AMTLICHE BEKANNTMACHUNG RWTH AACHEN UNIVERSITY

NUMMER 2013/059 **SEITEN** 1 - 42 **DATUM** 21.06.2013 **REDAKTION** Sylvia Glaser

Prüfungsordnung

für den Masterstudiengang Production Systems Engineering

der Rheinisch-Westfälischen Technischen Hochschule Aachen

vom 16.10.2006[1]

in der Fassung der 4. Ordnung zur Änderung der Prüfungsordnung

vom 18.06.2013

Nach der vorliegenden Prüfungsordnung (PO) kann nur noch bis zum Ende des Sommer-Semesters 2015 studiert werden, da eine neue PO für den Studiengang unter Nummer 2013/055 veröffentlicht wurde.

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 18.12.2012 (GV. NRW. S. 669), hat die Rheinisch-Westfälische Technische Hochschule Aachen (RWTH) folgende Prüfungsordnung erlassen:

[1] Amtliche Bekannmachung der RWTH Aachen Nr. 1120

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

Inhaltsübersicht

HERAUSGEGEBEN IM AUFTRAGE DES REKTORS VON DER ABTEILUNG 1.1 DES DEZERNATES 1.0 DER RWTH AACHEN
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Artikel I

Die Prüfungsordnung für den Masterstudiengang Production Systems Engineering der Rheinisch-Westfälischen Technischen Hochschule Aachen vom 02.10.2006 (Amtliche Bekanntmachungen der RWTH Nr. 1120, S. 9781), zuletzt geändert durch Ordnung vom 04.01.2012 (Amtliche Bekanntmachungen der RWTH Aachen Nr. 2012/008) wird wie folgt geändert:

1. Der Modulkatalog wird durch die beiliegende Fassung ersetzt.

2. Der Studienverlaufsplan wird durch die beiligende Fassung ersetzt.

Artikel II

(1) Diese Prüfungsordnung tritt am Tage nach der Veröffentlichung in Kraft und gilt für alle Studierenden ab dem Wintersemester 2012/2013. Studierende, die sich vor dem Wintersemester 2012/2013 eingeschrieben und Leistungen nach den bisherigen Regelungen erbracht haben, bekommen diese entsprechend angerechnet.

(2) Diese Prüfungsordnung wird in den Amtlichen Bekanntmachungen der RWTH veröffentlicht.

Ausgefertigt aufgrund des Beschlusses des Fakultätsrates der Fakultät für Maschinenwesen vom 21. August 2012.

Der Rektor
der Rheinisch-Westfälischen
Technischen Hochschule Aachen

Aachen, den 18.06.2013

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.

Pflichtbereich:

Modul: Manufacturing Technology I & II

MODUL TITEL: Manufacturing Technology I & II

ALLGEMEINE ANGABEN

Fachsemester	Dauer	Kreditpunkte	SWS	Häufigkeit	Turnus Start	Sprache
1	2	10	8	Jedes 2. Semester	WS 2011/2012	English

INHALTLICHE ANGABEN

Inhalt	Lernziele
Manufacturing Technology I • Introduction to manufacturing technology • Measuring and testing in manufacturing technology • Principles of machining with geometrically defined cutting edges • Cutting materials, tool and lubricants • Cutting materials and cutting tools • Cutting criteria • Manufacturing processes with geom. defined cutting 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) **Manufacturing Technology II** • Casting • Powder Metallurgy • Bulk Forming I • Bulk Forming II • Sheet Metal Forming I • Sheet Metal Forming II • Process Design I • Fine Blanking • Manufacturing Sequences and Process Design	**Manufacturing Technology I** The student 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 students 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. **Manufacturing Technology II** 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 students 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
	Manufacturing Technology I • eine schriftliche Prüfung oder • eine mündliche Prüfung **Manufacturing Technology II** • eine schriftliche Prüfung oder • eine mündliche Prüfung

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

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

Modul: Machine Tools I & II

MODUL TITEL: Machine Tools I & II						
ALLGEMEINE ANGABEN						
Fachsemester	**Dauer**	**Kreditpunkte**	**SWS**	**Häufigkeit**	**Turnus Start**	**Sprache**
1	2	10	8	Jedes 2. Semester	WS 2011/12	English

INHALTLICHE ANGABEN

Inhalt	**Lernziele**
Machine Tools I • 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: Appilcation 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-friciton 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	**Machine Tools I** 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. **Machine Tools II** The students know the relevant control aspects with regard to production machinery. They are able to understand and perform basic programming tasks. They are also able to solve tasks related to information technology and data processing.

• 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 **Machine Tools II** • L1: Structure of a feed axis, position measuring systems for NC-Machines • E1: Position measuring systems for NC-Machines • L2: Structure of a feed axis, mechanical transfer elements, converter • E2: Layout of the mechanical components of feed drives • L3: Dynamic behaviour of feed drives, path generation, layout of feed drives • E3: Position control of feed drives • L4: Process monitoring, control, diagnosis and maintenance • E4: Process control, machine monitoring and diagnosis • L5: Automatic functions of production, mechanical controllers • E5: Kinematic and dynamic behaviour of feed drives • L6: Fundamentals of information processing • E6: Boolean algebra • L7: Electrical controllers • E7:Programmable logic controller • L8: Structure of numerical controllers • E8: Manual programming of NC-Machines • L9: Operation of numerical controllers • E9: Interpolation • L10: Command variables and interpolation • E10: Kinematics and programming of robots • L11: Robot control (RC) and programming • E11: CIM-components and their linking • L12: Production guidance systems	
Voraussetzungen	**Benotung**
-none-	Oral or written exam

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN			
Titel	**Prüfungs-dauer (Minuten)**	**CP**	**SWS**
Prüfung Machine Tools I [IMPSE-1003.a/11]	90	5	0
Prüfung Machine Tools II [IMPSE-1003.aa/11]	90	5	0
Vorlesung Machine Tools I [IMPSE-1003.b/11]		0	2
Vorlesung Machine Tools II [IMPSE-1003.bb/11]		0	2
Übung Machine Tools I [IMPSE-1003.c/11]		0	2
Übung Machine Tools II [IMPSE-1003.cc/11]		0	2

Modul: Production Management A & B

MODUL TITEL: Production Management A&B						
ALLGEMEINE ANGABEN						
Fachsemester	**Dauer**	**Kreditpunkte**	**SWS**	**Häufigkeit**	**Turnus Start**	**Sprache**
1	2	10	8	2	WS 2011/2012	English

INHALTLICHE ANGABEN

Inhalt	**Lernziele**
Producion Management A • 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 • Business Modelling • Process Modelling • The Industrial History: From Taylorism To Virtual Factory **Producion Management B** • IT in Production Management • Customer Relations Management • Enterprise Ressource Planning I • Enterprise Ressource Planning II • Enterprise Ressource Planning III • Supply Chain Management I • Supply Chain Management II • Product Lifecycle Managment I • Product Lifecycle Managment II • Product Lifecycle Managment III • Digitale Plant Planning and Simulation • Business Engineering - Method of selecting IT-Systems	**Producion Management A** 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 gainded knowledge can be transferred to daily business of a company. For the purposes of manufacturing egineering, 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 **Producion Management B** On the basis of the lecture "Producion Management A" students will gain knowledge concerning particular aspects of the domains design, process planning, production as well as program planning and investment planning. They will understand the usefulness of modern planning methods, with emphasis on the application of computers (CAD, CAP, CAM etc.). Practical examples offer the possibility to understand the boundary conditions in daily business and give the students a comprehensive basis to reflect advantages and disadvantages of the discussed systems.

Voraussetzungen	Benotung
-none-	**Producion Management A** • eine schriftliche Prüfung oder • eine mündliche Prüfung **Producion Management B** • eine schriftliche Prüfung oder • eine mündliche Prüfung

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	Prüfungs-dauer (Minuten)	CP	SWS
Prüfung Production Management A [IMPSE-1004.a/11]	90	5	0
Prüfung Production Management B [IMPSE-1004.aa/11]	90	5	0
Vorlesung Production Management A [IMPSE-1004.b/11]		0	2
Vorlesung Production Management B [IMPSE-1004.bb/11]		0	2
Übung Production Management A [IMPSE-1004.c/11]		0	2
Übung Production Management B [IMPSE-1004.cc/11]		0	2

Modul: Welding and Joining Technologies

MODUL TITEL: Welding and Joining Technologies

ALLGEMEINE ANGABEN

Fachsemester	Dauer	Kreditpunkte	SWS	Häufigkeit	Turnus Start	Sprache
2	1	6	4	2	SS 2012	English

INHALTLICHE ANGABEN

Inhalt	Lernziele
• Introduction • Gas Fusion Welding • Manual Metal Arc Welding • Submerged Arc Welding • TIG Welding • Plasma Welding • MIG Welding • Electro Gas Welding • Electro Slag Welding • Narrow Gap Welding • Pressure Welding, • Resistance Welding • Electron Beam Welding • Laser Beam Welding • Special Processes • Surfacing • Shape Welding • Thermal Cutting • Mechanisation • Automation • Robots • Sensor Technology	Welding is an interdisciplinary technology. All fields of industrial manufacturing require the joining of individual parts to functional groups. Many welding and cutting technologies are applicable for this purpose. After having participated in this course, the student is acquainted with the main welding technologies. The student is capable to select the suitable welding technologies for a welding task and to substantiate the selection by specifying the advantages and the disadvantages of the individual methods.
Voraussetzungen	**Benotung**
-none-	Oral or written exam

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	Prüfungs-dauer (Minuten)	CP	SWS
Examination Welding and Joining Technologies	120	5	0
Lecture Welding and Joining Technologies	0	0	2
Exercise Welding and Joining Technologies	0	0	2

Modul: Quality Management

MODUL TITEL: Quality Management

ALLGEMEINE ANGABEN

Fachsemester	Dauer	Kreditpunkte	SWS	Häufigkeit	Turnus Start	Sprache
3	1	6	4	2	WS 2011/12	English

INHALTLICHE ANGABEN

Inhalt	Lernziele
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 .	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.

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. Practical Computer Training: • Continuous Improvement, Value Added and Waste, Optimizing the Production Process etc.	
Voraussetzungen	**Benotung**
-none-	Oral or written exam

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	**Prüfungs-dauer (Minuten)**	**CP**	**SWS**
Examination Quality Management	120	6	0
Lecture Quality Management	0	0	2
Exercise 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	6	4	1	WS 2011/12	English

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	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.

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 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**
-none-	Oral or written exam

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	**Prüfungs-dauer (Minuten)**	**CP**	**SWS**
Examination Industrial Engineering, Ergonomics and Work Organisation	120	6	0
Lecture Industrial Engineering, Ergonomics and Work Organisation	0	0	2
Exercise Industrial Engineering, Ergonomics and Work Organisation	0	0	2

Wahlfachbereich:

Modul: Gear and Transmission Technology

MODUL TITEL: Gear and Transmission Technology

ALLGEMEINE ANGABEN

Fachsemester	Dauer	Kreditpunkte	SWS	Häufigkeit	Turnus Start	Sprache
1	1	6	4	1	WS 2011/12	English

INHALTLICHE ANGABEN

Inhalt	Lernziele
• Introduction • Gear Geometry - Spur Gears • Damage of gears • Basics of the gear development process I • Basics of the gear development process II • Investigation of gears - Fatigue tests • Investigation of gears - Running behavior • Gear Production • Gear Production – Finishing • Machine Tools for Gear Production • Simulation • Gear Geometry - Bevel Gears • Special Gears, Beveloids	• The students get knowledge about the geometry of gears • They learn about the requirements on modern gears. • The students gain knowledge about the calculation and test methods that are used in the development process of gears. • The students will be taught in the phenomenons that on operating gear sets • The students gain experience in simulation techniques in gear design and corresponding manufacturing processes. • The test rigs for fatigue and gear noise tests will be introduced. • The students get knowledge about the gear production and the machine tools for gear production. The students gain experience in the analysis of gear tests. The taught methods can be also used for tests in other disciplines.
Voraussetzungen	**Benotung**
-none-	Oral or written exam

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	Prüfungs-dauer (Minuten)	CP	SWS
Examination Gear and Transmission Technology	120	6	0
Lecture Gear and Transmission Technology	0	0	2
Exercise Gear and Transmission Technology	0	0	2

Modul: Control Engineering

MODUL TITEL: Control Engineering

ALLGEMEINE ANGABEN

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

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 exam

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	Prüfungsdauer (Minuten)	CP	SWS
Examination Control Engineering	90	3	0
Lecture Control Engineering	0	0	1
Exercise Control Engineering	0	0	1

Modul: Virtual Machine Tool – Modelling and Simulation

MODUL TITEL: Virtual Machine Tool						
ALLGEMEINE ANGABEN						
Fachsemester	**Dauer**	**Kreditpunkte**	**SWS**	**Häufigkeit**	**Turnus Start**	**Sprache**
1	1	5	4	2	WS 2011/12	English

INHALTLICHE ANGABEN

Inhalt	**Lernziele**
L1: Introduction to the Machine Tool Construction E1: WZL Machine Shop Guiding L2: Construction of a Machining Centre E2: Introduction to CAD Modelling L3: Construction and Design of Structural Components E3: Introduction to the FEA-Simulation L4: Structure Optimisation of Stand Components E4: Structure Optimisation of Stand Components L5: Guiding Mechanisms E5: Guiding Mechanisms L6: Bearings, Main Spindle Systems E6: Bearings, Main Spindle Systems L7: Mechanical Drive Components E7: Mechanical Drive Components L8: Gears E8: Gears L9: Feed Drives E9: Feed Drives L10: Multi Body Simulation with Rigid Bodies E10: Multi Body Simulation with Rigid Bodies L11: Multi Body Simulation with Flexible Bodies E11: Multi Body Simulation with Flexible Bodies	The students know the most important parameters which are relevant to model and simulate production machinery. They are aware of common simulation methods, are able to use basic features of simulations tools independently and can interpret the results.
Voraussetzungen	**Benotung**
-none-	Oral or written exam

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	**Prüfungs-dauer (Minuten)**	**CP**	**SWS**
Examination Virtual Machine Tool	120	5	0
Lecture Virtual Machine Tool	0	0	2
Exercise Virtual Machine Tool	0	0	2

Modul: Industrial Logistics

MODUL TITEL: Industrial Logistics

ALLGEMEINE ANGABEN

Fachsemester	Dauer	Kreditpunkte	SWS	Häufigkeit	Turnus Start	Sprache
2	1	5	3	jedes 2. Semester	WS 2012/2013	englisch

INHALTLICHE ANGABEN

Inhalt

- Objectives and tasks of logistics
- Organisational involvement of logistics
- Exercise: Prozess optimisation
- Material flow design
- Recitation by an external
- Information logistics
- Exercise: "Beergame"
- Development and Procurement
- Exercise: Development and Procurement
- Material and finished goods disposition
- Exercise: Workshop on the Enhancement of Disposition Quality
- Distribution logistics
- Exercise: Opening proceedings for tour planning
- Spare part logistics
- Recitation by an external
- Logistics controlling
- Exercise: ABC, XYZ Analysis

Lernziele

Students know objectives and tasks of industrial logistics as well as main aspects of industrial logistics from organisational involvement to logistics controlling. Students understand the meaning and the effects of individual aspects of industrial logistics and can place them in the overall context.They can apply the knowledge acquired to practical problems.

Voraussetzungen

Benotung

- eine schriftliche Prüfung oder
- eine mündliche Prüfung

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	Prüfungsdauer (Minuten)	CP	SWS
Prüfung Industrial Logistics	120	5	0
Vorlesung Industrial Logistics		0	2
Übung Industrial Logistics		0	1

Modul: Multibody Dynamics

MODUL TITEL: Multibody Dynamics

ALLGEMEINE ANGABEN

Fachsemester	Dauer	Kreditpunkte	SWS	Häufigkeit	Turnus Start	Sprache
2	1	5	4	1	SS 2012	English

INHALTLICHE ANGABEN

Inhalt

- Introduction
- Fundamentals
- Fields of application
- Model Building

- Methods of Approach for Equivalent Models
- Multi-body Systems
- Determination of the Model Parameters
- General mathematical description
- Kinematics of Multi Body Systems

- Position and Orientation of Bodies
- Translational Kinematics
- Rotational Kinematics
- Equations of Motion

- Lagrangian Equations of 2nd Kind
- Newton-Euler equations
- Linearisation
- Eigen Value Approach
- Undamped non-gyroscopic systems
- Damped gyroscopic systems
- Eigen Value Stability Criteria

Linear Systems with Harmonic Excitation

- Real Frequency Matrix
- Complex Frequency Matrix
- State Equation
- System Matrix
- Eigen Value Approach
- Fundamental Matrix
- Modal Matrix
- Theorem of Cayley-Hamilton
- Analytical Solution
- Numerical Solution
- Step Excitation
- Harmonic Excitation
- Periodical Excitation

Introduction of Multi Body Simulation Software

- ADAMS
- SIMPACK
- SimMechanics

Lernziele

- The students have a profound knowledge of theory of vibrations.
- The students are capable of comprehending, describing and analyzing vibratory systems.
- The students have the ability of describing mathematically any mechanical system with its inherent physical effects like elasticity, damping and friction.
- The students are familiar with the most important matrix based procedures for the calculation of eigen motions and the behavior of linear systems under forced excitations.
- For the calculation of nonlinear system the students can select suitable program systems and carry out proper simulations.
- The students are able to properly interpret simulation results especially under consideration of simplifications within the model compared to the real system.
- The students are able to derive from their knowledge the necessary methods and proceedings for the analysis and synthesis of the systems in regard. Thus they are capable to solve - accessing their acquired theoretical knowledge - complex problems concerning the choice and design of industrial vibratory systems.

Hands-On-Laboratory for Multi Body Simulation Software • ADAMS • SIMPACK • SimMechanics Example • Modelling • Determination of Parameters • Calculation • Evaluation	
Voraussetzungen	**Benotung**
-none-	Oral or written exam

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	**Prüfungs-dauer (Minuten)**	**CP**	**SWS**
Examination Multibody Dynamics	120	5	0
Lecture Multibody Dynamics	0	0	2
Exercise Multibody Dynamics	0	0	2

Modul: Process Chains for Replication of Complex Optical Component

MODUL TITEL: Process Chains for Replication of Complex Optical Component						
ALLGEMEINE ANGABEN						
Fachsemester	**Dauer**	**Kreditpunkte**	**SWS**	**Häufigkeit**	**Turnus Start**	**Sprache**
2	1	3	2	1		English

INHALTLICHE ANGABEN

Inhalt	**Lernziele**
The lecture covers replication methods for complex optical elements in consumerables and shows production strategies for higher quality, higher output, higher complexity and lower costs. The entire process chain will be considered, from design procedures, to mold making, coatings and replication technologies. For each step, the relevant metrology methods are explained. The replication processes cover injection molding of plastic optics and hot pressing of glass optics. The lecture is an e-learning offer, which consists of 12 lectures that can be downloaded (videos, slides). The exam can be done at RWTH Aachen, Bremen University or Stillwater (USA). Setup: L1: Introduction (Prof. Brinksmeier) L2: Machine Technology for Ultra Precision Optics Manufacturing (Prof. Brecher) L3: Mold machining processes – plastic optics I (Prof. Brinksmeier) L4: Mold machining processes – plastic optics II (Prof. Brinksmeier) L5: Mold machining processes – glass optics I (Prof. Klocke) L6: Mold machining processes – glass optics II (Prof. Klocke) L7:Hard coatings (Prof. Zoch, Dr. Mehner) L8: Modification and characterization of hard coatings (Prof. Lucca) L9: Replication of plastic optics (Prof. Michaeli) L10: Replication of glass optics (Prof. Klocke) L11: Measurement technology (Prof. Goch) L12: Managing process chains (Prof. Schmitt)	Development of a scientific foundation for a deterministic and cost-efficient production of optical elements with complex geometries

Voraussetzungen	Benotung
-none-	Oral or written exam

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	Prüfungs-dauer (Minuten)	CP	SWS
Examination Process Chains for Replication of Complex Optical Component	120	3	0
Lecture Process Chains for Replication of Complex Optical Component	0	0	2

Modul: Production Metrology

MODUL TITEL: Production Metrology						
ALLGEMEINE ANGABEN						
Fachsemester	**Dauer**	**Kreditpunkte**	**SWS**	**Häufigkeit**	**Turnus Start**	**Sprache**
2	1	5	4	2	SS 2012	English

INHALTLICHE ANGABEN

Inhalt	**Lernziele**
Introduction • Relevance of metrology for quality assurance and its integration in production processes. Metrological Basics • Metrological concepts and definitions (Calibration, Uncertainty etc.) Tolerancing • Form and positional tolerances, tolerancing principles and basics Inspection Planning • Tasks and workflow of inspection planning, Procedure for creation of inspection plans Shop floor measuring devices/ Measuring sensors • Commonly used manual inspection devices for the shop floor, Function and application of inductive, capacitive and pneumatical sensors Optoelectronic inspection devices • Optical inspection systems for geometry testing and applications Form and surface inspection devices • Tactile and optical system for the characterisation of forms and surfaces, surfaces parameters Coordinate measurement technology • Principles, types and applications of coordinate measuring machines Gauging inspection • Form and positional gauging, Gauging Procedures Statistical basics • Statistical parameters for the description of production and • measuring processes, tests on normal distribution SPC, Process Capability • Statistical analysis and control of processes, Process capability indices Inspection device management • Tasks and procedures of inspection device management, Calculation of measuring device capability, Calibration chain	First of all, the elements of the application of the means of measurement concerning the production are pointed out. The theoretical fundamentals which have to be taken into consideration while the measuring process is planned, controlled, analysed, are discussed. Thereby, current measuring principles and devices in the field of industrial production will be considered and new measuring techniques and trends will be presented In this context the characteristics of the measured quantities and their fringe conditions are explained. A further subject of the lecture will be the statistical analysis of the measured values. The aim of this lecture is to create the awareness, that “measuring” comprehends a lot more than plain data acquisition and metrology is a vital part of modern production processes.

Voraussetzungen	**Benotung**
-none-	Oral or written exam

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	**Prüfungs-dauer (Minuten)**	**CP**	**SWS**
Examination Production Metrology	120	5	0
Lecture Production Metrology	0	0	2
Exercise Production Metrology	0	0	2

Modul: Factory Planning

MODUL TITLE: Factory Planning
MODUL TITEL: Factory Planning

GENERAL INFORMATION
ALLGEMEINE ANGABEN

Term Fachsemester	Duration Dauer	Credit Points Kreditpunkte	Contact Hour SWS	Frequency Häufigkeit	Start Turnus Start	Language Sprache
2	1	6	4	7	SS	English

CONTENT DETAILS
INHALTLICHE ANGABEN

Content Inhalt	Educational Objectives Lernziele
L1/L2 - Introduction Comprehending the basic glossary, getting to know the content and understanding the challenges and requirements of modern factory planning. **L3/L4 - Dimensions of added value in Production / Evaluation methods for the planing process of value added** Getting to know different categories of value added in factory planning as well as strategical and economical methods for their evaluation. **L5/L6 - Production site planning** This lecture focusses on current trends within the field of production site planning and presents methods for the assessment of production site alternatives and decision-making. **L7/8 – Production Systems I: Process Planning and Resource Planning** Learning about challenges and approaches within the production process planning, understanding the problem of capacity planning in manufacturing and human resources. **L9/10 - Production Systems II: Organization and Lean Production** Introduction to different organizational structures and forms of production, comprehending lean production with its basic elements and understanding the implementation of lean principles into production systems **L11/12 - Logistics planning** Comprehend the basics of logistics planning, getting to know the development of logistic strategies and principles from sourcing to recycling processes. **L13/L14 - Layout and factory structure planning** Introduction to challenges and targets of layout and factory structure planning. Acquiring knowledge of design and assessment of factory layouts.	Dear factory planer, design a factory which can produce watches today and cars tomorrow, that can produce different volumes each day, which is inflatable and transportable (Helmut Schulte). The global competition, wide production programs und frequent discontinuities lead to so far unknown challenges for the planning process of factories. Besides the classical resource, layout and logistic planning, also the definition of the own value adding scope, the choice and allocation of suitable production locations, the conception of production systems and the usage of suitable planning tools, are part of the process. The lecture factory planning shows the state of the art of the particular topics, best-practice methods and approaches are explained and reference solutions presented. The theoretical content is deepened by an accompanying case-study and the presentation of actual industrial factory planning projects. This approach enables future production managers and factory planners to define and develop single production plants as well as production networks of globalized companies.

Requirements Voraussetzungen	**Grading** Benotung
-none-	**Factory Planning** • Written Exam (schriftliche Prüfung)

TEACHING METHODS / COURSES & EXAMINATIONS
LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Title Titel	**Duration of Examination (Minutes)** Prüfungsdauer (Minuten)	**Credit Points** CP	**Contact Hours** SWS
Exam (Prüfung) Factory Planning	90	6	2
Lecture (Vorlesung) Factory Planning	90		2
Exercise (Übung) Factory Planning	90		2

Modul: Modeling, Model Reduction and Simulation in Laser Processing I

MODUL TITEL: Modeling, Model Reduction and Simulation in Laser Processing I

ALLGEMEINE ANGABEN

Fachsemester	Dauer	Kreditpunkte	SWS	Häufigkeit	Turnus Start	Sprache
3	0	5	4	unregelmaes-sig	WS 2012/2013	englisch

INHALTLICHE ANGABEN

Inhalt	Lernziele
• overview of contents, definition of the 10 learning targets • the constribution of the engineer to the interactive cooperation of scientific disciplines • main features of the theory of cognition (Karl Popper) • laser radiation, Helmholtz equation, reduced model: SVE-approximation • Learning target 1:gaussian beam, beam guiding and forming • reflection, transmission and absorption of light • Learning target 2:reduced model of the Fresnel Formulae for the limiting case of small discplacemant current, optical parameters • technical task and examples: cutting with laser radiation • Learning target 3:quality features of the high quality cut • physical task of cutting and identification of quality defined processing domains • Learning target 4:relation of physicl phenomena to built up of quality degradations • technical task and examples: drilling with laser radiation • physical task and 5 dominant phenomena • Learning target 5: quality features of the drilled hole • mathematical modelling Ia: time scales • degrees of freedom in phase space of dependent variables • separation of time scales in simple dynamical systems • Learning target 6a: separation of time scales • mathematical modelling Ib:length scales • thermal boundary layer in heat conduction with moving boundaries • Learning target 6b: separation of length scales • mathematical modelling IIa: Free Boundary Problems (FBP) for the solid phase • reduced model for the FBP: motion of the melting front, integral methods, variational formulation • Learning target 7: heating and melting phase of ablation • mathematical modelling IIb: FBP for the liquid phase • Navier-Stokes equations, material equations and boundary values • mathematical model reduction: melt flow	The students obtain scientific skills for the application of: 1. Free Boundary Problems and integral methods of solution, 2. non-linear stability analysis using spectral methods, 3. analysis of the structural stability of model equations and • know the least 3 types of laser systems, temporal and spatial distribution of laser radiation, Fresnel-number, invariant quantity of light propagation • understand the structure of solution for the Helmholtz-equation, diffraction, 5 parameter pairs of optical material equations, transmission, reflection, absorption, Fresnel Formulae, polarisation of matter and radiation • know and understand the 5 different, dominant phenomena of drilling, welding and cutting with laser radiation • know the physical meaning of the terms contained in the Navier-Stokes equations for mass, momentum and energy balance • know the main properties of the solution in the asymptotic case of thin film flow (boundary layer) and can explain the relation between dynamical properties of the solution and quality features of the product as well as productivity of the process for drilling and cutting • know the effect of dissipation in disctributed dynamical systems (inertial manifold) and know examples for the application of methods for the reduction of the dimension in dissipative systems, understand and perform the separation of length and time scales in simple systems The students get to know non-scientific tasks: • understand the interactive cooperation of scientists from engineering, physics and mathematics for application of model based methods for diagnosis in laser processing • Application of model based methods for solving practical tasks from discussion of project examples

• reduced model for thin film flow • Learning target 8: boundary character, integral and spectral methods • model reduction and solution with controlled error: melt flow at low Reynolds-number • structural stability of the reduced model: lubrication approximation, fingering and droplet formation • Learning target 9: creeping flow and expansion with respect to the Reynolds-number, exact solution of a model problem for arbitrary Reynolds-number • global properties of the solution of balance equations for mass, momentum and thermal energy • Learning target 10: scales for the choice of processing parameters in cutting and drilling • concluding discussion of the learning targets • actual research and development of laser processing	
Voraussetzungen	**Benotung**
	• eine schriftliche Prüfung oder • eine mündliche Prüfung

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	Prüfungs-dauer (Minuten)	CP	SWS
Prüfung Modeling, Model Reduction and Simulation in Laser Processing I	120	5	0
Vorlesung Modeling, Model Reduction and Simulation in Laser Processing I		0	2
Übung Modeling, Model Reduction and Simulation in Laser Processing I		0	2

Modul: Modeling, Model Reduction and Simulation in Laser Processing II

MODUL TITEL: Modeling, Model Reduction and Simulation in Laser Processing II

ALLGEMEINE ANGABEN

Fachsemester	Dauer	Kreditpunkte	SWS	Häufigkeit	Turnus Start	Sprache
3	1	5	4	unregelmaes-sig	WS 2012/2013	englisch

INHALTLICHE ANGABEN

Inhalt	Lernziele
• overview of contents, definition of the learning targets • recapitulation of the 10 learning targets from part I of the course • derivation and consolidation of the application of integral methods for treating heat conduction with Stefan-type boundary conditions • Learning target 1: variational formulation compared with direct integration for one space variable • spectral methods for error control of integral methods: spatial one-dimensional model problem • Eigen-functions of differential operators, spectral decomposition of non-linear problems, discrets and continuous spectral • Learning target 2: separation of variables and relation to spectral methods, applications of spectral methods • asymptotic expansion of partial differential equations and their solution applied to a model problem of heat conduction • Learning target 3: identification of characteristic dynamical variables, degrees of freedom of an inertial manifold • determination of dimensionless groups, Buckingham's Pi-theorem • definition and physical meaning of Peclet-, Reynolds-, Marangoni- and Stefan-number, • Learning target 4: physical interpretation of dimensionless groups of system parameters and the dimension in phase space of processing parameters • optical modes in passive fibers • numerical aperture, total reflection, maximum mode-number, coupling of modes • optical excitation in active fibers and dissipation • Learning target 5: laser light and optical fiber • Slow surfaces in dynamical systems • Application of time scale separation • Learning target 6: thermal effects of large and small Peclet-number • model problems in thin film flow • applications of spectral methods:	The students obtain scientific skills for the application of: 1. Free Boundary Problems and integral methods of solution, 2. non-linear stability analysis using spectral methods, 3. analysis of the structural stability of model equations and • are able to determine the maximum number of dimensionsless groups of Boundary Value Problems • understand the relation of boundary conditions, boundary values and the structure of solution for the Navier-Stokes equations • know and understand the 5 different, dominant phenomena of drilling, welding and cutting with laser radiation • know and can explain the physical meaning of the Navier-Stokes equations • know the main properties of the solution in the asymptotic case of thin film flow (boundary layer) and can explain the relation between dynamical properties of the solution and quality features of the product as well as productivity of the process for drilling and cutting • know the effect of dissipation in disctributed dynamical systems (inertial manifold) and know examples for the application of methods for the reduction of the dimension in dissipative systems, understand and perform the separation of length and time scales in simple systems The students get to know non-scientific tasks: • understand the interactive cooperation of scientists from engineering, physics and mathematics for application of model based methods for diagnosis in laser processing • Application of model based methods for solving practical tasks from discussion of project examples

- formation of pores in welding - closure of the drill hole • Learning target 7: relation of time scales and the onset of • quality features • modelling evaporation and recondensation of metals I • comparison of models from Aden and Aoki & Sone • Learning target 8: liquid-vapor phase transition in drilling and welding • modelling evaporation and recondensation of metals I • Laplace-pressure, evaporation and recondensation as driving forces for momentum of the liquid by pressure gradients • Learning target 9: boundary conditions for momentum at ideal surfaces • technical examples I: drilling with laser radiation • technical examples I: welding with laser radiation • concluding discussion of learning targets • actual research and development of laser processing	
Voraussetzungen	**Benotung**
• Modeling, Model Reduction and Simulation in Laser Processing I	• eine schriftliche Prüfung oder • eine mündliche Prüfung

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	Prüfungs-dauer (Minuten)	CP	SWS
Prüfung Modeling, Model Reduction and Simulation in Laser Processing II [IMPSE-3109.a/11]	120	5	0
Vorlesung Modeling, Model Reduction and Simulation in Laser Processing II [IMPSE-3109.b/11]		0	2
Übung Modeling, Model Reduction and Simulation in Laser Processing II [IMPSE-3109.c/11]		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	2		English

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 Modelling 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**
-none-	Oral or written exam

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	**Prüfungs-dauer (Minuten)**	**CP**	**SWS**
Examination Advanced Software Engineering	120	5	0
Lecture Advanced Software Engineering	0	0	2
Exercise Advanced Software Engineering	0	0	2

Modul: Tribology

MODUL TITEL: Tribology

ALLGEMEINE ANGABEN

Fachsemester	Dauer	Kreditpunkte	SWS	Häufigkeit	Turnus Start	Sprache
3	1	5	4	jedes 2. Semester	WS 2012/2013	engisch

INHALTLICHE ANGABEN

Inhalt	Lernziele
• 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) • Basics of hydrodynamics and elastohydrodynamics: • Fundamentals and principles of flow mechanisms, derivation of Navier-Stokes and Reynolds equations and continuity equation • Basics of hydrodynamics and elastohydrodynamics: • Application of the hydrodynamic equations regarding the calculation of bearings, Basics of the elastohydrodynamics	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.

• Triboystem Journal Bearings: • Functionality and calculation of *hydrodynamic* axial and radial journal bearings, different occurring damages and failures and the choice of suitable lubricants • Triboystem Journal Bearings: • Functionality and calculation of *hydrostatical* 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 roler 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	
Voraussetzungen	**Benotung**
	• eine schriftliche Prüfung oder • eine mündliche Prüfung

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

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

Modul: Machine Design Process

MODUL TITEL: Machine Design Process						
ALLGEMEINE ANGABEN						
Fachsemester	**Dauer**	**Kreditpunkte**	**SWS**	**Häufigkeit**	**Turnus Start**	**Sprache**
3	1	5	4	jedes 2. Semester	WS 2012/2013	englisch

INHALTLICHE ANGABEN

Inhalt	**Lernziele**
Topic: Introduction Topic: Drawing Standards I • Projection drawing and axonometric views • Elements of technical drawings • Dimensioning Topic: Drawing Standards II • Section views • Broken views Topic: Joins and Connections • Connection types • Bolted connections • Shaft and hub connections Topic: Geometrical Irregularities and Tolerances • Dimension tolerances • Form and position tolerances • Technical surfaces Topic: Bearing of Shafts • Bearing principles • Bearing arrangements • Seals Topic: Power Transmission • Definitions and principles • Technical representation • Examples Topic: Engineering Design Process, Requirements List • Introduction to design methodology • General process of engineering design • Requirements list	The students • know the most common machine elements and applicable design rules. They are able to draft such solutions according to ISO drawing standards and understand production drawing including dimensions and tolerances. • know structured problem solving strategies, esp. the engineering design process acc. to VDI 2221. They are able to identify possible restrictions on a design task and to develop and select applicable concept solutions with a systematic approach. • know the body of design rules and are able to determine applicability depending on effective design restrictions. Basic rules of embodiment design, design principles and guidelines can be applied to draw up technical drafts.

Topic: Conceptual Design I • Function structures and principle solutions • Design catalogues • Heuristic and analogy methods Topic: Conceptual Design II • Systematic variation, classification schemes • Overall solutions: morphological matrix Topic: Design Rules I - Basic Rules • Introduction to design rules • Basic rules 'simple' and 'clear' • Basic rule 'safe' Topic: Design Rules II - Principles • Principles of fault-free design, force transmission, stability and bi-stability, self-help, division of tasks Topic: Design Rules III - Guidelines / DFX • Selected examples: design for assembly and production...	
Voraussetzungen	**Benotung**
Qualification for • Systematic Engineering Design II	• eine schriftliche Prüfung oder • eine mündliche Prüfung

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

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

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 2011/12	German

INHALTLICHE ANGABEN

Inhalt

- Getting to know someone
- Introducing oneself
- City explorations
- Orientation in the city
- Techniques: learning and remembering words
- Buying groceries
- Communication on the phone
- Techniques: learning grammar systematically
- Calendar, festivities
- Holidays
- Learning and forgetting
- Learning psychology
- German newspapers
- Reading habits
- When in Rome, do as the Romans do
- Intercultural experience
- Media
- Geographic German studies
- Inventions and progress
- Between cultures
- Environmental protection/problems
- Project Europe
- Job market Germany
- Applications
- CVs

Lernziele

- German classes communicate basic knowledge on German Culture and Cultural Studies;
- German classes enable one to accomplish every-day communication within university surroundings (dormitory, cafeteria etc.);
- German classes offer prerequisites for culturally adequate application documents for internships
- (CV, letter of motivation);
- German classes communicate insight into cultural situations at German universities

Voraussetzungen	Benotung
-none-	Oral or written exam

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN

Titel	Prüfungs-dauer (Minuten)	CP	SWS
Examination	200	6	0
Lecture and Exercise	0	0	4

Modul: Industrial Internship

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

INHALTLICHE ANGABEN	
Inhalt	**Lernziele**
See Guidelines for Practical Work Experience	See Guidelines for Practical Work Experience
Voraussetzungen	**Benotung**
-none-	-none-

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

Modul: Mini Thesis

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

INHALTLICHE ANGABEN	
Inhalt	**Lernziele**
Completed academic paper, which is written under supervision. The students work out an outline with their tutors, determine partial tasks and aids and the required amount of time necessary for fulfilling the task.	The students learn the approach and processing of academic themes, their documentation and written interpretation under intensive supervision. They acquire the methodology of systematic academic research.
Voraussetzungen	**Benotung**
	Mini-Thesis (written paper, 40-70 pages)

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

Modul: Master Thesis

MODUL TITEL: Master Thesis						
ALLGEMEINE ANGABEN						
Fachsemester	**Dauer**	**Kreditpunkte**	**SWS**	**Häufigkeit**	**Turnus Start**	**Sprache**
4	20 weeks	20				English

INHALTLICHE ANGABEN	
Inhalt	**Lernziele**
Completed academic paper which shall show that the students are capable of independently processing a problem related to their subject according to academic methods within a set deadline.	The students learn the independent approach and processing of academic themes, their documentation and written interpretation within a set deadline. They acquire systematic academic research.
Voraussetzungen	**Benotung**
- Industrial internship - Mini Thesis - 92 ECTS	

LEHRFORMEN / VERANSTALTUNGEN & ZUGEHÖRIGE PRÜFUNGEN			
Titel	**Prüfungs-dauer (Minuten)**	**CP**	**SWS**
Master Thesis		15	0
Master Thesis Kolloquium	30	5	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														
Manufacturing Technology I & II	10	2	2		2	2								8
Machine Tools I & II	10	2	2		2	2								8
Production Management A & B	10	2	2		2	2								8
Welding and Joining Technologies	6				2	2								4
Quality Management	6							2	2					4
Industrial Engineering, Ergonomics and Work Organisation	6							2	2					4
Total Compulsory Courses	**48**													
Elective Courses	**23 CP are to be taken**													
Gear and Transmission Technology	6	2	2											4
Control Engineering	4	2	1											3
Virtual Machine Tool [1)]	5	2	2											4
Industrial Logistics	5				2	1								3
Multi Body Dynamics	5				2	2								4
Process Chains for Replication of Complex Optical Components	3				2									2
Production Metrology	5				2	2								4
Factory Planning	6				2	2								4
Modelling, Model Reduction and Simulation in Lasers Processsing I [2)]	5				2	2								4
Modelling, Model Reduction and Simulation in Lasers Processsing II [3)]	5							2	2					4
Advanced Software Engineering	5							2	2					4
Tribology	5							2	2					4
Machine Design Process	5							2	2					4
Total Elective Courses	**23**													
General Technical Elective [4)]	5				2	2								4
German Language Course	6	2	2											4
Industrial Internship	9								9 weeks					
Mini Thesis	9								260 h					
Master Thesis	20								4 months					
Total	**120**													

HERAUSGEGEBEN IM AUFTRAGE DES REKTORS VON DER ABTEILUNG 1.1 DES DEZERNATES 1.0 DER RWTH AACHEN
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Anlage 3: Legende zum Studienverlaufsplan

CP = Credit Points
SS = Summer Semester
WS = Winter Semester
L = Lecture
E = Excersise
P = Practical Session
SWS = Weekly Semester Hours (Semesterwochenstunden)

HERAUSGEGEBEN IM AUFTRAGE DES REKTORS VON DER ABTEILUNG 1.1 DES DEZERNATES 1.0 DER RWTH AACHEN
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