • REFA types of activities and REFA types of times • Methods for the determination of time data • The REFA Stop Watch Time Study method and the work sampling method Work and Time Study II • The basic principles of the sequence-analytic time modelling (predetermined motion-time systems) • Basics and application of MTM („Methods Time Measurement“) Ergonomic Design and Usability Engineering • Design criteria and requirements of ergonomic design • Anthropometric design • Methods for the analysis of movement-, sight- and reaching-areas • Computer aided design and evaluation aids Computer and Office Work • Conventional and modern components of a computer workstation • Overview of display technologies • Aspects of work psychology • Risk assessment for computer work stations • Office concepts Ergonomic Work Place Design in Production Areas • Different types of physical and muscular work • Factors influencing spine damage • Methods for assessing the danger of spine damage at work places • Physiological principles of work place design	The students know the essentials of work science covering technical, organizational and personnel aspects. Based on this knowledge the students are able to interpret respective work situations, predict consequences and future work system states. The students are able to independently scrutinize and discuss the proposed methods and theories and judge their applicability. By using the methods students are able to analyse work systems according to various practical problems. Furthermore, the students are able to apply the theoretical models, methodologies and practical techniques to problem solution and work system design in modern enterprises.

Occupational Risk Prevention (ORP) • Effects of occupational safety for the company and national economy • Terms of safety science • Technical, organizational and personal measures of occupational risk prevention Work Ecology - Noise and Hazardous Substances • Physical and psychological measurement categories of sound • Noise induced hearing damages • Organizational and personal noise control • Taxonomy and effects of hazardous substances Work Ecology II - Illumination • Physical and physiological basics of illumination • Effects of lighting on work performance and health • Measurement of light • Relevance of illumination for workplace design. Remuneration and Motivation • Forms of remuneration • Relationship between remuneration and motivation • Approaches to job evaluation Interorganizational Cooperation and Suitable Information Technological (IT) Support • Basic terms of network technology • Software tools for the support of coordination, cooperation, and communication • Effects of the technology on enterprises and employees • Forms of organizations and conditions suitable for the use of network technology	
Voraussetzungen	**Benotung**
	Oral or written examination

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	**Prüfungs-dauer (Minuten)**	**CP**	**SWS**
Prüfung Industrial Engineering, Ergonomics and Work Organisation	120	5	0
Vorlesung Industrial Engineering, Ergonomics and Work Organisation	0	0	2
Übung Industrial Engineering, Ergonomics and Work Organisation	0	0	2

Modul: Control Engineering

MODUL TITEL: Control Engineering

ALLGEMEINE ANGABEN

Fachsemester	Dauer	Kreditpunkte	SWS	Häufigkeit	Turnus Start	Sprache
1	1	3	2	1	WS 2011/12	Englisch

INHALTLICHE ANGABEN

Inhalt	Lernziele
Significance of control theory, examples of biological and biomedical control loops, functional diagrams, linearization, set up and solving of differential equations, stability, features in time domain of dynamical systems, Laplace transform, transfer function, frequency response, functional diagram algebra, features in frequency domain of dynamical systems, bode diagram, Nyquist plot, Linear control loop elements, principle and goals of controller design, algebraic stability criteria, steady state analysis and transient performance of a control loop, controller setting rules, Nyquist stability criterion, phase margin, gain margin, controller design in bode diagram.	Enable students to • analyze dynamical, biological and biomedical systems and identify the relevant causalities • employ different mathematical descriptions of dynamical systems • solve differential equations by means of Laplace transform • obtain, interpret and employ the frequency response of dynamical systems • know, recognize and classify the most common linear control loop elements • assess of the stability of dynamical systems using different methods know about the effects of feedback and apply different methods to set up feedback elements (controllers) such that predefined control goals are met
Voraussetzungen	**Benotung**
Basic knowledge in mathematics as defined in the examination regulations.	Oral or written examination

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	Prüfungsdauer (Minuten)	CP	SWS
Prüfung Control Engineering	90	3	0
Vorlesung Control Engineering	0	0	1
Übung Control Engineering	0	0	1

Modul: German Language Course

MODUL TITEL: German Language Course

ALLGEMEINE ANGABEN

Fachsemester	Dauer	Kreditpunkte	SWS	Häufigkeit	Turnus Start	Sprache
1	1	6	4	1	WS	Englisch

INHALTLICHE ANGABEN

Inhalt	Lernziele
• Kennen lernen • Sich vorstellen • Stadterkundungen • Orientierung in der Stadt • Techniken: Wörter lernen und behalten • Lebensmittel einkaufen • Telefonkommunikation • Techniken: Systematisch Grammatik lernen • Kalender, Feste • Feiertage • Lernen und Vergessen • Lernpsychologie • Deutschsprachige Zeitungen • Lesegewohnheiten • Andere Länder, andere Sitten • Interkulturelle Erfahrungen • Medien • Geografische Deutschlandkunde • Erfindungen und Fortschritt • Zwischen den Kulturen • Umweltschutz/Umweltprobleme • Das Projekt Europa • Arbeitsmarkt Deutschland • Bewerbungen • Lebensläufe	- Deutschkurse vermitteln grundlegendes Wissen über die deutsche Kultur und Landeskunde; - Deutschkurse befähigen zur sprachlichen Bewältigung der Alltagskommunikation im universitären Umwelt (Wohnheim, Mensa, usw,); - Deutschkurse bieten Voraussetzungen für kulturell angemessene Bewerbungsunterlagen für Praktika (Lebenslauf, Bewerbungsschreiben); - Deutschkurse vermitteln Einsichten in kulturelle Gegebenheiten an deutschen Hochschulen
Voraussetzungen	**Benotung**
	Oral or written examination

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	Prüfungs-dauer (Minuten)	CP	SWS
Prüfung		6	0
Vorlesung und Übung	0	0	4

Modul: Industrial Internship

MODUL TITEL: Industrial Internship						
ALLGEMEINE ANGABEN						
Fachsemester	**Dauer**	**Kreditpunkte**	**SWS**	**Häufigkeit**	**Turnus Start**	**Sprache**
4	9 Wochen	9				Englisch

INHALTLICHE ANGABEN	
Inhalt	**Lernziele**
Siehe Richtlinien für die berufspraktische Tätigkeit	Siehe Richtlinien für die berufspraktische Tätigkeit
Voraussetzungen	**Benotung**
	Keine

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN			
Titel	**Prüfungs-dauer (Minuten)**	**CP**	**SWS**
Bericht, Kolloquium		9	0

Modul: Industrial Internship

MODUL TITEL: Industrial Internship						
ALLGEMEINE ANGABEN						
Fachsemester	**Dauer**	**Kreditpunkte**	**SWS**	**Häufigkeit**	**Turnus Start**	**Sprache**
4	9 Wochen	9				Englisch

INHALTLICHE ANGABEN	
Inhalt	**Lernziele**
Siehe Richtlinien für die berufspraktische Tätigkeit	Siehe Richtlinien für die berufspraktische Tätigkeit
Voraussetzungen	**Benotung**
	keine

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN			
Titel	**Prüfungs-dauer (Minuten)**	**CP**	**SWS**
Bericht, Kolloquium	30	9	0

Modul: Mini Thesis

MODUL TITEL: Mini Thesis						
ALLGEMEINE ANGABEN						
Fachsemester	**Dauer**	**Kreditpunkte**	**SWS**	**Häufigkeit**	**Turnus Start**	**Sprache**
3	9 Wochen	9				Englisch

INHALTLICHE ANGABEN	
Inhalt	**Lernziele**
Wissenschaftliche abgeschlossene Arbeit, die unter Anleitung angefertigt wird. Die Studierenden erarbeiten mit den Betreuern eine Gliederung, legen die zur Erfüllung der Aufgabe notwendigen Teilaufgaben und Hilfsmittel und den voraussichtlich erforderlichen Zeitbedarf fest.	Die Studierenden erlernen die Herangehensweise und Abarbeitung von wissenschaftlichen Themenstellungen, deren Dokumentation und schriftlichen Darstellung unter intensiver Anleitung. Sie Erlernen die Methodik des systematischen, wissenschaftlichen Arbeitens.
Voraussetzungen	**Benotung**

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN			
Titel	**Prüfungs-dauer (Minuten)**	**CP**	**SWS**
Mini Thesis	0	9	0

Modul: Master Thesis

MODUL TITEL: Master Thesis

ALLGEMEINE ANGABEN

Fachsemester	Dauer	Kreditpunkte	SWS	Häufigkeit	Turnus Start	Sprache
4	20 Wochen	20				Englisch

INHALTLICHE ANGABEN

Inhalt	Lernziele
Wissenschaftliche abgeschlossene Arbeit, die zeigen soll, dass die Studierenden in der Lage sind, ein Problem aus einem in Beziehung zu ihrem stehenden Fach in begrenzter Frist selbstständig nach wissenschaftlichen Methoden zu bearbeiten.	Die Studierenden erlernen die selbstständige Herangehensweise und Abarbeitung von wissenschaftlichen Themenstellungen, deren Dokumentation und schriftlichen Darstellung in einer in begrenzter Frist. Sie Erlernen das systematische, wissenschaftlichen Arbeiten.
Voraussetzungen	**Benotung**

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	Prüfungs-dauer (Minuten)	CP	SWS
Master Thesis	30	20	0
Master Thesis Kolloquium	15	0	0

Anlage 2

Studienverlaufsplan

Module	CP	WS			SS			WS			SS			SWS
		L	E	P	L	E	P	L	E	P	L	E	P	
Compulsory Courses														
Internal Combustion Engine Fundamentals and	5	2	1											3
Energy Conversion Machinery	5	2	1											3
Energy Economics	5				2	1								3
Combustion I	5				3	2								5
Heat and Mass Transfer	8	3	2											5
Fluid Dynamics	5				2	2								4
Internal Combustion Engines I and	5				2	2								4
Internal Combustion Engines II	5							2	2					4
Combustion II	3							1	1					2
Alternative and Electrified Vehicle Propulsion Systems	4				2	1								3
Automotive Engineering I	4	2	1											3
Pumps and Compressors	4				2	1								3
Engine Acoustics	5				2	2								4
Total Compulsory Courses	**63**													**46**
Elective Courses	**13 CP are to be taken (8 CP in the 1. semester, 5 CP in the 3. semester)**													
Advanced Software Engineering	5							2	2					4
Automotive Engineering II	4				2	1								3
Automotive Engineering III	5							2	2					4
Dynamics of Machines II	5				2	2								4
Manufacturing Technology I	5	2	2											4
Manufacturing Technology II	5				2	2								4
Tribology	5	2	2											4
Machine Tools I	5	2	2											4
Fundamentals of Light Weight Design	4	2	1											3
Production Management I	5	2	2											4
Quality Management	5	2	2											4
Industrial Engineering, Ergonomics and Work Organisation	5	2	2											4
Control Engineering	4	2	1											3
Total Elective Courses	**13**													**49 ***
German Language Course	6	2	2											4
Industrial Internship	9								9 weeks					
Mini Thesis	9								260 h					
Master Thesis	20								4 months					
Total	**120**													**99 ***

* Total SWS depend on modules selected

CP = Credit Points / SS = Summer Semester / WS = Winter Semester

L = Lecture / E = Excersise / SWS = Weekly Semester Hours (Semesterwochenstunden)

HERAUSGEGEBEN IM AUFTRAGE DES REKTORS VON DER ABTEILUNG 1.1 DES DEZERNATES 1.0 DER RWTH AACHEN
Templergraben 55, 52056 Aachen | Tel. +49 241 80-99087 | Fax. +49 241 80-92664 | akad@zhv.rwth-aachen.de