Karlsruher Institut für Technologie

Module Handbook

Modules of Mechanical Engineering for Exchange Students

Valid from Summer Term 2020

Date: 01/04/2020

KIT DEPARTMENT OF MECHANICAL ENGINEERING

Table Of Contents

1 Field of study structure

Mandatory	
KIT-Department of Mechanical Engineering Courses	90 CR
Courses of Other Faculties and Soft Skills	90 CR

1.1 KIT-Department of Mechanical Engineering Courses

Credits
90

Election block: KIT-Department of Mechanical Engineering Courses ()		
M-MACH-104847	Major Field Fundamentals of Engineering	60 CR
M-MACH-104848	Major Field Energy and Environmental Engineering	90 CR
M-MACH-104849	Major Field Automotive Engineering	90 CR
M-MACH-104850	Major Field Mechatronics and Microsystem Technology	90 CR
M-MACH-104851	Major Field Product Development and Construction	90 CR
M-MACH-104852	Major Field Production Technology	90 CR
M-MACH-104853	Major Field Theoretical Foundations of Mechanical Engineering	90 CR
M-MACH-104854	Major Field Materials and Structures for High Performance Systems	90 CR
M-MACH-104878	Specification in Mechanical Engineering	60 CR
M-MACH-105134	Elective Module Mechanical Engineering	60 CR

1.2 Courses of Other Faculties and Soft Skills

Credits
90

Election block: Courses of Other Faculties and Soft Skills ()		
M-MACH-104882	Courses of the Department of Electrical Engineering and Information Technology	90 CR
M-MACH-104883	Courses of the Department of Informatics	30 CR
M-MACH-104884	Courses of the Department of Economics and Management	20 CR
M-MACH-104885	Courses of the Department of Mathematics	10 CR
M-MACH-105100	Courses of the Department of Chemical and Process Engineering	4 CR
M-MACH-105405	Courses of the Department of Civil Engineering, Geo and Environmental Sciences	10 CR

2 Modules

M 2.1 Module: Courses of the Department of Chemical and Process Engineering [M-MACH-105100]

Organisation: KIT Department of Mechanical Engineering
Part of: Courses of Other Faculties and Soft Skills

Credits	Recurrence	Language	Level	Version
4	Each term	English	4	1

Election notes
Exchange students are allowed to choose bricks from this module. There may be prerequisites or restrictions, for instance regarding the number of places for individual courses. Exchange students do not need to choose the whole module, but can select individual bricks.

Election block: Exchange Students_CIW (between 0 and 90 credits)			
T-CIWVT-110307	Chemical Fuels	6 CR	Rauch

Competence Certificate
Oral exams: duration approx. 5 min per credit point

Written exams: duration approx. 20 - 25 min per credit point

Amount, type and scope of the success control can vary according to the individually choice.

Competence Goal
The students are able to reconstruct selected topics of Mathematics.

Prerequisites
Exchange students are allowed to choose bricks from this module. There may be prerequisites or restrictions, for instance regarding the number of places for individual courses. Exchange students do not need to choose the whole module, but can select individual bricks.

Content
See individual bricks

M 2.2 Module: Courses of the Department of Civil Engineering, Geo and Environmental Sciences [M-MACH-105405]

Organisation: KIT Department of Mechanical Engineering

Part of: Courses of Other Faculties and Soft Skills

Credits	Recurrence	Language	Level	Version
10	Each term	German/English	4	1

Election notes

Exchange students are allowed to choose bricks from this module. There may be prerequisites or restrictions, for instance regarding the number of places for individual courses. Exchange students do not need to choose the whole module, but can select individual bricks.

Election block: Exchange Students_BGU ()			
T-BGU-109581	Fluid Mechanics of Turbulent Flows	4 CR	Uhlmann
T-BGU-110842	Modeling of Turbulent Flows - RANS and LES	6 CR	Uhlmann

Competence Certificate

Oral exams: duration approx. 5 min per credit point

Written exams: duration approx. 20 - 25 min per credit point

Amount, type and scope of the success control can vary according to the individually choice.

Competence Goal

The students are able to reconstruct selected topics of Mathematics.

Prerequisites

Exchange students are allowed to choose bricks from this module. There may be prerequisites or restrictions, for instance regarding the number of places for individual courses. Exchange students do not need to choose the whole module, but can select individual bricks.

Content

See individual bricks

M 2.3 Module: Courses of the Department of Economics and Management [M-MACH-104884]

Responsible: Prof. Dr.-Ing. Martin Heilmaier
Prof. Dr.-Ing. Carsten Proppe

Organisation: KIT Department of Mechanical Engineering

Part of: Courses of Other Faculties and Soft Skills

Credits	Recurrence	Language	Level	Version
20	Each term	German/English	4	1

Election notes
Exchange students are allowed to choose bricks from this module. There may be prerequisites or restrictions, for instance regarding the number of places for individual courses. Exchange students do not need to choose the whole module, but can select individual bricks.

Election block: Exchange Students_WIWI (between 0 and 90 credits)			
T-WIWI-102758	Introduction to Operations Research I and II	9 CR	Nickel, Rebennack, Stein
T-WIWI-107501	Energy Market Engineering	4,5 CR	Weinhardt
T-WIWI-102864	Entrepreneurship	3 CR	Terzidis
T-WIWI-102900	Financial Analysis	4,5 CR	Luedecke
T-WIWI-102870	Logistics and Supply Chain Management	3,5 CR	Schultmann, Wiens
T-WIWI-102800	Management Accounting 1	4,5 CR	Wouters
T-WIWI-109864	Product and Innovation Management	3 CR	Klarmann
T-WIWI-103091	Production and Logistics Controlling	3 CR	Rausch
T-WIWI-100806	Renewable Energy-Resources, Technologies and Economics	4 CR	Jochem, McKenna
T-WIWI-102629	Management and Strategy	3,5 CR	Lindstädt

Competence Certificate
Oral exams: duration approx. 5 min per credit point

Written exams: duration approx. 20 - 25 min per credit point

Amount, type and scope of the success control can vary according to the individually choice.

Competence Goal
The students are able to reconstruct selected topics of Economics and Management.

Prerequisites
Exchange students are allowed to choose bricks from this module. There may be prerequisites or restrictions, for instance regarding the number of places for individual courses. Exchange students do not need to choose the whole module, but can select individual bricks.

Content
See individual bricks

M 2.4 Module: Courses of the Department of Electrical Engineering and Information Technology [M-MACH-104882]

Responsible: Prof. Dr.-Ing. Martin Heilmaier
Prof. Dr.-Ing. Carsten Proppe

Organisation: KIT Department of Mechanical Engineering

Part of: Courses of Other Faculties and Soft Skills

Credits	Recurrence	Language	Level	Version
90	Each term	German/English	4	2

Election notes
Exchange students are allowed to choose bricks from this module. There may be prerequisites or restrictions, for instance regarding the number of places for individual courses. Exchange students do not need to choose the whole module, but can select individual bricks.

Election block: Exchange Students_ETIT (between 0 and 90 credits)			
T-ETIT-101930	Medical Imaging Techniques I	3 CR	Dössel
T-ETIT-101931	Medical Imaging Techniques II	3 CR	Dössel
T-ETIT-101956	Bioelectric Signals	3 CR	Loewe
T-ETIT-106492	Biomedical Measurement Techniques I	3 CR	Nahm
T-ETIT-101918	Digital Technology	6 CR	Becker
T-ETIT-100807	Electrical Machines	4 CR	Becker
T-ETIT-101954	Electrical Machines and Power Electronics	6 CR	Becker
T-ETIT-101923	Electric Energy Systems	5 CR	Leibfried
T-ETIT-109318	Electronic Devices and Circuits	6 CR	Siegel
T-ETIT-108386	Electrical Engineering and Electronics	8 CR	Becker
T-ETIT-109820	Electrical Engineering and Electronics	8 CR	Becker
T-ETIT-100784	Hybrid and Electric Vehicles	4 CR	Becker
T-ETIT-100694	Methods of Signal Processing	6 CR	Puente Leon
T-ETIT-101939	Photovoltaics	6 CR	Powalla
T-ETIT-108344	Seminar Novel Concepts for Solar Energy Harvesting	3 CR	Richards
T-ETIT-101911	Sensors	3 CR	Menesklou
T-ETIT-109313	Signals and Systems	6 CR	Puente Leon
T-ETIT-100774	Solar Energy	6 CR	Richards
T-ETIT-106970	Superconducting Materials for Energy Applications	4 CR	Grilli
T-ETIT-101921	System Dynamics and Control Engineering	6 CR	Hohmann
T-ETIT-100677	Systems Engineering for Automotive Electronics	4 CR	Bortolazzi
T-ETIT-101952	Theory of Probability	5 CR	Jäkel

Competence Certificate
Oral exams: duration approx. 5 min per credit point

Written exams: duration approx. 20 - 25 min per credit point

Amount, type and scope of the success control can vary according to the individually choice.

Competence Goal
The students are able to reconstruct selected topics of Electrical Engineering and Information Technology.

Prerequisites
Exchange students are allowed to choose bricks from this module. There may be prerequisites or restrictions, for instance regarding the number of places for individual courses. Exchange students do not need to choose the whole module, but can select individual bricks.

Content
See individual bricks

M 2.5 Module: Courses of the Department of Informatics [M-MACH-104883]

Responsible: Prof. Dr.-Ing. Martin Heilmaier
Prof. Dr.-Ing. Carsten Proppe

Organisation: KIT Department of Mechanical Engineering

Part of: Courses of Other Faculties and Soft Skills

Credits	Recurrence	Language	Level	Version
30	Each term	German/English	4	1

Election notes
Exchange students are allowed to choose bricks from this module. There may be prerequisites or restrictions, for instance regarding the number of places for individual courses. Exchange students do not need to choose the whole module, but can select individual bricks.

Election block: Exchange Students_INFO (between 0 and 90 credits)			
T-INFO-101466	Information Processing in Sensor Networks	6 CR	Hanebeck
T-INFO-101356	Cognitive Systems	6 CR	Neumann, Waibel
T-INFO-101377	Localization of Mobile Agents	6 CR	Hanebeck
T-INFO-101266	Human-Machine-Interaction	6 CR	Beigl
T-INFO-101310	Patent Law	3 CR	Dreier
T-INFO-108014	Robotics I - Introduction to Robotics	6 CR	Asfour
T-INFO-105723	Robotics II: Humanoid Robotics	3 CR	Asfour
T-INFO-109931	Robotics III - Sensors and Perception in Robotics	3 CR	Asfour
T-INFO-101357	Medical Robotics	3 CR	Kröger, Mathis-Ullrich

Competence Certificate
Oral exams: duration approx. 5 min per credit point

Written exams: duration approx. 20 - 25 min per credit point

Amount, type and scope of the success control can vary according to the individually choice.

Competence Goal
The students are able to reconstruct selected topics of Informatics.

Prerequisites
Exchange students are allowed to choose bricks from this module. There may be prerequisites or restrictions, for instance regarding the number of places for individual courses. Exchange students do not need to choose the whole module, but can select individual bricks.

Content
See individual bricks

M 2.6 Module: Courses of the Department of Mathematics [M-MACH-104885]

Responsible: Prof. Dr.-Ing. Martin Heilmaier
Prof. Dr.-Ing. Carsten Proppe

Organisation: KIT Department of Mechanical Engineering

Part of: Courses of Other Faculties and Soft Skills

Credits	Recurrence	Language	Level	Version
10	Each term	German/English	4	1

Election notes
Exchange students are allowed to choose bricks from this module. There may be prerequisites or restrictions, for instance regarding the number of places for individual courses. Exchange students do not need to choose the whole module, but can select individual bricks.

Election block: Exchange Students_MATH (between 0 and 90 credits)			
T-MATH-102242	Numerical Mathematics for Students of Computer Science	6 CR	Rieder, Weiß, Wieners
T-MATH-109620	Probability Theory and Statistics	5 CR	Hug

Competence Certificate
Oral exams: duration approx. 5 min per credit point

Written exams: duration approx. 20 - 25 min per credit point

Amount, type and scope of the success control can vary according to the individually choice.

Competence Goal
The students are able to reconstruct selected topics of Mathematics.

Prerequisites
Exchange students are allowed to choose bricks from this module. There may be prerequisites or restrictions, for instance regarding the number of places for individual courses. Exchange students do not need to choose the whole module, but can select individual bricks.

Content
See individual bricks

2.7 Module: Elective Module Mechanical Engineering [M-MACH-105134]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Prof. Dr.-Ing. Martin Heilmaier
Organisation: KIT Department of Mechanical Engineering
Part of: KIT-Department of Mechanical Engineering Courses

Credits	Recurrence	Language	Level	Version
60	Each term	German/English	4	1

Election notes
Exchange students are allowed to choose bricks from this module. There may be prerequisites or restrictions, for instance regarding the number of places for individual courses. Exchange students do not need to choose the whole module, but can select individual bricks.

Election block: Elective Area A ()			
T-MACH-105308	Atomistic Simulations and Molecular Dynamics	4 CR	Brandl, Gumbsch, Schneider
T-MACH-105407	CFD in Power Engineering	4 CR	Otic
T-MACH-109302	Computational Homogenization on Digital Image Data	6 CR	Schneider
T-MACH-106698	A holistic approach to power plant management	4 CR	Seidl, Stieglitz
T-MACH-108407	NMR micro probe hardware conception and construction	4 CR	Korvink
T-MACH-110431	Digital microstructure characterization and modeling	6 CR	Schneider
T-MACH-105444	Combined Cycle Power Plants	4 CR	Schulenberg
T-MACH-105182	Introduction to Microsystem Technology I	4 CR	Badilita, Jouda, Korvink
T-MACH-105183	Introduction to Microsystem Technology II	4 CR	Jouda, Korvink
T-MACH-105530	Fundamentals of reactor safety for the operation and dismantling of nuclear power plants	4 CR	Sanchez-Espinoza
T-MACH-105162	Fundamentals of Automobile Development I	2 CR	Frech
T-MACH-105163	Fundamentals of Automobile Development II	2 CR	Frech
T-MACH-105459	High Temperature Materials	4 CR	Heilmaier
T-MACH-109185	Innvative Project	6 CR	Class, Terzidis
T-MACH-105466	Introduction to Neutron Cross Section Theory and Nuclear Data Generation	4 CR	Dagan
T-MACH-105402	Nuclear Power Plant Technology	4 CR	Badea, Cheng, Schulenberg
T-MACH-105410	Coal Fired Power Plants	4 CR	Schulenberg
T-MACH-105224	Machine Dynamics II	4 CR	Proppe
T-MACH-105223	Machine Vision	8 CR	Lauer, Stiller
T-MACH-105189	Mathematical Models and Methods for Production Systems	6 CR	Baumann, Furmans
T-MACH-105782	Micro Magnetic Resonannce	4 CR	Korvink, MacKinnon
T-MACH-105557	Microenergy Technologies	4 CR	Kohl
T-MACH-108383	Microsystem Simulation	4 CR	Korvink
T-MACH-105532	Nonlinear Continuum Mechanics	5 CR	Böhlke
T-MACH-102191	Polymers in MEMS B: Physics, Microstructuring and Applications	4 CR	Worgull
T-MACH-102192	Polymers in MEMS A: Chemistry, Synthesis and Applications	4 CR	Rapp
T-MACH-102200	Polymers in MEMS C: Biopolymers and Bioplastics	4 CR	Rapp, Worgull
T-MACH-107447	Reliability Engineering 1	3 CR	Konnov
T-MACH-105445	Simulator Exercises Combined Cycle Power Plants	2 CR	Schulenberg
T-MACH-105456	Ten Lectures on Turbulence	4 CR	Otic
T-MACH-105363	Thermal Turbomachines I	6 CR	Bauer
T-MACH-105364	Thermal Turbomachines II	6 CR	Bauer

T-MACH-105554	Thin Film and Small-scale Mechanical Behavior	4 CR	Gruber, Schwaiger, Weygand
T-MACH-102206	Vehicle Ride Comfort & Acoustics I	3 CR	Gauterin
T-MACH-102205	Vehicle Ride Comfort & Acoustics II	3 CR	Gauterin
T-MACH-102123	Virtual Engineering I	4 CR	Ovtcharova
T-MACH-102124	Virtual Engineering II	4 CR	Ovtcharova
T-MACH-105529	Heat Transfer in Nuclear Reactors	4 CR	Cheng
Election block: Elective Area B ()			
T-MACH-102141	Constitution and Properties of Wearresistant Materials	4 CR	Ulrich
T-MACH-105528	Aerodynamics	4 CR	Frohnapfel, Ohle
T-MACH-105451	Drive Systems and Possibilities to Increase Efficiency	2 CR	Kollmeier
T-MACH-105530	Fundamentals of reactor safety for the operation and dismantling of nuclear power plants	4 CR	Sanchez-Espinoza
T-MACH-105786	Contact Mechanics	4 CR	Greiner
T-MACH-106700	Do it! – Service-Learning for prospective mechanical engineers	2 CR	Deml
T-MACH-108374	Vehicle Ergonomics	4 CR	Kunkel
T-INFO-101262	Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy	3 CR	Dillmann, Spetzger
T-MACH-106746	Hands-on BioMEMS	4 CR	Guber
T-MACH-105537	Physical and Chemical Principles of Nuclear Energy in View of Reactor Accidents and Back-End of Nuclear Fuel Cycle	4 CR	Dagan
T-MACH-105235	Principles of Medicine for Engineers	4 CR	Pylatiuk
T-MACH-106493	Solar Thermal Energy Systems	4 CR	Dagan
T-MACH-105574	Mechatronical Systems and Products	3 CR	Hohmann, Matthiesen
T-MACH-106707	Workshop on Computer-based Flow Measurement Techniques	4 CR	Bauer
T-MACH-106747	Neurovascular Interventions (BioMEMS V)	4 CR	Cattaneo, Guber
T-MACH-108809	Micro- and Nanosystem Integration for Medical, Fluidic and Optical Applications	4 CR	Gengenbach, Koker, Sieber
T-MACH-105652	Fundamentals of Combustion Engine Technology	5 CR	Bernhardt, Kubach, Pfeil, Toedter, Wagner

Competence Certificate
Oral exams: duration approx. 5 min per credit point

Written exams: duration approx. 20 - 25 min per credit point

Amount, type and scope of the success control can vary according to the individually choice.

Competence Goal
In the Elective Module Mechanical Engineering, students acquire sound knowledge in engineering. With this in-depth knowledge of scientific theories, principles and methods, students can successfully deal with clearly specified problems that have a unique solution approach in mechanical engineering.

Prerequisites
none

Learning type
Lectures, tutorials

M 2.8 Module: Major Field Automotive Engineering [M-MACH-104849]

Responsible: Prof. Dr. Frank Gauterin
Organisation: KIT Department of Mechanical Engineering

Part of: KIT-Department of Mechanical Engineering Courses

Credits	Recurrence	Language	Level	Version
90	Each term	German/English	4	2

Election notes
Exchange students are allowed to choose bricks from this module. There may be prerequisites or restrictions, for instance regarding the number of places for individual courses. Exchange students do not need to choose the whole module, but can select individual bricks.

Election block: Exchange Students_Automotive Engineering ()			
T-MACH-105173	Analysis of Exhaust Gas and Lubricating Oil in Combustion Engines	4 CR	Gohl
T-MACH-105655	Alternative Powertrain for Automobiles	4 CR	Noreikat
T-MACH-105307	Drive Train of Mobile Machines	4 CR	Geimer, Wydra
T-MACH-105311	Design and Development of Mobile Machines	4 CR	Geimer, Siebert
T-MACH-108887	Design and Development of Mobile Machines - Advance	0 CR	Geimer, Siebert
T-MACH-105536	Dimensioning and Optimization of Power Train System	4 CR	Albers, Faust, Kirchner, Matthiesen
T-MACH-106424	Rail System Technology	4 CR	Gratzfeld
T-MACH-105184	Fuels and Lubricants for Combustion Engines	4 CR	Kehrwald, Kubach
T-MACH-102150	BUS-Controls	4 CR	Becker, Geimer
T-MACH-108889	BUS-Controls - Advance	0 CR	Daiß, Geimer
T-MACH-105540	Railways in the Transportation Market	4 CR	Gratzfeld
T-MACH-105226	Dynamics of the Automotive Drive Train	5 CR	Fidlin
T-MACH-102121	Electric Rail Vehicles	4 CR	Gratzfeld
T-MACH-105152	Handling Characteristics of Motor Vehicles I	4 CR	Unrau
T-MACH-105153	Handling Characteristics of Motor Vehicles II	4 CR	Unrau
T-MACH-105154	Vehicle Comfort and Acoustics I	4 CR	Gauterin
T-MACH-105155	Vehicle Comfort and Acoustics II	4 CR	Gauterin
T-MACH-105237	Vehicle Lightweight Design - Strategies, Concepts, Materials	4 CR	Henning
T-MACH-105156	Vehicle Mechatronics I	4 CR	Ammon
T-MACH-102207	Tires and Wheel Development for Passenger Cars	4 CR	Leister
T-MACH-105218	Automotive Vision	6 CR	Lauer, Stiller
T-MACH-102093	Fluid Power Systems	4 CR	Geimer, Pult
T-MACH-100092	Automotive Engineering I	8 CR	Gauterin, Unrau
T-MACH-102117	Automotive Engineering II	4 CR	Gauterin, Unrau
T-MACH-105044	Fundamentals of Catalytic Exhaust Gas Aftertreatment	4 CR	Deutschmann, Grunwaldt, Kubach, Lox
T-MACH-102116	Fundamentals for Design of Motor-Vehicle Bodies I	2 CR	Bardehle
T-MACH-102119	Fundamentals for Design of Motor-Vehicle Bodies II	2 CR	Bardehle
T-MACH-105160	Fundamentals in the Development of Commercial Vehicles I	2 CR	Zürn
T-MACH-105161	Fundamentals in the Development of Commercial Vehicles II	2 CR	Zürn
T-MACH-105162	Fundamentals of Automobile Development I	2 CR	Frech
T-MACH-105163	Fundamentals of Automobile Development II	2 CR	Frech
T-MACH-105375	Industrial Aerodynamics	4 CR	Breitling, Frohnapfel
T-MACH-105188	Integrative Strategies in Production and Development of High Performance Cars	4 CR	Schlichtenmayer

T-MACH-105222	Motor Vehicle Labor	4 CR	Frey
T-MACH-105168	Mobile Machines	8 CR	Geimer
T-MACH-105337	Engine Laboratory	4 CR	Wagner
T-MACH-105169	Engine Measurement Techniques	4 CR	Bernhardt
T-MACH-102155	Product, Process and Resource Integration in the Automotive Industry	4 CR	Mbang
T-MACH-102156	Project Workshop: Automotive Engineering	6 CR	Frey, Gauterin, Gießler
T-MACH-105441	Development of Oil-Hydraulic Powertrain Systems	4 CR	Ays, Geerling
T-MACH-104599	Project Management in Rail Industry	4 CR	Gratzfeld
T-MACH-105350	Computational Vehicle Dynamics	4 CR	Proppe
T-MACH-105353	Rail Vehicle Technology	4 CR	Gratzfeld
T-MACH-105172	Simulation of Coupled Systems	4 CR	Geimer, Xiang
T-MACH-108888	Simulation of Coupled Systems - Advance	0 CR	Geimer, Xiang
T-MACH-105970	Structural Analysis of Composite Laminates	4 CR	Kärger
T-MACH-105423	Tractors	4 CR	Becker, Geimer, Kremmer
T-MACH-102194	Combustion Engines I	4 CR	Koch, Kubach
T-MACH-104609	Combustion Engines II	5 CR	Koch, Kubach
T-MACH-105367	Behaviour Generation for Vehicles	4 CR	Stiller, Werling
T-MACH-110318	Product- and Production-Concepts for modern Automobiles	4 CR	Kienzle, Steegmüller

Competence Certificate
Oral exams: duration approx. 5 min per credit point

Written exams: duration approx. 20 - 25 min per credit point

Amount, type and scope of the success control can vary according to the individually choice.

Competence Goal
Major Field Automotive Engineering serves as a comprehensive, in-depth analysis in selected areas of mechanical engineering.

Prerequisites
Exchange students are allowed to choose bricks from this module. There may be prerequisites or restrictions, for instance regarding the number of places for individual courses. Exchange students do not need to choose the whole module, but can select individual bricks.

Content
See individual bricks

M 2.9 Module: Major Field Energy and Environmental Engineering [M-MACH-104848]

Responsible: Prof. Dr. Ulrich Maas
Organisation: KIT Department of Mechanical Engineering

Part of: KIT-Department of Mechanical Engineering Courses

Credits	Recurrence	Language	Level	Version
90	Each term	German/English	4	2

Election notes
Exchange students are allowed to choose bricks from this module. There may be prerequisites or restrictions, for instance regarding the number of places for individual courses. Exchange students do not need to choose the whole module, but can select individual bricks.

Election block: Exchange Students_Energy and Environmental Engineering ()			
T-MACH-105428	Selected Chapters of the Combustion Fundamentals	4 CR	Maas
T-MACH-105462	Selected Problems of Applied Reactor Physics and Exercises	4 CR	Dagan
T-MACH-105313	CFD-Lab Using OpenFOAM	4 CR	Koch
T-MACH-105391	Finite Difference Methods for Numerial Solution of Thermal and Fluid Dynamical Problems	4 CR	Günther
T-MACH-105525	Introduction to Nuclear Energy	4 CR	Cheng
T-MACH-102211	Energy and Process Technology I	9 CR	Bauer, Schwitzke, Velji, Wirbser
T-MACH-102212	Energy and Process Technology II	9 CR	Schwitzke, Wirbser
T-MACH-105715	Energy demand of buildings – fundamentals and applications, with building simulation exercises	6 CR	Schmidt
T-MACH-105952	Energy Storage and Network Integration	4 CR	Jäger, Stieglitz
T-MACH-105408	Energy Systems I: Renewable Energy	4 CR	Dagan
T-MACH-105550	Energy systems II: Reactor Physics	4 CR	Badea
T-MACH-105564	Energy Conversion and Increased Efficiency in Internal Combustion Engines	4 CR	Koch, Kubach
T-MACH-105512	Experimental Fluid Mechanics	4 CR	Kriegseis
T-MACH-110331	Nuclear Fusion Technology	4 CR	Badea
T-MACH-105411	Fusion Technology A	4 CR	Stieglitz
T-MACH-105433	Fusion Technology B	4 CR	Stieglitz
T-MACH-105533	Gasdynamics	4 CR	Magagnato
T-MACH-105220	Fundamentals of Energy Technology	8 CR	Badea, Cheng
T-MACH-105326	Hydraulic Fluid Machinery	8 CR	Pritz
T-MACH-105404	Innovative Nuclear Systems	4 CR	Cheng
T-MACH-110332	Nuclear Power and Reactor Technology	4 CR	Badea
T-MACH-105414	Cooling of Thermally High Loaded Gas Turbine Components	4 CR	Bauer, Schulz
T-MACH-105331	Laboratory Exercise in Energy Technology	4 CR	Bauer, Maas, Wirbser
T-MACH-105426	Magnetohydrodynamics	4 CR	Bühler
T-MACH-105434	Magnet Technology of Fusion Reactors	4 CR	Fietz, Weiss
T-MACH-105419	Mathematical Models and Methods in Combustion Theory	4 CR	Bykov, Maas
T-MACH-105167	Analysis Tools for Combustion Diagnostics	4 CR	Pfeil
T-MACH-105435	Neutron Physics of Fusion Reactors	4 CR	Fischer
T-MACH-105397	Numerical Simulation of Turbulent Flows	4 CR	Grötzbach
T-MACH-105338	Numerical Fluid Mechanics	4 CR	Magagnato
T-MACH-110838	Numerical Fluid Mechanics with PYTHON	4 CR	Frohnapfel
T-MACH-105405	Reactor Safety I: Fundamentals	4 CR	Sanchez-Espinoza

T-MACH-105421	Reduction Methods for the Modeling and the Simulation of Vombustion Processes	4 CR	Bykov, Maas
T-MACH-105400	Scaling in Fluid Dynamics	4 CR	Bühler
T-MACH-105422	Flows with Chemical Reactions	4 CR	Class
T-MACH-105403	Flows and Heat Transfer in Energy Technology	4 CR	Cheng
T-MACH-105559	Technical Energy Systems for Buildings 1: Processes & Components	4 CR	Schmidt
T-MACH-105560	Technical Energy Systems for Buildings 2: System Concept	4 CR	Schmidt
T-MACH-105225	Thermal Solar Energy	4 CR	Stieglitz
T-MACH-105363	Thermal Turbomachines I	6 CR	Bauer
T-MACH-105364	Thermal Turbomachines II	6 CR	Bauer
T-MACH-106372	Thermal-Fluid-Dynamics	4 CR	Ruck
T-MACH-105365	Turbine and Compressor Design	4 CR	Bauer
T-MACH-108784	Vacuum and Tritium Technology in Nuclear Fusion	4 CR	Bornschein, Day
T-MACH-105292	Heat and Mass Transfer	4 CR	Bockhorn, Maas
T-MACH-105430	Heatpumps	4 CR	Maas, Wirbser
T-MACH-105416	Hydrogen Technologies	4 CR	Jordan
T-MACH-105234	Windpower	4 CR	Lewald
T-MACH-105406	Two-Phase Flow and Heat Transfer	4 CR	Schulenberg, Wörner

Competence Certificate
Oral exams: duration approx. 5 min per credit point

Written exams: duration approx. 20 - 25 min per credit point

Amount, type and scope of the success control can vary according to the individually choice.

Competence Goal
Major Field Energy and Environmental Engineering serves as a comprehensive, in-depth analysis in selected areas of mechanical engineering.

Prerequisites
Exchange students are allowed to choose bricks from this module. There may be prerequisites or restrictions, for instance regarding the number of places for individual courses. Exchange students do not need to choose the whole module, but can select individual bricks.

Content
See individual bricks

M 2.10 Module: Major Field Fundamentals of Engineering [M-MACH-104847]

Responsible: Prof. Dr.-Ing. Martin Heilmaier
Organisation: KIT Department of Mechanical Engineering

Part of: KIT-Department of Mechanical Engineering Courses

Credits	Recurrence	Language	Level	Version
60	Each term	German/English	4	2

Election notes
Exchange students are allowed to choose bricks from this module. There may be prerequisites or restrictions, for instance regarding the number of places for individual courses. Exchange students do not need to choose the whole module, but can select individual bricks.

Election block: Exchange Students_Fundamentals of Engineering ()			
T-MACH-104745	Basics in Measurement and Control Systems	7 CR	Stiller
T-MACH-105208	Machines and Processes	7 CR	Bauer, Kubach, Maas, Pritz
T-MACH-105232	Machines and Processes, Prerequisite	0 CR	Bauer, Kubach, Maas, Pritz
T-MACH-105293	Mathematical Methods in Dynamics	6 CR	Proppe
T-MACH-105294	Mathematical Methods of Vibration Theory	6 CR	Seemann
T-MACH-105295	Mathematical Methods in Fluid Mechanics	6 CR	Frohnapfel
T-MACH-105298	Mathematical Methods in Structural Mechanics	5 CR	Böhlke
T-MACH-105189	Mathematical Models and Methods for Production Systems	6 CR	Baumann, Furmans
T-MACH-109192	Methods and Processes of PGE - Product Generation Development	6 CR	Albers, Burkardt, Matthiesen
T-MACH-105297	Modeling and Simulation	7 CR	Furmans, Geimer, Pritz, Proppe
T-MACH-105383	Product Development - Dimensioning of Components	7 CR	Dietrich, Schulze
T-MACH-105207	Fluid Mechanics 1&2	8 CR	Frohnapfel
T-MACH-105204	Excercises in Technical Thermodynamics and Heat Transfer I	0 CR	Maas
T-MACH-104747	Technical Thermodynamics and Heat Transfer I	8 CR	Maas
T-MACH-105288	Excercises in Technical Thermodynamics and Heat Transfer II	0 CR	Maas
T-MACH-105287	Technical Thermodynamics and Heat Transfer II	7 CR	Maas
T-MACH-106830	Tutorial Mathematical Methods in Strength of Materials	1 CR	Böhlke
T-MACH-106831	Tutorial Mathematical Methods in Structural Mechanics	1 CR	Böhlke

Competence Certificate
Oral exams: duration approx. 5 min per credit point

Written exams: duration approx. 20 - 25 min per credit point

Amount, type and scope of the success control can vary according to the individually choice.

Competence Goal
In the Major Field Fundamentals of Engineering, students acquire sound basic knowledge in engineering. With this in-depth knowledge of scientific theories, principles and methods, students can successfully deal with clearly specified problems that have a unique solution approach in mechanical engineering.

Prerequisites
Exchange students are allowed to choose bricks from this module. There may be prerequisites or restrictions, for instance regarding the number of places for individual courses. Exchange students do not need to choose the whole module, but can select individual bricks.

Content
See individual bricks

M 2.11 Module: Major Field Materials and Structures for High Performance Systems [M-MACH-104854]

Responsible: Prof. Dr.-Ing. Martin Heilmaier
Organisation: KIT Department of Mechanical Engineering

Part of: KIT-Department of Mechanical Engineering Courses

Credits	Recurrence	Language	Level	Version
90	Each term	German/English	4	2

Election notes
Exchange students are allowed to choose bricks from this module. There may be prerequisites or restrictions, for instance regarding the number of places for individual courses. Exchange students do not need to choose the whole module, but can select individual bricks.

Election block: Exchange Students_Materials and Structures for High Performance Systems ()			
T-MACH-105527	Applied Materials Simulation	4 CR	Gumbsch, Schulz
T-MACH-100288	Working Methods in Materials Science and Technology	2 CR	Heilmaier
T-MACH-105150	Constitution and Properties of Protective Coatings	4 CR	Ulrich
T-MACH-105310	Design of Highly Stresses Components	4 CR	Aktaa
T-MACH-108721	Designing with Composites	4 CR	Schnack
T-MACH-105320	Introduction to the Finite Element Method	4 CR	Böhlke, Langhoff
T-MACH-105321	Introduction to Theory of Materials	4 CR	Kamlah
T-MACH-105984	Fatigue of Welded Components and Structures	3 CR	Farajian, Gumbsch
T-MACH-105447	Metallographic Lab Class	4 CR	Heilmaier, Mühl
T-MACH-102099	Experimental Lab Class in Welding Technology, in Groups	4 CR	Dietrich
T-MACH-105535	Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies	4 CR	Henning
T-MACH-105392	FEM Workshop - Constitutive Laws	4 CR	Schulz, Weygand
T-MACH-107667	Solid State Reactions and Kinetics of Phase	4 CR	Franke, Seifert
T-MACH-105417	Finite Element Workshop	4 CR	Mattheck, Weygand
T-MACH-105179	Functional Ceramics	4 CR	Hinterstein, Rheinheimer
T-MACH-105157	Foundry Technology	4 CR	Wilhelm
T-MACH-102111	Principles of Ceramic and Powder Metallurgy Processing	4 CR	Schell
T-MACH-105398	High Performance Computing	5 CR	Nestler, Selzer
T-MACH-100287	Introduction to Ceramics	6 CR	Hoffmann
T-MACH-106722	Ceramic Matrix Composites	4 CR	Koch
T-MACH-100293	Structural Materials	6 CR	Guth, Lang
T-MACH-105164	Laser in Automotive Engineering	4 CR	Schneider
T-MACH-100285	Materials Physics and Metals	13 CR	Heilmaier, Pundt
T-MACH-100290	Seminar in Materials Science	2 CR	Gruber, Wagner
T-MACH-105333	Mechanics and Strength of Polymers	4 CR	von Bernstorff
T-MACH-105468	Metals	6 CR	Heilmaier, Pundt
T-MACH-105303	Modelling of Microstructures	5 CR	August, Nestler
T-MACH-100300	Modelling and Simulation	5 CR	Gumbsch, Nestler
T-MACH-102102	Physical Basics of Laser Technology	5 CR	Schneider
T-MACH-105516	Multi-Scale Plasticity	4 CR	Greiner, Schulz
T-MACH-102137	Polymer Engineering I	4 CR	Elsner, Liebig
T-MACH-102138	Polymer Engineering II	4 CR	Elsner, Liebig
T-MACH-102154	Laboratory Laser Materials Processing	4 CR	Schneider
T-MACH-105178	Practical Course Technical Ceramics	1 CR	Schell

T-MACH-102157	High Performance Powder Metallurgy Materials	4 CR	Schell
T-MACH-105724	Failure Analysis	4 CR	Greiner, Schneider
T-MACH-105170	Welding Technology	4 CR	Farajian
T-MACH-105354	Fatigue of Metallic Materials	4 CR	Guth, Lang
T-MACH-102179	Structural Ceramics	4 CR	Hoffmann
T-MACH-102103	Superhard Thin Film Materials	4 CR	Ulrich
T-MACH-100531	Systematic Materials Selection	4 CR	Dietrich, Schulze
T-MACH-105362	Technology of Steel Components	4 CR	Schulze
T-MACH-105531	Tribology	8 CR	Dienwiebel, Scherge
T-MACH-109304	Excercises - Fatigue of Welded Components and Structures	1 CR	Farajian, Gumbsch
T-MACH-109303	Exercices - Tribology	0 CR	Dienwiebel
T-MACH-107671	Exercises for Applied Materials Simulation	2 CR	Gumbsch, Schulz
T-MACH-107632	Exercises for Solid State Reactions and Kinetics of Phase Transformations	2 CR	Franke, Seifert
T-MACH-107685	Exercises for Materials Characterization	2 CR	Gibmeier
T-MACH-102139	Failure of Structural Materials: Fatigue and Creep	4 CR	Gruber, Gumbsch
T-MACH-102140	Failure of Structural Materials: Deformation and Fracture	4 CR	Gumbsch, Weygand
T-MACH-107684	Materials Characterization	4 CR	Gibmeier
T-MACH-105211	Materials of Lightweight Construction	4 CR	Elsner, Liebig
T-MACH-105301	Materials Science and Engineering III	8 CR	Heilmaier
T-MACH-105369	Materials Modelling: Dislocation Based Plasticy	4 CR	Weygand
T-MACH-100295	Materials Processing Technology	6 CR	Binder, Liebig

Competence Certificate
Oral exams: duration approx. 5 min per credit point

Written exams: duration approx. 20 - 25 min per credit point

Amount, type and scope of the success control can vary according to the individually choice.

Competence Goal
Major Field Materials and Structures for High Performance Systems serves as a comprehensive, in-depth analysis in selected areas of mechanical engineering.

Prerequisites
Exchange students are allowed to choose bricks from this module. There may be prerequisites or restrictions, for instance regarding the number of places for individual courses. Exchange students do not need to choose the whole module, but can select individual bricks.

Content
See individual bricks

M 2.12 Module: Major Field Mechatronics and Microsystem Technology [M-MACH-104850]

Responsible: Prof. Dr. Jan Gerrit Korvink
Organisation: KIT Department of Mechanical Engineering

Part of: KIT-Department of Mechanical Engineering Courses

Credits	Recurrence	Language	Level	Version
90	Each term	German/English	4	2

Election notes
Exchange students are allowed to choose bricks from this module. There may be prerequisites or restrictions, for instance regarding the number of places for individual courses. Exchange students do not need to choose the whole module, but can select individual bricks.

Election block: Exchange Students_Mechatronics and Microsystem Technology ()			
T-MACH-105238	Actuators and Sensors in Nanotechnology	4 CR	Kohl
T-MACH-100966	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I	4 CR	Guber
T-MACH-100967	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II	4 CR	Guber
T-MACH-100968	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III	4 CR	Guber
T-MACH-102172	Bionics for Engineers and Natural Scientists	4 CR	Hölscher
T-MACH-102169	Chemical, Physical and Material Scientific Aspects of Polymers in Microsystem Technologies	3 CR	Worgull
T-MACH-105314	Computational Intelligence	4 CR	Jakob, Mikut, Reischl
T-MACH-105694	Data Analytics for Engineers	5 CR	Ludwig, Mikut, Reischl
T-MACH-105317	Digital Control	4 CR	Knoop
T-MACH-100535	Introduction into Mechatronics	6 CR	Böhland, Lorch, Reischl
T-MACH-105228	Organ Support Systems	4 CR	Pylatiuk
T-MACH-102166	Fabrication Processes in Microsystem Technology	4 CR	Bade
T-MACH-105378	Cognitive Automobiles - Laboratory	6 CR	Kitt, Lauer, Stiller
T-MACH-105334	Mechanics in Microtechnology	4 CR	Greiner, Gruber
T-MACH-105370	Laboratory Mechatronics	4 CR	Hagenmeyer, Seemann, Stiller
T-MACH-105335	Measurement II	4 CR	Stiller
T-MACH-105300	Measurement Instrumentation Lab	4 CR	Richter, Stiller
T-MACH-101910	Microactuators	4 CR	Kohl
T-MACH-105539	Modern Control Concepts I	4 CR	Groell, Matthes
T-MACH-105180	Nanotechnology for Engineers and Natural Scientists	4 CR	Dienwiebel, Hölscher, Walheim
T-MACH-102152	Novel Actuators and Sensors	4 CR	Kohl, Sommer
T-MACH-102192	Polymers in MEMS A: Chemistry, Synthesis and Applications	4 CR	Rapp
T-MACH-102191	Polymers in MEMS B: Physics, Microstructuring and Applications	4 CR	Worgull
T-MACH-102200	Polymers in MEMS C: Biopolymers and Bioplastics	4 CR	Rapp, Worgull
T-MACH-105341	Lab Computer-Aided Methods for Measurement and Control	4 CR	Stiller
T-MACH-102164	Practical Training in Basics of Microsystem Technology	4 CR	Last
T-MACH-105555	System Integration in Micro- and Nanotechnology	4 CR	Gengenbach
T-MACH-105360	Computer Engineering	6 CR	Keller, Lorch
T-MACH-102149	Virtual Reality Practical Course	4 CR	Ovtcharova

Competence Certificate
Oral exams: duration approx. 5 min per credit point

Written exams: duration approx. 20 - 25 min per credit point

Amount, type and scope of the success control can vary according to the individually choice.

Competence Goal
Major Field Mechatronics and Microsystem Technology serves as a comprehensive, in-depth analysis in selected areas of mechanical engineering.

Prerequisites
Exchange students are allowed to choose bricks from this module. There may be prerequisites or restrictions, for instance regarding the number of places for individual courses. Exchange students do not need to choose the whole module, but can select individual bricks.

Content
See individual bricks

M 2.13 Module: Major Field Product Development and Construction [M-MACH-104851]

Responsible: Prof. Dr.-Ing. Albert Albers
Prof. Dr.-Ing. Sven Matthiesen

Organisation: KIT Department of Mechanical Engineering

Part of: KIT-Department of Mechanical Engineering Courses

Credits	Recurrence	Language	Level	Version
90	Each term	German/English	4	1

Election notes
Exchange students are allowed to choose bricks from this module. There may be prerequisites or restrictions, for instance regarding the number of places for individual courses. Exchange students do not need to choose the whole module, but can select individual bricks.

Election block: Exchange Students_Product Development and Construction ()			
T-MACH-106744	Agile Product Innovation Management - Value-driven Planning of New Products	4 CR	Kläger
T-MACH-105215	Applied Tribology in Industrial Product Development	4 CR	Albers, Lorentz, Matthiesen
T-MACH-102185	CATIA CAD Training Course	2 CR	Ovtcharova
T-MACH-105216	Powertrain Systems Technology B: Stationary Machinery	4 CR	Albers, Matthiesen, Ott
T-MACH-102187	CAD-NX Training Course	2 CR	Ovtcharova
T-MACH-105212	CAE-Workshop	4 CR	Albers, Matthiesen
T-MACH-105312	CATIA Advanced	4 CR	Ovtcharova
T-MACH-105182	Introduction to Microsystem Technology I	4 CR	Badilita, Jouda, Korvink
T-MACH-105183	Introduction to Microsystem Technology II	4 CR	Jouda, Korvink
T-MACH-106743	IoT Platform for Engineering	4 CR	Ovtcharova
T-MACH-105330	Design with Plastics	4 CR	Liedel
T-MACH-105221	Lightweight Engineering Design	4 CR	Albers, Burkardt
T-MACH-105231	Leadership and Management Development	4 CR	Albers, Matthiesen, Ploch
T-MACH-105442	Intellectual Property Rights and Strategies in Industrial Companies	4 CR	Albers, Matthiesen, Zacharias
T-MACH-105440	Leadership and Conflict Management	4 CR	Hatzl
T-MACH-105347	Project Management in Global Product Engineering Structures	4 CR	Albers, Gutzmer, Matthiesen
T-MACH-105696	Strategic Product Development - Identification of Potentials of Innovative Products	3 CR	Albers, Matthiesen, Siebe
T-MACH-105358	Sustainable Product Engineering	4 CR	Albers, Matthiesen, Ziegahn
T-MACH-105361	Technical Design in Product Development	4 CR	Albers, Matthiesen, Schmid
T-MACH-102123	Virtual Engineering I	4 CR	Ovtcharova
T-MACH-102124	Virtual Engineering II	4 CR	Ovtcharova

Competence Certificate
Oral exams: duration approx. 5 min per credit point

Written exams: duration approx. 20 - 25 min per credit point

Amount, type and scope of the success control can vary according to the individually choice.

Competence Goal
Major Field Product Development and Construction serves as a comprehensive, in-depth analysis in selected areas of mechanical engineering.

Prerequisites
Exchange students are allowed to choose bricks from this module. There may be prerequisites or restrictions, for instance regarding the number of places for individual courses. Exchange students do not need to choose the whole module, but can select individual bricks.

Content
See individual bricks

M 2.14 Module: Major Field Production Technology [M-MACH-104852]

Responsible: Prof. Dr.-Ing. Volker Schulze
Organisation: KIT Department of Mechanical Engineering

Part of: KIT-Department of Mechanical Engineering Courses

Credits	Recurrence	Language	Level	Version
90	Each term	German/English	4	3

Election notes
Exchange students are allowed to choose bricks from this module. There may be prerequisites or restrictions, for instance regarding the number of places for individual courses. Exchange students do not need to choose the whole module, but can select individual bricks.

Election block: Exchange Students_Production Technology ()			
T-MACH-105518	Human Factors Engineering I	4 CR	Deml
T-MACH-105519	Human Factors Engineering II	4 CR	Deml
T-MACH-105830	Human Factors Engineering III: Empirical research methods	4 CR	Deml
T-MACH-108844	Automated Manufacturing Systems	8 CR	Fleischer
T-MACH-102105	Manufacturing Technology	8 CR	Schulze, Zanger
T-MACH-105159	Global Production and Logistics - Part 2: Global Logistics	4 CR	Furmans
T-MACH-109919	Basics of Technical Logistics I	4 CR	Mittwollen, Oellerich
T-MACH-109920	Basics of Technical Logistics II	5 CR	Hochstein
T-MACH-105388	Introduction to Industrial Production Economics	4 CR	Dürrschnabel
T-MACH-105386	Occupational Safety and Environmental Protection	4 CR	von Kiparski
T-MACH-108849	Integrated Production Planning in the Age of Industry 4.0	8 CR	Lanza
T-MACH-102128	Information Systems and Supply Chain Management	3 CR	Kilger
T-MACH-105174	Warehousing and Distribution Systems	3 CR	Furmans
T-MACH-102151	Material Flow in Logistic Systems	9 CR	Furmans
T-MACH-105470	Production Planning and Control	4 CR	Rinn
T-MACH-105346	Production Techniques Laboratory	4 CR	Deml, Fleischer, Furmans, Ovtcharova
T-MACH-105523	Productivity Management in Production Systems	4 CR	Stowasser
T-MACH-105457	Project Mikromanufacturing: Development and Manufacturing of Microsystems	5 CR	Schulze
T-MACH-102107	Quality Management	4 CR	Lanza
T-MACH-105171	Safety Engineering	4 CR	Kany
T-MACH-105185	Control Technology	4 CR	Gönnheimer
T-MACH-102083	Integrated Information Systems for Engineers	4 CR	Ovtcharova
T-MACH-105177	Metal Forming	4 CR	Herlan
T-MACH-102148	Gear Cutting Technology	4 CR	Klaiber
T-MACH-109055	Machine Tools and Industrial Handling	8 CR	Fleischer

Competence Certificate
Oral exams: duration approx. 5 min per credit point

Written exams: duration approx. 20 - 25 min per credit point

Amount, type and scope of the success control can vary according to the individually choice.

Competence Goal
Major Field Production Technology serves as a comprehensive, in-depth analysis in selected areas of mechanical engineering.

Prerequisites
Exchange students are allowed to choose bricks from this module. There may be prerequisites or restrictions, for instance regarding the number of places for individual courses. Exchange students do not need to choose the whole module, but can select individual bricks.

Content
See individual bricks

M 2.15 Module: Major Field Theoretical Foundations of Mechanical Engineering [M-MACH-104853]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Organisation: KIT Department of Mechanical Engineering

Part of: KIT-Department of Mechanical Engineering Courses

Credits	Recurrence	Language	Level	Version
90	Each term	German/English	4	2

Election notes
Exchange students are allowed to choose bricks from this module. There may be prerequisites or restrictions, for instance regarding the number of places for individual courses. Exchange students do not need to choose the whole module, but can select individual bricks.

Election block: Exchange Students_Theoretical Foundations of Mechanical Engineering ()			
T-MACH-105209	Introduction into the Multi-Body Dynamics	5 CR	Seemann
T-MACH-108718	Introduction to numerical mechanics	4 CR	Schnack
T-MACH-108808	Introduction to Engineering Mechanics I: Statics	3 CR	Fidlin
T-MACH-102208	Introduction to Engineering Mechanics I: Statics and Strength of Materials	5 CR	Fidlin
T-MACH-105439	Introduction to Nonlinear Vibrations	7 CR	Fidlin
T-MACH-105514	Experimental Dynamics	5 CR	Fidlin
T-MACH-105474	Fluid-Structure-Interaction	4 CR	Frohnapfel, Mühlhausen
T-MACH-105324	Foundations of Nonlinear Continuum Mechanics	4 CR	Kamlah
T-MACH-105396	Modeling of Thermodynamical Processes	6 CR	Maas, Schießl
T-MACH-108720	Numerical Mechanics for Industrial Applications	4 CR	Schnack
T-MACH-105420	Numerical Simulation of Multi-Phase Flows	4 CR	Wörner
T-MACH-105348	Process Simulation in Forming Operations	4 CR	Helm
T-MACH-105349	Computational Dynamics	4 CR	Proppe
T-MACH-105384	Computerized Multibody Dynamics	4 CR	Seemann
T-MACH-105351	Computational Mechanics I	6 CR	Böhlke, Langhoff
T-MACH-105352	Computational Mechanics II	6 CR	Böhlke, Langhoff
T-MACH-105373	Practical Training in Measurement of Vibrations	4 CR	Fidlin
T-MACH-105372	Theory of Stability	6 CR	Fidlin
T-MACH-105458	Flow Simulations	4 CR	Frohnapfel
T-MACH-105290	Vibration Theory	5 CR	Fidlin, Seemann
T-MACH-105443	Wave Propagation	4 CR	Seemann

Competence Certificate
Oral exams: duration approx. 5 min per credit point

Written exams: duration approx. 20 - 25 min per credit point

Amount, type and scope of the success control can vary according to the individually choice.

Competence Goal
Major Field Theoretical Foundations of Mechanical Engineering serves as a comprehensive, in-depth analysis in selected areas of mechanical engineering.

Prerequisites
Exchange students are allowed to choose bricks from this module. There may be prerequisites or restrictions, for instance regarding the number of places for individual courses. Exchange students do not need to choose the whole module, but can select individual bricks.

Content
See individual bricks

M 2.16 Module: Specification in Mechanical Engineering [M-MACH-104878]

Responsible: Prof. Dr.-Ing. Martin Heilmaier
Organisation: KIT Department of Mechanical Engineering

Part of: KIT-Department of Mechanical Engineering Courses

Credits	Recurrence	Language	Level	Version
60	Each term	German/English	4	1

Election notes
Exchange students are allowed to choose bricks from this module. There may be prerequisites or restrictions, for instance regarding the number of places for individual courses. Exchange students do not need to choose the whole module, but can select individual bricks.

Election block: Exchange Students_Bricks in English_Elective ()			
T-MACH-108689	Advanced Materials Thermodynamics: Experiments and Modelling	4 CR	Seifert
T-MACH-105308	Atomistic Simulations and Molecular Dynamics	4 CR	Brandl, Gumbsch, Schneider
T-MACH-105381	Virtual Engineering (Specific Topics)	4 CR	Ovtcharova
T-MACH-105407	CFD in Power Engineering	4 CR	Otic
T-MACH-106698	A holistic approach to power plant management	4 CR	Seidl, Stieglitz
T-ETIT-100807	Electrical Machines	4 CR	Becker
T-MACH-105154	Vehicle Comfort and Acoustics I	4 CR	Gauterin
T-MACH-105155	Vehicle Comfort and Acoustics II	4 CR	Gauterin
T-MACH-105444	Combined Cycle Power Plants	4 CR	Schulenberg
T-MACH-105220	Fundamentals of Energy Technology	8 CR	Badea, Cheng
T-MACH-100092	Automotive Engineering I	8 CR	Gauterin, Unrau
T-MACH-102117	Automotive Engineering II	4 CR	Gauterin, Unrau
T-MACH-105379	Global Logistics	4 CR	Furmans
T-MACH-105182	Introduction to Microsystem Technology I	4 CR	Badilita, Jouda, Korvink
T-MACH-105183	Introduction to Microsystem Technology II	4 CR	Jouda, Korvink
T-MACH-105162	Fundamentals of Automobile Development I	2 CR	Frech
T-MACH-105163	Fundamentals of Automobile Development II	2 CR	Frech
T-MACH-105466	Introduction to Neutron Cross Section Theory and Nuclear Data Generation	4 CR	Dagan
T-MACH-105402	Nuclear Power Plant Technology	4 CR	Badea, Cheng, Schulenberg
T-MACH-105410	Coal Fired Power Plants	4 CR	Schulenberg
T-MACH-105223	Machine Vision	8 CR	Lauer, Stiller
T-MACH-105434	Magnet Technology of Fusion Reactors	4 CR	Fietz, Weiss
T-MACH-105210	Machine Dynamics	5 CR	Proppe
T-MACH-105224	Machine Dynamics II	4 CR	Proppe
T-MACH-105189	Mathematical Models and Methods for Production Systems	6 CR	Baumann, Furmans
T-MACH-105557	Microenergy Technologies	4 CR	Kohl
T-MACH-105782	Micro Magnetic Resonannce	4 CR	Korvink, MacKinnon
T-MACH-105532	Nonlinear Continuum Mechanics	5 CR	Böhlke
T-WIWI-100806	Renewable Energy-Resources, Technologies and Economics	4 CR	Jochem, McKenna
T-MACH-105445	Simulator Exercises Combined Cycle Power Plants	2 CR	Schulenberg
T-MACH-105456	Ten Lectures on Turbulence	4 CR	Otic
T-MACH-105363	Thermal Turbomachines I	6 CR	Bauer
T-MACH-105364	Thermal Turbomachines II	6 CR	Bauer

T-MACH-105554	Thin Film and Small-scale Mechanical Behavior	4 CR	Gruber, Schwaiger, Weygand
T-MACH-102123	Virtual Engineering I	4 CR	Ovtcharova
T-MACH-102124	Virtual Engineering II	4 CR	Ovtcharova
T-MACH-105529	Heat Transfer in Nuclear Reactors	4 CR	Cheng
T-MACH-105459	High Temperature Materials	4 CR	Heilmaier

Competence Certificate
Oral exams: duration approx. 5 min per credit point

Written exams: duration approx. 20 - 25 min per credit point

Amount, type and scope of the success control can vary according to the individually choice.

Competence Goal
Incoming Students_Bricks in English serves as a comprehensive, of fundamentals in selected areas of mechanical engineering.

Prerequisites
None

Content
See individual bricks

Annotation
The courses in this module are offered in English.

3 Courses

T 3.1 Course: A holistic approach to power plant management [T-MACH-106698]

Responsible: Dr. Marcus Seidl
Prof. Dr. Robert Stieglitz

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104878 - Specification in Mechanical Engineering
M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each term	1

Events					
WS 19/20	2189404	A holistic approach to power plant management	2 SWS	Lecture (V)	Seidl
Exams					
WS 19/20	76-T-MACH-106698	A holistic approach to power plant management		Prüfung (PR)	Stieglitz

Competence Certificate
oral exam of about 30 minutes

Prerequisites
none

Annotation
none

Below you will find excerpts from events related to this course:

V A holistic approach to power plant management

Lecture (V)

2189404, WS 19/20, 2 SWS, Language: English, Open in study portal

Content

Main Contents:

The structure ofelectricity markets

Requirements from network operators

The basics of commodity markets

The impact of regulation on power plant operation

The role of behavioral economics in power plant decision making

Integration of renewable energy sources into the electricity market

Calibration of power plant operation and maintenance to market requirements

Asset management for power plant fleets

Applying financial engineering to optimize asset utilization

Day-to-day decision making for power plant operation

The lecture provides an overview of the many practical aspects of power plant operation. For this purpose, the knowledge of the energy and commodity markets, the regulatory boundary conditions, the energy trading instruments, the principles of fleet management and the requirements of power plant maintenance are required.

For the purpose of an efficient management of a power plant fleet it is explained how a variety of statistical models can be used to determine the optimal combination of resource purchases, outage management, load availability and ask prices.

Each credit point equals to 25-30 h working time of a student. Thereby, the time is based on an average student finishing with and average score. The working time can be split into: 1 attendance of the lectures, 2. pre- and post-processing of the lecture, 3 preparations for examination.

Students understand the many aspects of power plant operation: the structure of the energy and commodity markets, the regulatory boundary conditions, the energy trading instruments, the principles of fleet management and the requirements of power plant maintenance.

Furthermore, students can develop on their own a suitable strategy for the management of a power plant fleet.

Oral exam of about 25 min.

Literature

G. Balzer, C. Schorn, Asset Management für Infrastrukturanlagen - Energie und Wasser, VDI

R. Weron, Modeling and Forecasting Electricity Loads and Prices: A Statistical Approach, Wiley

D. Edwards, Energy Trading and Investing: Trading, Risk Management and Structuring Deals in the Energy Market, McGraw-Hill

T 3.2 Course: Actuators and Sensors in Nanotechnology [T-MACH-105238]

Responsible: Prof. Dr. Manfred Kohl
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104850 - Major Field Mechatronics and Microsystem Technology

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2141866	Actuators and sensors in nanotechnology	2 SWS	Lecture (V)	Kohl, Sommer
Exams					
WS 19/20	76-T-MACH-105238	Actuators and Sensors in Nanotechnology		Prüfung (PR)	Kohl, Sommer

Competence Certificate
oral exam

Prerequisites
none

Below you will find excerpts from events related to this course:

V Actuators and sensors in nanotechnology

Lecture (V)

2141866, WS 19/20, 2 SWS, Language: German, Open in study portal

T 3.3 Course: Advanced Materials Thermodynamics: Experiments and Modelling [T-MACH-108689]

Responsible: Prof. Dr. Hans Jürgen Seifert
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104878 - Specification in Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	2

Events					
SS 2020	2194660	Advanced Materials Thermodynamics: Experiments and Modelling	2 SWS	Lecture (V)	Seifert, Franke
Exams					
WS 19/20	76-T-MACH-108689	Advanced Materials Thermodynamics: Experiments and Modelling		Prüfung (PR)	Seifert

Competence Certificate
oral exam (about 30 min)

Prerequisites
none

Recommendation
Basics in thermodynamics (lectures during bachelor degree course in engineering, materials science and engineering (MatWerk), physics or chemistry)

Below you will find excerpts from events related to this course:

V Advanced Materials Thermodynamics: Experiments and Modelling
Lecture (V)
2194660, SS 2020, 2 SWS, Language: German/English, Open in study portal

Content

- Fundamentals of thermodynamics
- Introduction to experimental methods for the determination of phase diagrams and the measurement of thermodynamic properties
- Thermal analysis and differential scanning calorimetry to determine phase transformation temperatures, enthalpies of transformation, and heat capacities
- The drop calorimetry and solution calorimetry methods to be able to measure enthalpies of formation of intermetallic and oxide compounds.
- EMF and KEMS methods for the measurement of chemical potentials
- Introduction to computational thermodynamics and the Calphad method
- Thermodynamic modelling
- Calculation of binary and ternary phase diagrams using Thermo-Calc software
- Calculation of property diagrams using Thermo-Calc software

This course focuses on the experimental methods which are used to investigate binary and ternary phase diagrams as well as those methods which can be employed to measure thermodynamic properties of multi-component systems. Additionally, participants will be able to understand thermodynamic models used to describe the Gibbs free energies of stoichiometric and solution phases, as well as to use Thermo-Calc software to calculate binary and ternary phase diagrams and property diagrams.

- Attendance in Lecture: 18 Stunden
- Extra Requirements: 98 Stunden

Recommendations:

- Fundamentals of Thermodynamics / Heterogeneous Equilibria (with exercises)
- Solid State Reactions and Kinetics of Phase Transformations and Corrosion (with Exercises)

Oral examination (ca. 30 Min)

Literature

- Hemminger, W.F., Cammenga, H.K. : Methoden der Thermischen Analyse, Springer Verlag, Berlin Heidelberg, 1989
- Höhne, G.W.H., Hemminger, W.F., Flammersheim, H.-J.: Differential Scanning Calorimetry, Springer Verlag, Berlin Heidelberg, 2003
- Sarge, S.F., Höhne, W.H., Hemminger, W.: Calorimetry: Fundamentals, Instrumentation and Applications, Wiley-VCH Verlag, Weinham, 2014
- Lukas, H.L., Fries, S.G., Sundman, B. : Computational Thermodynamics: The Calphad Method, Cambridge University Press, New York, 2007

T 3.4 Course: Aerodynamics [T-MACH-105528]

Responsible: Prof. Dr.-Ing. Bettina Frohnapfel
Frank Ohle

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2154420	Aerodynamics	2 SWS		Ohle
Exams					
WS 19/20	76-T-MACH-105528	Aerodynamics		Prüfung (PR)	Frohnapfel
SS 2020	76-T-MACH-105528	Aerodynamics		Prüfung (PR)	Frohnapfel

Competence Certificate
oral exam 30 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Aerodynamics
2154420, SS 2020, 2 SWS, Language: German, Open in study portal

Content

- Basics of aerodynamics
- Basic properties of flowing gas
- Potential Theory
- Airfoils (2-D wing)
- The finite (3-D) wing
- Airplane performance
- CFD
- Experimental verification

Literature
Schlichting, Gersten. Grenzschichttheorie, Springer

Schlichting, Truckenbrodt. Aerodynamik des Flugzeugs Bd.1 und 2, Springer

J.D. Anderson, jr.. Fundamentals of Aerodynamics, McGraw-Hill

E.L. Houghton. Aerodynamics for Engineering Students, Butterworth-Heinemann (Elsevier)

Schlichting, Gersten. Grenzschichttheorie, Springer

T 3.5 Course: Agile Product Innovation Management - Value-driven Planning of New Products [T-MACH-106744]

Responsible: Hon.-Prof. Dr. Roland Kläger
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104851 - Major Field Product Development and Construction

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	3

Competence Certificate
Oral examination, 20 min.

Prerequisites
None

T 3.6 Course: Alternative Powertrain for Automobiles [T-MACH-105655]

Responsible: Prof.Dipl.-Ing. Karl Ernst Noreikat
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	1

Events					
WS 19/20	2133132	Alternative Powertrains for Automobiles	2 SWS	Lecture (V)	Noreikat
Exams					
WS 19/20	76-T-MACH-105655	Alternative Powertrain for Automobiles		Prüfung (PR)	Noreikat
SS 2020	76-T-MACH-105655	Alternative Powertrain for Automobiles		Prüfung (PR)	Noreikat

Competence Certificate
written exam

Below you will find excerpts from events related to this course:

V Alternative Powertrains for Automobiles

2133132, WS 19/20, 2 SWS, Open in study portal

Lecture (V)

Content
History

Infrastructure

Market Situation

Legislation

Alternative Fuels

Innovative Drivetrains

Hybrids

Plug-In Hybrids

BEV

Fuel Cells

T 3.7 Course: Analysis of Exhaust Gas and Lubricating Oil in Combustion Engines [T-MACH-105173]

Responsible: Dr.-Ing. Marcus Gohl
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2134150	Analysis of Exhaust Gas und Lubricating Oil in Combustion Engines	2 SWS	Lecture (V)	Gohl
Exams					
WS 19/20	76-T-MACH-105173	Analysis of Exhaust Gas and Lubricating Oil in Combustion Engines		Prüfung (PR)	Koch
SS 2020	76--T-Mach-105173	Analysis of Exhaust Gas and Lubricating Oil in Combustion Engines		Prüfung (PR)	Gohl

Competence Certificate
Letter of attendance or oral exam (25 minutes, no auxillary means)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Analysis of Exhaust Gas und Lubricating Oil in Combustion Engines

Lecture (V)

2134150, SS 2020, 2 SWS, Language: German, Open in study portal

Literature
Die Vorlesungsunterlagen werden vor jeder Veranstaltung an die Studenten verteilt.

T 3.8 Course: Analysis Tools for Combustion Diagnostics [T-MACH-105167]

Responsible: Jürgen Pfeil
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2134134	Analysis tools for combustion diagnostics	2 SWS	Lecture (V)	Pfeil
Exams					
WS 19/20	76-T-MACH-105167	Analysis Tools for Combustion Diagnostics		Prüfung (PR)	Koch
SS 2020	76-T-MACH-105167	Analysis Tools for Combustion Diagnostics		Prüfung (PR)	Koch

Competence Certificate
oral examination, Duration: 25 min., no auxiliary means

Prerequisites
none

Below you will find excerpts from events related to this course:

V Analysis tools for combustion diagnostics
2134134, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Literature
Skript, erhältlich in der Vorlesung

T 3.9 Course: Applied Materials Simulation [T-MACH-105527]

Responsible: Prof. Dr. Peter Gumbsch
Dr. Katrin Schulz

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	2

Events					
SS 2020	2182614	Applied Materials Modelling	4 SWS	Lecture / Practice (VÜ)	Schulz, Gumbsch
Exams					
WS 19/20	76-T-MACH-105527	Applied Materials Modelling		Prüfung (PR)	Gumbsch, Schulz
SS 2020	76-T-MACH-105527	Applied Materials Modelling		Prüfung (PR)	Gumbsch, Schulz

Competence Certificate
oral exam ca. 30 minutes

no tools or reference materials

Prerequisites
The successful participation in Exercises for Applied Materials Modelling is the condition for the admittance to the oral exam in Applied Materials Modelling.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-107671 - Exercises for Applied Materials Simulation must have been passed.

Below you will find excerpts from events related to this course:

V Applied Materials Modelling

2182614, SS 2020, 4 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Content
This lecture should give the students an overview of different simulation methods in the field of materials science and engineering. Numerical methods are presented and their use in different fields of application and size scales shown and discussed. On the basis of theoretical as well as practical aspects, a critical examination of the opportunities and challenges of numerical material simulation shall be carried out.

The student can

- define different numerical methods and distinguish their range of application
- approach issues by applying the finite element method and discuss the processes and results
- understand complex processes of metal forming and crash simulation and discuss the structural and material behavior
- define and apply the physical fundamentals of particle-based simulation techniques to applications of materials science
- illustrate the range of application of atomistic simulation methods and distinguish between different models

preliminary knowlegde in mathematics, physics and materials science recommended

regular attendance: 34 hours

exercise: 11 hours

self-study: 165 hours

oral exam ca. 35 minutes

no tools or reference materials

admission to the exam only with successful completion of the exercises

Literature

1. D. Frenkel, B. Smit: Understanding Molecular Simulation: From Algorithms to Applications, Academic Press, 2001
2. W. Kurz, D.J. Fisher: Fundamentals of Solidification, Trans Tech Publications, 1998
3. P. Haupt: Continuum Mechanics and Theory of Materials, Springer, 1999
4. M. P. Allen, D. J. Tildesley: Computer simulation of liquids, Clarendon Press, 1996

T 3.10 Course: Applied Tribology in Industrial Product Development [T-MACH-105215]

Responsible: Prof. Dr.-Ing. Albert Albers
Dr.-Ing. Benoit Lorentz
Prof. Dr.-Ing. Sven Matthiesen

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104851 - Major Field Product Development and Construction

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	2

Events					
WS 19/20	2145181	Applied Tribology in Industrial Product Development	2 SWS	Lecture (V)	Lorentz
Exams					
WS 19/20	76-T-MACH-105215	Applied Tribology in Industrial Product Development		Prüfung (PR)	Lorentz, Albers

Competence Certificate
oral exam (20 min)

Prerequisites
None

Below you will find excerpts from events related to this course:

V Applied Tribology in Industrial Product Development — Lecture (V)

2145181, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
The aim of the lecture is to discuss tribological problems, tribological features and the tribological variety on examples of the industry.

The students are able to

- define a tribological system,
- design a tribological system,
- discuss wear and damage impacts,
- explain measurement techniques to investigate tribological systems and
- show the limits of a tribological system.

Further content:

- Friction, Wear, Wear Measurement
- Lubricant (Oil, Grease, etc.)
- Hydrodynamic and elastohydrodynamic Lubrication
- Design of Tribologic Working Surface Pairs
- Technique of Measurement in Lubricated Contacts
- Prevention of Maschine Failure
- Protective Surface Layers
- Journal Bearings, Roller Bearings
- Gear Wheels and Transmissions

Regular attendance: 21 h

Self-study: 99 h

Exam: oral exam

Literature
Vorlesungsfolien werden im Ilias veröffentlicht.

The lecture script will be allocated at Ilias.

T 3.11 Course: Atomistic Simulations and Molecular Dynamics [T-MACH-105308]

Responsible: Dr. Christian Brandl
Prof. Dr. Peter Gumbsch
Dr.-Ing. Johannes Schneider

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104878 - Specification in Mechanical Engineering
M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	2

Events					
SS 2020	2181740	Atomistic simulations and molecular dynamics	2 SWS	Lecture (V)	Weygand, Gumbsch
SS 2020	2181741	Lab for 'Atomistic simulations and molecular dynamics'	2 SWS	Practice (Ü)	Weygand, Gumbsch
Exams					
WS 19/20	76-T-MACH-105308	Atomistic Simulations and Molecular Dynamics		Prüfung (PR)	Gumbsch

Competence Certificate
oral exam ca. 30 minutes

Prerequisites
none

Recommendation
preliminary knowlegde in mathematics, physics and materials science

Below you will find excerpts from events related to this course:

V Atomistic simulations and molecular dynamics

2181740, SS 2020, 2 SWS, Language: English, Open in study portal **Lecture (V)**

Content
The lecture introduces the foundation of particle based simulation methods focussing on molecular dynamics:

1. Introduction
2. Physics of Materials
3. MD Basics, Atom-Billard
* particle, position, energy, forces, pair potentials
* initial and boundary conditions
* time integration
4. algorithms
5. statics, dynamics, thermodynamics
6. MD output
7. interaction between particles
* pair potential -- many body potentials
* principles of quantum mechanics
* tight binding methods
* dissipative particle dynamics
8. application of particle based methods

Exercises (2181741, 2 SWS) are used for complementing and deepening the contents of the lecture as well as for answering more extensive questions raised by the students.

The student can

- describe the physical foundation of particle based simulation method (e.g. molecular dynamics)
- apply particle based simulation methods to problems in materials science

preliminary knowlegde in mathematics, physics and materials science recommended

regular attendance: 22,5 hours
exercise: 22,5 hours
self-study: 75 hours

oral exam ca. 30 minutes

Literature

1. Understanding Molecular Simulation: From Algorithms to Applications, Daan Frenkel and Berend Smit (Academic Press, 2001) wie alle guten MD Bücher stark aus dem Bereich der physikalischen Chemie motiviert und auch aus diesem Bereich mit Anwendungsbeispielen gefüllt, trotzdem für mich das beste Buch zum Thema!
2. Computer simulation of liquids, M. P. Allen and Dominic J. Tildesley (Clarendon Press, Oxford, 1996) Immer noch der Klassiker zu klassischen MD Anwendungen. Weniger stark im Bereich der Nichtgleichgewichts-MD.

V **Lab for 'Atomistic simulations and molecular dynamics'** **Practice (Ü)**
2181741, SS 2020, 2 SWS, Language: English, Open in study portal

Content
Introduction to the basic usage of the MD software package IMD:

* generating initial structures
* energy calculations
* defects in lattices
* visualization of MD structures

The students will be able to use a standard molecular dyanamics software package.

Literature
siehe Voprlesung

T 3.12 Course: Automated Manufacturing Systems [T-MACH-108844]

Responsible: Prof. Dr.-Ing. Jürgen Fleischer
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104852 - Major Field Production Technology

Type	Credits	Recurrence	Version
Oral examination	8	Each summer term	1

Events					
SS 2020	2150904	Automated Manufacturing Systems	6 SWS	Lecture / Practice (VÜ)	Fleischer
Exams					
WS 19/20	76-T-MACH-108844	Automated Manufacturing Systems		Prüfung (PR)	Fleischer
SS 2020	76-T-MACH-108844	Automated Manufacturing Systems		Prüfung (PR)	Fleischer

Competence Certificate
oral exam (40 minutes)

Prerequisites
"T-MACH-102162 - Automatisierte Produktionsanlagen" must not be commenced.

Below you will find excerpts from events related to this course:

V Automated Manufacturing Systems

2150904, SS 2020, 6 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Content

The lecture provides an overview of the structure and functioning of automated manufacturing systems. In the introduction chapter the basic elements for the realization of automated manufacturing systems are given. This includes:

- Drive and control technology
- Handling technology for handling work pieces and tools
- Industrial Robotics
- Quality assurance in automated manufacturing
- automatic machines, cells, centers and systems for manufacturing and assembly
- structures of multi-machine systems
- planning of automated manufacturing systems

An interdisciplinary view of these subareas enables Industry 4.0 solutions.
In the second part of the lecture, the basics are illustrated using implemented manufacturing processes for the production of automotive components (chassis and drive technology).The analysis of automated manufacturing systems for manufacturing of defined components is also included.
In the field of vehicle power train both, the automated manufacturing process for the production of the conventional internal-combustion engine and the automated manufacturing process for the production of the prospective electric power train
(electric motor and battery) are considered. In the field of car body, the focus is on the analysis of the process chain for the automated manufacturing of conventional sheet metal body parts, as well as for automated manufacturing of body components made out of
fiber-reinforced plastics.
Within tutorials, the contents from the lecture are advanced and applied to specific problems and tasks.

Learning Outcomes:

The students …

- are able to analyze implemented automated manufacturing systems and describe their components.
- are capable to assess the implemented examples of implemented automated manufacturing systems and apply them to new problems.
- are able to name automation tasks in manufacturing plants and name the components which are necessary for the implementation of each automation task.
- are capable with respect to a given task to plan the configuration of an automated manufacturing system and to determine the necessary components to its realization.
- are able to design and select components for a given use case of the categories: "Handling Technology", "Industrial Robotics", "Sensory" and "Controls".
- are capable to compare different concepts for multi-machine systems and select a suitable concept for a given use case.

Workload:

MACH:
regular attendance: 63 hours
self-study: 177 hours
WING:
regular attendance: 63 hours
self-study: 207 hours

Literature
Medien:
Skript zur Veranstaltung wird über (https://ilias.studium.kit.edu/) bereitgestellt.

Media:
Lecture notes will be provided in Ilias (https://ilias.studium.kit.edu/).

T 3.13 Course: Automotive Engineering I [T-MACH-100092]

Responsible: Prof. Dr. Frank Gauterin
Dr.-Ing. Hans-Joachim Unrau

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering
M-MACH-104878 - Specification in Mechanical Engineering

Type	Credits	Recurrence	Expansion	Language	Version
Written examination	8	Each winter term	1 terms		3

Events					
WS 19/20	2113805	Automotive Engineering I	4 SWS	Lecture (V)	Gauterin, Unrau
WS 19/20	2113809	Automotive Engineering I	4 SWS	Lecture (V)	Gauterin, Gießler
Exams					
WS 19/20	76-T-MACH-100092	Automotive Engineering		Prüfung (PR)	Unrau, Gauterin

Competence Certificate
Written examination

Duration: 120 minutes

Auxiliary means: none

Prerequisites
The brick "T-MACH-102203 - Automotive Engineering I" is not started or finished. The bricks "T-MACH-100092 - Grundlagen der Fahrzeugtechnik I" and "T-MACH-102203 - Automotive Engineering I" can not be combined.

Below you will find excerpts from events related to this course:

V Automotive Engineering I

2113805, WS 19/20, 4 SWS, Language: German, Open in study portal

Lecture (V)

Content
1. History and future of the automobile

2. Driving mechanics: driving resistances and driving performance, mechanics of longitudinal and lateral forces, active and passive safety

3. Drive systems: combustion engine, hybrid and electric drive systems

4. Transmission: clutches (e.g. friction clutch, visco clutch), transmission (e.g. mechanical transmission, hydraulic fluid transmission)

5. Power transmission and distribution: drive shafts, cardon joints, differentials

Learning Objectives:

The students know the movements and the forces at the vehicle and are familiar with active and passive safety. They have proper knowledge about operation of engines and alternative drives, the necessary transmission between engine and drive wheels and the power distribution. They have an overview of the components necessary for the drive and have the basic knowledge, to analyze, to evaluate, and to develop the complex system "vehicle".

Literature
1. Mitschke, M. / Wallentowitz, H.: Dynamik der Kraftfahrzeuge, Springer Vieweg, Wiesbaden 2014

2. Pischinger, S. / Seiffert, U.: Handbuch Kraftfahrzeugtechnik, Springer Vieweg, Wiesbaden 2016

3. Gauterin, F. / Unrau, H.-J. / Gnadler, R.: Scriptum zur Vorlesung "Grundlagen der Fahrzeugtechnik I", KIT, Institut für Fahrzeugsystemtechnik, Karlsruhe, jährlich aktualisiert

V Automotive Engineering I

2113809, WS 19/20, 4 SWS, Language: English, Open in study portal

Lecture (V)

Content

1. History and future of the automobile

2. Driving mechanics: driving resistances and driving performances, mechanics of longitudinal and lateral forces, active and passive safety

3. Drive systems: combustion engine, hybrid and electric drive systems

4. Transmission: clutches (e.g. friction clutch, visco clutch), transmission (e.g. mechanical transmission, hydraulic fluid transmission)

5.Power transmission and distribution: drive shafts, cardon joints, differentials

Learning Objectives:

The students know the movements and the forces at the vehicle and are familiar with active and passive safety. They have proper knowledge about operation of engines and alternative drives, the necessary transmission between engine and drive wheels and the power distribution. They have an overview of the components necessary for the drive and have the basic knowledge, to analyze, to evaluate, and to develop the complex system "vehicle".

Literature

1. Robert Bosch GmbH: Automotive Handbook, 9th Edition, Wiley, Chichister 2015

2. Onori, S. / Serrao, L: / Rizzoni, G.: Hybrid Electric Vehicles - Energy Management Strategies, Springer London, Heidelberg, New York, Dordrecht 2016

3. Reif, K.: Brakes, Brake Control and Driver Assistance Systems - Function, Regulation and Components, Springer Vieweg, Wiesbaden 2015

4. Gauterin, F. / Gießler, M. / Gnadler, R.: Scriptum zur Vorlesung 'Automotive Engineering I', KIT, Institut für Fahrzeugsystemtechnik, Karlsruhe, jährlich aktualisiert

T 3.14 Course: Automotive Engineering II [T-MACH-102117]

Responsible: Prof. Dr. Frank Gauterin
Dr.-Ing. Hans-Joachim Unrau

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering
M-MACH-104878 - Specification in Mechanical Engineering

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	1

Events					
SS 2020	2114835	Automotive Engineering II	2 SWS	Lecture (V)	Unrau
SS 2020	2114855	Automotive Engineering II	2 SWS	Lecture (V)	Gießler
Exams					
WS 19/20	76-T-MACH-102117	Automotive Engineering II		Prüfung (PR)	Unrau, Gauterin
WS 19/20	76T-MACH-102117-2	Automotive Engineering II		Prüfung (PR)	Gauterin, Unrau

Competence Certificate
Written Examination

Duration: 90 minutes

Auxiliary means: none

Prerequisites
none

Below you will find excerpts from events related to this course:

V Automotive Engineering II

2114835, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
1. Chassis: Wheel suspensions (rear axles, front axles, kinematics of axles), tyres, springs, damping devices
2. Steering elements: Manual steering, servo steering, steer by wire
3. Brakes: Disc brake, drum brake, comparison of designs

Learning Objectives:

The students have an overview of the modules which are necessary for the tracking of a motor vehicle and the power transmission between vehicle bodywork and roadway. They have knowledge of different wheel suspensions, tyres, steering elements, and brakes. They know different design versions, functions and the influence on driving and braking behavior. They are able to correctly develop the appropriate components. They are ready to analyze, to evaluate, and to optimize the complex interaction of the different components under consideration of boundary conditions.

Literature
1. Heißing, B. / Ersoy, M.: Fahrwerkhandbuch: Grundlagen, Fahrdynamik, Komponenten, Systeme, Mechatronik, Perspektiven, Springer Vieweg, Wiesbaden, 2013

2. Breuer, B. / Bill, K.-H.: Bremsenhandbuch: Grundlagen - Komponenten - Systeme - Fahrdynamik, Springer Vieweg, Wiesbaden, 2017

3. Unrau, H.-J. / Gnadler, R.: Scriptum zur Vorlesung 'Grundlagen der Fahrzeugtechnik II', KIT, Institut für Fahrzeugsystemtechnik, Karlsruhe, jährliche Aktualisierung

V

Automotive Engineering II

2114855, SS 2020, 2 SWS, Language: English, Open in study portal

Lecture (V)

Content

1. Chassis: Wheel suspensions (rear axles, front axles, kinematics of axles), tyres, springs, damping devices
2. Steering elements: Manual steering, servo steering, steer by wire
3. Brakes: Disc brake, drum brake, comparison of the designs

Learning Objectives:

The students have an overview of the modules which are necessary for the tracking of a motor vehicle and the power transmission between vehicle and roadway. They have knowledge of different wheel suspensions, tyres, steering elements, and brakes. They know different design versions, functions and the influence on driving and braking behavior. They are able to correctly develop the appropriate components. They are ready to analyze, to evaluate, and to optimize the complex interaction of the different components under consideration of boundary conditions.

Literature
Elective literature:

1. Robert Bosch GmbH: Automotive Handbook, 9th Edition, Wiley, Chichester 2015
2. Heißing, B. / Ersoy, M.: Chassis Handbook - fundamentals, driving dynamics, components, mechatronics, perspectives, Vieweg+Teubner, Wiesbaden 2011
3. Gießler, M. / Gnadler, R.: Script to the lecture "Automotive Engineering II", KIT, Institut of Vehicle System Technology, Karlsruhe, annual update

T 3.15 Course: Automotive Vision [T-MACH-105218]

Responsible: Dr. Martin Lauer
Prof. Dr.-Ing. Christoph Stiller

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Written examination	6	Each summer term	2

Events					
SS 2020	2138340	Automotive Vision	3 SWS	Lecture (V)	Lauer
Exams					
WS 19/20	76-T-MACH-105218	Automotive Vision		Prüfung (PR)	Stiller, Lauer
SS 2020	76-T-MACH-105218	Automotive Vision		Prüfung (PR)	Stiller, Lauer

Competence Certificate
Type of Examination: written exam

Duration of Examination: 60 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Automotive Vision

2138340, SS 2020, 3 SWS, Language: English, Open in study portal

Lecture (V)

Content
Lernziele (EN):

Machine perception and interpretation of the environment for the basis for the generation of intelligent behaviour. Especially visual perception opens the door to novel automotive applications. First driver assistance systems can already improve safety, comfort and efficiency in vehicles. Yet, several decades of research will be required to achieve an automated behaviour with a performance equivalent to a human operator. The lecture addresses students in mechanical engineering and related subjects who intend to get an interdisciplinary knowledge in a state-of-the-art technical domain. Machine vision, vehicle kinematics and advanced information processing techniques are presented to provide a broad overview on ßeeing vehicles'. Application examples from cutting-edge and future driver
assistance systems illustrate the discussed subjects.

Lehrinhalt (EN):

1. Driver assistance systems
2. Binocular vision
3. Feature point methods
4. Optical flow/tracking in images
5. Tracking and state estimation
6. Self-localization and mapping
7. Lane recognition
8. Behavior recognition

Nachweis: Written examination 60 minutes

Arbeitsaufwand (EN): 120 hours

Literature
Foliensatz zur Veranstaltung wird als kostenlose pdf-Datei bereitgestellt. Weitere Empfehlungen werden in der Vorlesung bekannt gegeben.

T 3.16 Course: Basics in Measurement and Control Systems [T-MACH-104745]

Responsible: Prof. Dr.-Ing. Christoph Stiller
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104847 - Major Field Fundamentals of Engineering

Type	Credits	Recurrence	Version
Written examination	7	Each winter term	3

Events					
WS 19/20	2137301	Measurement and Control Systems	3 SWS	Lecture (V)	Stiller
WS 19/20	2137302	Measurement and Control Systems (Tutorial)	1 SWS	Practice (Ü)	Stiller, Kröper, Fischer
WS 19/20	3137020	Measurement and Control Systems	3 SWS	Lecture (V)	Stiller
WS 19/20	3137021	Measurement and Control Systems (Tutorial)	1 SWS	Practice (Ü)	Stiller, Kröper, Fischer
Exams					
WS 19/20	76-T-MACH-104745	Basis of Measurement and Control Systems		Prüfung (PR)	Stiller

Competence Certificate
written exam

2,5 hours

Prerequisites
none

Below you will find excerpts from events related to this course:

V Measurement and Control Systems

Lecture (V)

2137301, WS 19/20, 3 SWS, Language: German, Open in study portal

Content
Lehrinhalt (EN):

1 Dynamic systems
2 Properties of important systems and modeling
3 Transfer characteristics and stability
4 Controller design
5 Fundamentals of measurement
6 Estimation
7 Sensors
8 Introduction to digital measurement

Lernziele (EN):

Measurement and control of physical entities is a vital requirement in most technical applications. Such entities may comprise e.g. pressure, temperature, flow, rotational speed, power, voltage and electrical current, etc.. From a general perspective, the objective of measurement is to obtain information about the state of a system while control aims to influence the state of a system in a desired manner. This lecture provides an introduction to this field and general systems theory. The control part of the lecture presents classical linear control theory. The measurement part discusses electrical measurement of non-electrical entities.

Voraussetzungen (EN)

Fundamentals in physics and electrical engineering; ordinary linear differential equations; Laplace transform

Nachweis (EN)

written exam; duration 2,5 h; paper reference materials only (no calculator)

Arbeitsaufwand (EN):

210 hours

Literature
Buch zur Vorlesung:
C. Stiller: Grundlagen der Mess- und Regelungstechnik, Shaker Verlag, Aachen, 2005

- Measurement and Control Systems:

R.H. Cannon: Dynamics of Physical Systems, McGraw-Hill Book Comp., New York, 1967
G.F. Franklin: Feedback Control of Dynamic Systems, Addison-Wesley Publishing Company, USA, 1988
R. Dorf and R. Bishop: Modern Control Systems, Addison-Wesley
C. Phillips and R. Harbor: Feedback Control Systems, Prentice-Hall

- Regelungstechnische Bücher:

J. Lunze: Regelungstechnik 1 & 2, Springer-Verlag
R. Unbehauen: Regelungstechnik 1 & 2, Vieweg-Verlag
O. Föllinger: Regelungstechnik, Hüthig-Verlag
W. Leonhard: Einführung in die Regelungstechnik, Teubner-Verlag
Schmidt, G.: Grundlagen der Regelungstechnik, Springer-Verlag, 2. Aufl., 1989

- Messtechnische Bücher:

E. Schrüfer: Elektrische Meßtechnik, Hanser-Verlag, München, 5. Aufl., 1992
U. Kiencke, H. Kronmüller, R. Eger: Meßtechnik, Springer-Verlag, 5. Aufl., 2001
H.-R. Tränkler: Taschenbuch der Messtechnik, Verlag Oldenbourg München, 1996
W. Pfeiffer: Elektrische Messtechnik, VDE Verlag Berlin 1999
Kronmüller, H.: Prinzipien der Prozeßmeßtechnik 2, Schnäcker-Verlag, Karlsruhe, 1. Aufl., 1980

V **Measurement and Control Systems** **Lecture (V)**
3137020, WS 19/20, 3 SWS, Language: English, Open in study portal

Content
Lehrinhalt (EN):

1 Dynamic systems
2 Properties of important systems and modeling
3 Transfer characteristics and stability
4 Controller design
5 Fundamentals of measurement
6 Estimation
7 Sensors
8 Introduction to digital measuremen

Lernhziele (EN):

Measurement and control of physical entities is a vital requirement in most technical applications. Such entities may comprise e.g. pressure, temperature, flow, rotational speed, power, voltage and electrical current, etc.. From a general perspective, the objective of measurement is to obtain information about the state of a system while control aims to influence the state of a system in a desired manner. This lecture provides an introduction to this field and general systems theory. The control part of the lecture presents classical linear control theory. The measurement part discusses electrical measurement of non-electrical entities.

Nachweis (EN): written exam; duration 2,5 h; paper reference materials only (no calculator)

Arbeitsaufwand (EN): 180 hours

Literature

- Measurement and Control Systems:

R.H. Cannon: Dynamics of Physical Systems, McGraw-Hill Book Comp., New York,1967
G.F. Franklin: Feedback Control of Dynamic Systems, Addison-Wesley Publishing Company, USA, 1988
R. Dorf and R. Bishop: Modern Control Systems, Addison-Wesley
C. Phillips and R. Harbor: Feedback Control Systems, Prentice-Hall

- Regelungstechnische Bücher:

J. Lunze: Regelungstechnik 1 & 2, Springer-Verlag
R. Unbehauen: Regelungstechnik 1 & 2, Vieweg-Verlag
O. Föllinger: Regelungstechnik, Hüthig-Verlag
W. Leonhard: Einführung in die Regelungstechnik, Teubner-Verlag
Schmidt, G.: Grundlagen der Regelungstechnik, Springer-Verlag, 2. Aufl., 1989

- Messtechnische Bücher:

E. Schrüfer: Elektrische Meßtechnik, Hanser-Verlag, München, 5. Aufl., 1992
U. Kiencke, H. Kronmüller, R. Eger: Meßtechnik, Springer-Verlag, 5. Aufl., 2001
H.-R. Tränkler: Taschenbuch der Messtechnik, Verlag Oldenbourg München, 1996
W. Pfeiffer: Elektrische Messtechnik, VDE Verlag Berlin 1999
Kronmüller, H.: Prinzipien der Prozeßmeßtechnik 2, Schnäcker-Verlag, Karlsruhe, 1. Aufl., 1980

V Measurement and Control Systems (Tutorial)

3137021, WS 19/20, 1 SWS, Language: English, Open in study portal

Practice (Ü)

Content
Tutorial for Event 3137020

T 3.17 Course: Basics of Technical Logistics I [T-MACH-109919]

Responsible: Dr.-Ing. Martin Mittwollen
Jan Oellerich

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104852 - Major Field Production Technology

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	1

Events					
WS 19/20	2117095	Basics of Technical Logistics	3 SWS	Lecture / Practice (VÜ)	Mittwollen, Oellerich
Exams					
WS 19/20	76-T-MACH-109919	Basics of Technical Logistics I		Prüfung (PR)	Mittwollen

Competence Certificate
The assessment consists of a written exam (60 min.) according to § 4 paragraph 2 Nr. 1 of the examination regulation.

Prerequisites
none

Recommendation
Knowledge of the basics of technical mechanics preconditioned.

Below you will find excerpts from events related to this course:

V Basics of Technical Logistics

2117095, WS 19/20, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Content

- effect model of conveyor machines
- elements for the change of position and orientation
- conveyor processes
- identification systems
- drives
- mechanical behaviour of conveyors
- structure and function of conveyor machines
- elements of intralogistics
- sample applications and calculations in addition to the lectures inside practical lectures

Students are able to:

- Describe processes and machines of technical logistics,
- Model the fundamental structures and the impacts of material handling machines with mathematical models,
- Refer to industrially used machines
- Model real machines applying knowledge from lessons and calculate their dimensions.

Literature
Empfehlungen in der Vorlesung / Recommendations during lessons

3.18 Course: Basics of Technical Logistics II [T-MACH-109920]

Responsible: Maximilian Hochstein
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104852 - Major Field Production Technology

Type	Credits	Recurrence	Version
Written examination	5	Each winter term	1

Events					
WS 19/20	2100001	Basics of Technical Logistics II	3 SWS	Lecture / Practice (VÜ)	Hochstein
Exams					
WS 19/20	76-T-MACH-109920	Basics of Technical Logistics II		Prüfung (PR)	Mittwollen

Competence Certificate
The assessment consists of a written exam (60 min.) according to § 4 paragraph 2 Nr. 1 of the examination regulation.

Prerequisites
none

Recommendation
Knowledge of the basics of technical mechanics and out of "Basic of Technical Logstics I" (T-MACH-109919) preconditioned.

T 3.19 Course: Behaviour Generation for Vehicles [T-MACH-105367]

Responsible: Prof. Dr.-Ing. Christoph Stiller
Dr. Moritz Werling
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	1

Events					
WS 19/20	2138336	Behaviour Generation for Vehicles	2 SWS	Lecture (V)	Werling, Stiller
SS 2020	2138336	Behaviour Generation for Vehicles	2 SWS	Lecture (V)	Werling, Stiller
Exams					
WS 19/20	76-T-MACH-105367	Behaviour Generation for Vehicles		Prüfung (PR)	Stiller

Competence Certificate
written examination

60 min.

Simple calculators are allowed, programmable or graphical ones are prohibited.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Behaviour Generation for Vehicles — Lecture (V)
2138336, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
Lernziele (EN):

Modern vehicle control systems like ABS or ESP transform the intention of the driver into a corresponding behaviour of the vehicle. This is achieved by compensating disturbances like a varying traction for example. Within the recent years, vehicles have been increasingly equipped with sensors that gather information about the environment (Radar, Lidar and Video for example). This enables the vehicles to generate an 'intelligent' behaviour and transform this behaviour into control signals for actors. Several so called 'driver assistance systems' have already achieved remarkable improvements as far as comfort, safety and efficiency are concerned. But nevertheless, several decades of research will be required to achieve an automated behaviour with a performance equivalent to a human operator ('the driver'). The lecture addresses students in mechanical engineering and related subjects who intend to get an interdisciplinary knowledge in a state-of-the-art technical domain. Information technology, control theory and kinematic aspects are treated to provide a broad overview over vehicle guidance. Application examples from cutting-edge and future driver assistance systems illustrate the discussed subjects.

Nachweis: written exam

Arbeitsaufwand: 120 hours

Literature
Foliensatz zur Veranstaltung wird als kostenlose pdf-Datei bereitgestellt. Weitere Empfehlungen werden in der Vorlesung bekannt gegeben.

V Behaviour Generation for Vehicles — Lecture (V)
2138336, SS 2020, 2 SWS, Language: German, Open in study portal

Content
Lernziele (EN):

Modern vehicle control systems like ABS or ESP transform the intention of the driver into a corresponding behaviour of the vehicle. This is achieved by compensating disturbances like a varying traction for example. Within the recent years, vehicles have been increasingly equipped with sensors that gather information about the environment (Radar, Lidar and Video for example). This enables the vehicles to generate an 'intelligent' behaviour and transform this behaviour into control signals for actors. Several so called 'driver assistance systems' have already achieved remarkable improvements as far as comfort, safety and efficiency are concerned. But nevertheless, several decades of research will be required to achieve an automated behaviour with a performance equivalent to a human operator ('the driver'). The lecture addresses students in mechanical engineering and related subjects who intend to get an interdisciplinary knowledge in a state-of-the-art technical domain. Information technology, control theory and kinematic aspects are treated to provide a broad overview over vehicle guidance. Application examples from cutting-edge and future driver assistance systems illustrate the discussed subjects.

Nachweis: written exam 60 minutes

Arbeitsaufwand: 120 hours

Literature
Foliensatz zur Veranstaltung wird als kostenlose pdf-Datei bereitgestellt. Weitere Empfehlungen werden in der Vorlesung bekannt gegeben.

T 3.20 Course: Bioelectric Signals [T-ETIT-101956]

Responsible: Dr.-Ing. Axel Loewe
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the Department of Electrical Engineering and Information Technology

Type	Credits	Recurrence	Version
Written examination	3	Each summer term	2

Events					
SS 2020	2305264	Bioelectric Signals	2 SWS	Lecture (V)	Loewe
Exams					
SS 2020	7305264	Bioelectric Signals		Prüfung (PR)	Loewe

Competence Certificate
The examination is a written examination with a duration of 90 minutes.

Prerequisites
none

T 3.21 Course: Biomedical Measurement Techniques I [T-ETIT-106492]

Responsible: Prof. Dr. Werner Nahm
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the Department of Electrical Engineering and Information Technology

Type	Credits	Recurrence	Version
Written examination	3	Each winter term	1

Events					
WS 19/20	2305269	Biomedical Measurement Techniques I	2 SWS	Lecture (V)	Nahm
Exams					
WS 19/20	7305269	Biomedical Measurement Techniques I		Prüfung (PR)	Nahm

Prerequisites
T-ETIT-101928 - Biomedizinische Messtechnik I darf weder begonnen noch abgeschlossen sein.

T 3.22 Course: BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I [T-MACH-100966]

Responsible: Prof. Dr. Andreas Guber
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104850 - Major Field Mechatronics and Microsystem Technology

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	2

Events					
WS 19/20	2141864	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I	2 SWS	Lecture (V)	Guber
Exams					
WS 19/20	76-T-MACH-100966	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I		Prüfung (PR)	Guber

Competence Certificate
written exam (75 Min.)

Prerequisites
none

Below you will find excerpts from events related to this course:

V BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I

Lecture (V)

2141864, WS 19/20, 2 SWS, Language: German, Open in study portal

Literature
Menz, W., Mohr, J., O. Paul: Mikrosystemtechnik für Ingenieure, VCH-Verlag, Weinheim, 2005

M. Madou
Fundamentals of Microfabrication
Taylor & Francis Ltd.; Auflage: 3. Auflage. 2011

T 3.23 Course: BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II [T-MACH-100967]

Responsible: Prof. Dr. Andreas Guber
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104850 - Major Field Mechatronics and Microsystem Technology

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	2

Events					
SS 2020	2142883	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II	2 SWS	Lecture (V)	Guber
Exams					
WS 19/20	76-T-MACH-100967	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II		Prüfung (PR)	Guber

Competence Certificate
Written exam (75 Min.)

Prerequisites
none

Below you will find excerpts from events related to this course:

V BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II

2142883, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Examples of use in Life-Sciences and biomedicine: Microfluidic Systems:
LabCD, Protein Cristallisation
Microarrys
Tissue Engineering
Cell Chip Systems
Drug Delivery Systems
Micro reaction technology
Microfluidic Cells for FTIR-Spectroscopy
Microsystem Technology for Anesthesia, Intensive Care and Infusion
Analysis Systems of Person´s Breath
Neurobionics and Neuroprosthesis
Nano Surgery

Literature
Menz, W., Mohr, J., O. Paul: Mikrosystemtechnik für Ingenieure, VCH-Verlag, Weinheim, 2005

Buess, G.: Operationslehre in der endoskopischen Chirurgie, Band I und II;
Springer-Verlag, 1994

M. Madou
Fundamentals of Microfabrication

T 3.24 Course: BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III [T-MACH-100968]

Responsible: Prof. Dr. Andreas Guber
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104850 - Major Field Mechatronics and Microsystem Technology

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	2

Events					
SS 2020	2142879	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III	2 SWS	Lecture (V)	Guber
Exams					
WS 19/20	76-T-MACH-100968	BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III		Prüfung (PR)	Guber

Competence Certificate
Written exam (75 Min.)

Prerequisites
none

Below you will find excerpts from events related to this course:

V BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III — Lecture (V)
2142879, SS 2020, 2 SWS, Language: German, Open in study portal

Content
Examples of use in minimally invasive therapy
Minimally invasive surgery (MIS)
Endoscopic neurosurgery
Interventional cardiology
NOTES
OP-robots and Endosystems
License of Medical Products and Quality Management

Literature
Menz, W., Mohr, J., O. Paul: Mikrosystemtechnik für Ingenieure, VCH-Verlag, Weinheim, 2005

Buess, G.: Operationslehre in der endoskopischen Chirurgie, Band I und II;
Springer-Verlag, 1994

M. Madou
Fundamentals of Microfabrication

T 3.25 Course: Bionics for Engineers and Natural Scientists [T-MACH-102172]

Responsible: PD Dr. Hendrik Hölscher
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104850 - Major Field Mechatronics and Microsystem Technology

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2142140	Bionics for Engineers and Natural Scientists	2 SWS	Lecture (V)	Hölscher, Greiner
Exams					
WS 19/20	76-T-MACH-102172	Bionics for Engineers and Natural Scientists		Prüfung (PR)	Hölscher

Competence Certificate
written or oral exam

Prerequisites
none

Below you will find excerpts from events related to this course:

V Bionics for Engineers and Natural Scientists
2142140, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Bionics focuses on the design of technical products following the example of nature. For this purpose we have to learn from nature and to understand its basic design rules. Therefore, the lecture focuses on the analysis of the fascinating effects used by many plants and animals. Possible implementations into technical products are discussed in the end.

The students should be able analyze, judge, plan and develop biomimetic strategies and products.

Basic knowledge in physics and chemistry

The successfull attendence of the lecture is controlled by a written examination.

Literature
Folien und Literatur werden in ILIAS zur Verfügung gestellt.

T 3.26 Course: BUS-Controls [T-MACH-102150]

Responsible: Simon Becker
Prof. Dr.-Ing. Marcus Geimer

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	2

Events					
SS 2020	2114092	BUS-Controls	2 SWS	Lecture (V)	Geimer, Daiß, Metzger
Exams					
WS 19/20	76T-MACH-102150	BUS-Controls		Prüfung (PR)	Geimer
WS 19/20	76-T-MACH-102150	BUS-Controls		Prüfung (PR)	Geimer
SS 2020	76T-MACH-102150	BUS-Controls		Prüfung (PR)	Geimer

Competence Certificate
The assessment consists of an oral exam (20 min) taking place in the recess period. The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Prerequisites
Required for the participation in the examination is the preparation of a report during the semester. The partial service with the code T-MACH-108889 must have been passed.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-108889 - BUS-Controls - Advance must have been passed.

Recommendation
Basic knowledge of electrical engineering is recommended. Programming skills are also helpful.

The number of participants is limited. A registration in mandatory, the details will be announced on the webpages of the *Institute of Vehicle System Technology / Institute of Mobile Machines.* In case of too many applications, attendance will be granted based on pre-qualification.

Annotation
The students will get an overview of the theoretic and practical functioning of different bus systems.

After the practical oriented lessons the students will be able to visualize the communication structure of different applications, design basic systems and evaluate the complexity of programming of the complete system.
Hereunto the students program in the practical orientated lessons IFM-controllers using the programming environment CoDeSys.

Content:

- Knowledge of the basics of data communication in networks
- Overview of the operating mode of current field buses
- Explicit observation of the operating mode and application areas of CAN buses
- Practical programming of an example application (hardware is provided)

Literature:

- Etschberger, K.: Controller Area Network, Grundlagen, Protokolle, Bausteine, Anwendungen; München, Wien: Carl Hanser Verlag, 2002.
- Engels, H.: CAN-Bus - CAN-Bus-Technik einfach, anschaulich und praxisnah dargestellt; Poing: Franzis Verlag, 2002.

Below you will find excerpts from events related to this course:

V

BUS-Controls

2114092, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content

- Knowledge of the basics of data communication in networks
- Overview of the operating mode of current field buses
- Explicit observation of the operating mode and application areas of CAN buses
- Practical programming of an example application (hardware is provided)

Basic knowledge of electrical engineering is recommended. Programming skills are also helpful.

- regular attendance: 21 hours
- self-study: 92 hours

Literature
Weiterführende Literatur:

- Etschberger, K.: Controller Area Network, Grundlagen, Protokolle, Bausteine, Anwendungen; München, Wien: Carl Hanser Verlag, 2002.
- Engels, H.: CAN-Bus - CAN-Bus-Technik einfach, anschaulich und praxisnah dargestellt; Poing: Franzis Verlag, 2002.

T 3.27 Course: BUS-Controls - Advance [T-MACH-108889]

Responsible: Kevin Daiß
Prof. Dr.-Ing. Marcus Geimer

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Completed coursework	0	Each summer term	1

Exams				
WS 19/20	76-T-MACH-108889	BUS-Controls - Advance	Prüfung (PR)	Geimer
SS 2020	76-T-MACH-108889	BUS-Controls - Advance	Prüfung (PR)	Geimer

Competence Certificate
Creation of control program

Prerequisites
none

T 3.28 Course: CAD-NX Training Course [T-MACH-102187]

Responsible: Prof. Dr.-Ing. Jivka Ovtcharova
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104851 - Major Field Product Development and Construction

Type	Credits	Recurrence	Version
Completed coursework (practical)	2	Each term	2

Events					
WS 19/20	2123357	CAD-NX training course	2 SWS	Practical course (P)	Ovtcharova, Mitarbeiter
SS 2020	2123357	CAD-NX training course	2 SWS	Practical course (P)	Ovtcharova, Mitarbeiter
Exams					
WS 19/20	76-T-MACH-102187	CAD-NX Training Course		Prüfung (PR)	Ovtcharova

Competence Certificate
Practical examination on CAD computer, duration: 60 min.

Prerequisites
None

Recommendation
Dealing with technical drawings is required.

Annotation
For the practical course compulsory attendance exists.

Below you will find excerpts from events related to this course:

V CAD-NX training course

2123357, WS 19/20, 2 SWS, Language: German, Open in study portal

Practical course (P)

Content

- Overview of the functional range
- Introduction to the work environment of NX
- Basics of 3D-CAD modelling
- Feature-based modelling
- Freeform modelling
- Generation of technical drawings
- Assembly modelling
- Finite element method (FEM) and multi-body simulation (MBS) with NX

Students are able to:

- create their own 3D geometric models in the CAD system NX and generate drawings due to the created geometry
- carry out FE-studies and kinematic simulations using the integrated CAE tools
- use advanced, knowledge-based functionalities of NX to automate the creation of geometry and thus to ensure the reusability of the models.

Literature
Praktikumsskript

V

CAD-NX training course

2123357, SS 2020, 2 SWS, Language: German, Open in study portal

Practical course (P)

Content

- Overview of the functional range
- Introduction to the work environment of NX
- Basics of 3D-CAD modelling
- Feature-based modelling
- Freeform modelling
- Generation of technical drawings
- Assembly modelling
- Finite element method (FEM) and multi-body simulation (MBS) with NX

Students are able to:

- create their own 3D geometric models in the CAD system NX and generate drawings due to the created geometry
- carry out FE-studies and kinematic simulations using the integrated CAE tools
- use advanced, knowledge-based functionalities of NX to automate the creation of geometry and thus to ensure the reusability of the models.

Literature
Praktikumsskript

T 3.29 Course: CAE-Workshop [T-MACH-105212]

Responsible: Prof. Dr.-Ing. Albert Albers
Prof. Dr.-Ing. Sven Matthiesen

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104851 - Major Field Product Development and Construction

Type	Credits	Recurrence	Version
Examination of another type	4	Each term	2

Events					
WS 19/20	2147175	CAE-Workshop	3 SWS	Block (B)	Albers, Mitarbeiter
SS 2020	2147175	CAE-Workshop	3 SWS	Block (B)	Albers, Mitarbeiter
Exams					
WS 19/20	76-T-MACH-105212	CAE-Workshop		Prüfung (PR)	Albers

Competence Certificate
Written test (with practical part on the computer), duration 60 min.

Prerequisites
None

Annotation
For a successful participation in the examination a continuous attendance at the workshop days is necessary. Limited number of participants. Selection is made according to a selection procedure.

Below you will find excerpts from events related to this course:

V CAE-Workshop

2147175, WS 19/20, 3 SWS, Language: German, Open in study portal

Block (B)

Content
Content:

- Introduction to the finite element analysis (FEA)
- Stess and modal analysis of finite element models using Abaqus/CAE as a preprocessor and Abaqus solver
- Introduction to topology and shape optimization
- Creation and calculation of various optimization models with the Abaqus optimization package

The students are able to:

- name the purposes and limits of numerical simulation and optimization of the virtual product development.
- solve simple realistic tasks in the field of finite element analysis, multi-body-simulation and structure optimization with industrial common software (the content in winter and summer term is different).
- evaluate and to question the results of a simulation.
- identify and improve the mistakes of a simulation or optimization.

Exam: 1h Regularly written

Regular attendance: 31.5 h

Self-study: 58 h

Literature
Kursunterlagen werden in Ilias bereitgestellt.

Content is provided on Ilias.

V CAE-Workshop

2147175, SS 2020, 3 SWS, Language: German, Open in study portal

Block (B)

Content
Content:

- Introduction to the finite element analysis (FEA)
- Stess and modal analysis of finite element models using Abaqus/CAE as a preprocessor and Abaqus solver
- Introduction to topology and shape optimization
- Creation and calculation of various optimization models with the Abaqus optimization package

The students are able to:

- name the purposes and limits of numerical simulation and optimization of the virtual product development.
- solve simple realistic tasks in the field of finite element analysis, multi-body-simulation and structure optimization with industrial common software (the content in winter and summer term is different).
- evaluate and to question the results of a simulation.
- identify and improve the mistakes of a simulation or optimization.

Exam: 1h Regularly written

Regular attendance: 31.5 h

Self-study: 58 h

Literature
Kursunterlagen werden in Ilias bereitgestellt.
Content is provided on Ilias.

T 3.30 Course: CATIA Advanced [T-MACH-105312]

Responsible: Prof. Dr.-Ing. Jivka Ovtcharova
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104851 - Major Field Product Development and Construction

Type	Credits	Recurrence	Version
Examination of another type	4	Each term	1

Events					
WS 19/20	2123380	Advanced CATIA	3 SWS	Project (PRO)	Ovtcharova, Mitarbeiter
SS 2020	2123380	CATIA advanced	3 SWS	Project (PRO)	Ovtcharova, Mitarbeiter

Competence Certificate
Assessment of another type. Design project and written documentation in team work and final presentation. Grading: Project work 3/5, documentation 1/5 and presentation 1/5.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Advanced CATIA

2123380, WS 19/20, 3 SWS, Language: German/English, Open in study portal

Project (PRO)

Content
In this design project, students develop a product in small groups according to an agile approach using the 3DEXPERIENCE platform (CATIA V6) from Dassault Systèmes. The extended functionalities of the platform are addressed and model-based work is carried out.

The development process is traced from the idea to the finished model. The main focus is on independent solution finding, teamwork, function fulfillment, production and design. The project results are presented at the end of the semester.

Literature
Keine / None

V CATIA advanced

2123380, SS 2020, 3 SWS, Language: German/English, Open in study portal

Project (PRO)

Content
In this design project, students develop a product in small groups according to an agile approach using the 3DEXPERIENCE platform (CATIA V6) from Dassault Systèmes. The extended functionalities of the platform are addressed and model-based work is carried out.

The development process is traced from the idea to the finished model. The main focus is on independent solution finding, teamwork, function fulfillment, production and design. The project results are presented at the end of the semester.

Literature
Keine / None

T 3.31 Course: CATIA CAD Training Course [T-MACH-102185]

Responsible: Prof. Dr.-Ing. Jivka Ovtcharova
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104851 - Major Field Product Development and Construction

Type	Credits	Recurrence	Version
Completed coursework (practical)	2	Each term	2

Events					
WS 19/20	2123358	CATIA CAD training course	2 SWS	Practical course (P)	Ovtcharova, Mitarbeiter
SS 2020	2123358	CATIA CAD training course	3 SWS	Practical course (P)	Ovtcharova, Mitarbeiter
Exams					
WS 19/20	76-T-MACH-102185	CATIA CAD Training Course		Prüfung (PR)	Ovtcharova

Competence Certificate
Practical examination on CAD computer, duration: 60 min.

Prerequisites
None

Recommendation
Dealing with technical drawings is required.

Annotation
For the practical course attendance is compulsory.

Below you will find excerpts from events related to this course:

V CATIA CAD training course
2123358, WS 19/20, 2 SWS, Language: German, Open in study portal

Practical course (P)

Content

- Basics of CATIA such as user interface, handling etc.
- Production and processing of different model types
- Production of basic geometries and parts
- Generation of detailed drawings
- Integration of partial solutions in modules
- Working with constrains
- Strength analysis with FEM
- Kinematic simulation with DMU
- Dealing with CATIA Knowledgeware

Students are able to:

- create their own 3D geometric models in the CAD system CATIA and generate drawings due to the created geometry
- carry out FE-studies and kinematic simulations using the integrated CAE tools
- use advanced, knowledge-based functionalities of CATIA to automate the creation of geometry and thus to ensure the reusability of the models.

Literature
Praktikumskript

V

CATIA CAD training course

2123358, SS 2020, 3 SWS, Language: German, Open in study portal

Practical course (P)

Content

- Basics of CATIA such as user interface, handling etc.
- Production and processing of different model types
- Production of basic geometries and parts
- Generation of detailed drawings
- Integration of partial solutions in modules
- Working with constrains
- Strength analysis with FEM
- Kinematic simulation with DMU
- Dealing with CATIA Knowledgeware

Students are able to:

- create their own 3D geometric models in the CAD system CATIA and generate drawings due to the created geometry
- carry out FE-studies and kinematic simulations using the integrated CAE tools
- use advanced, knowledge-based functionalities of CATIA to automate the creation of geometry and thus to ensure the reusability of the models.

Literature
Praktikumskript

T 3.32 Course: Ceramic Matrix Composites [T-MACH-106722]

Responsible: Prof. Dr.-Ing. Dietmar Koch
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Competence Certificate
oral exam

T 3.33 Course: CFD in Power Engineering [T-MACH-105407]

Responsible: Dr. Ivan Otic
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104878 - Specification in Mechanical Engineering
M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2130910	CFD for Power Engineering	2 SWS	Lecture (V)	Otic
Exams					
WS 19/20	76-T-MACH-105407	CFD in Power Engineering		Prüfung (PR)	Otic

Competence Certificate
Oral exam, 30 min

Prerequisites
none

Below you will find excerpts from events related to this course:

V CFD for Power Engineering
2130910, SS 2020, 2 SWS, Language: English, Open in study portal

Lecture (V)

Content
Contents:

The course is aimed of giving the fundamental of Computational Fluid Dynamics (CFD) for energy technologies. Starting from the basic physical phenomena equations an overview on computational methods and turbulence modeling is given.
The course consists of both, a theoretical and a numerical component. The former will deal with the derivations and properties of the methods and models for CFD. The numerical part will make use of open source CFD computer program OpenFOAM to give a "hands on" insight into the simulation of turbulent flows. After completing the course you should be able to establish a connection between theory and CFD modeling and simulation for energy applications.

Tentative Course Outline:
The weekly coverage might change as it depends on the progress of the class.
Content
1 Introduction: What is Computational Fluid Dynamics?
2 Governing Equations
3 Numerical Methods: Introduction
4 Numerical Methods: Finite Volume
5 Numerical Methods: Solution of ordinary differential equations
6 Numerical Methods: Convergence and numerical stability
7 Turbulence and Turbulence Modelling
8 Reynolds Averaged Navier-Stokes Simulation Approach
9 Heat Transfer

CFD Project:

- Part of this class is performing CFD simulations of turbulent heat and mass transfer using open-source CFD software OpenFOAM
- After CFD analysis is completed students have to write a technical report
- Projects are to be performed individually or in teams of two but every student writes his own report
- The CFD analysis technical report is part of the final examination.

Objectives:

After completing the course students:

- are able to understand fundamentals of non-linear partial differential equations
- will get working knowledge of computational techniques that can be used for solving engineering heat and mass transfer problems
- are able to understand fundamentals of statistical fluid mechanics and to derive RANS transport equations
- have learned how to computationally solve turbulent heat and mass transfer problems using OpenFOAM software
- are able to present their results in form of technical report.

Literature
Vorlesungsskript

Projektskript und Unterlagen

An Introduction to Computational Fluid Dynamics: The Finite Volume Method, H. Versteeg and W. Malalasekra, 2007.

Ferziger, J; Peric, M.: Computational Methods for Fluid Dynamics, Springer 2002.

T 3.34 Course: CFD-Lab Using OpenFOAM [T-MACH-105313]

Responsible: Dr.-Ing. Rainer Koch
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Completed coursework	4	Each winter term	1

Events					
WS 19/20	2169459	CFD-Lab using OpenFOAM	3 SWS	Practical course (P)	Koch
Exams					
WS 19/20	76-T-MACH-105313	CFD-Lab Using Open Foam		Prüfung (PR)	Koch

Competence Certificate
Successful solution of problems

Prerequisites
none

Below you will find excerpts from events related to this course:

V CFD-Lab using OpenFOAM
2169459, WS 19/20, 3 SWS, Language: German, Open in study portal

Practical course (P)

Content

- Successful solution of problems
- A CD containing the course material will be handed out to the students

- Introduction to using Open Foam
- Grid generation
- Boundary conditions
- Numerical errors
- Discretization schemes
- Turbulence models
- Two phase flow - spray
- Two Phase flow - Volume of Fluid method

The students are able to:

- use OpenFOAM
- generate simple grids or import grids into OpenFOAM
- choose and define appropriate boundary conditions
- estimate numerical errors and asses them
- judge turbulence models and select an appropriate model
- simulate 2-phase flows using suitable models

Literature

- Dokumentation zu Open Foam
- www.open foam.com/docs

T 3.35 Course: Chemical Fuels [T-CIWVT-110307]

Responsible: Prof. Dr. Reinhard Rauch
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-MACH-105100 - Courses of the Department of Chemical and Process Engineering

Type	Credits	Recurrence	Version
Oral examination	6	Each summer term	2

Events					
SS 2020	22331	Chemical Fuels (ENTECH)	2 SWS	Lecture (V)	Rauch
Exams					
SS 2020	7230020	Chemical Fuels		Prüfung (PR)	Rauch

Competence Certificate
Learning Control is an oral examination with a duration of about 20 minutes.

Prerequisites
None

Below you will find excerpts from events related to this course:

V Chemical Fuels (ENTECH) — Lecture (V)
22331, SS 2020, 2 SWS, Language: English, Open in study portal

T 3.36 Course: Chemical, Physical and Material Scientific Aspects of Polymers in Microsystem Technologies [T-MACH-102169]

Responsible: Dr.-Ing. Matthias Worgull
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104850 - Major Field Mechatronics and Microsystem Technology

Type	Credits	Recurrence	Version
Oral examination	3	Each term	1

Competence Certificate
The assessment will consist of a oral exam (30 min) (following §4 (2), 2 of the examination regulation).

Prerequisites
none

T 3.37 Course: Coal Fired Power Plants [T-MACH-105410]

Responsible: Prof. Dr.-Ing. Thomas Schulenberg
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104878 - Specification in Mechanical Engineering
M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2169461	Coal fired power plants	2 SWS	Lecture (V)	Schulenberg

Competence Certificate
Oral examination, Duration approximately 30 Minutes

no tools or reference materials may be used during the exam

Prerequisites
none

Below you will find excerpts from events related to this course:

V Coal fired power plants

Lecture (V)

2169461, WS 19/20, 2 SWS, Language: English, Open in study portal

Content
This lecture will be omitted until further

T 3.38 Course: Cognitive Automobiles - Laboratory [T-MACH-105378]

Responsible: Bernd Kitt
Dr. Martin Lauer
Prof. Dr.-Ing. Christoph Stiller

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104850 - Major Field Mechatronics and Microsystem Technology

Type	Credits	Recurrence	Version
Oral examination	6	Each summer term	1

Events					
SS 2020	2138341	Cogitive Automobiles - Laboratory	3 SWS		Stiller, Lauer, Kamran

Competence Certificate
oral exam

30 minutes

Prerequisites
none

Annotation
The number of participants is limited. A registration is mandatory, the details are announced on the webpages of the institute of measurement and control systems (mrt). In case of too many interested students a subset will be selected (see website).

Below you will find excerpts from events related to this course:

V Cogitive Automobiles - Laboratory
2138341, SS 2020, 3 SWS, Language: German, Open in study portal

Content
Lehrinhalt (EN):

1. Lane recognition
2. Object detection
3. Vehicle lateral control
4. Vehicle longitudinal control
5. Collision avoidance

Lernziele (EN):

The laboratory accompanies the lectures "Automotive Vision" and "Behaviour Generation for Vehicles". It will provide the opportunity of turning theoretical skills taught in the lecture to practice. The laboratory is divided into four groups with a maximum number of five students in each group. During the lessons you will be supervised by scientific staff.
The lecture addresses students in mechanical engineering and related subjects who intend to get an interdisciplinary knowledge in a state-of-the-art technical domain. Machine vision, vehicle kinematics and advanced information processing techniques are presented to provide a broad overview on "seeing vehicles". Each group is given the task to extract lane markings from video images and generate a suitable trajectory which the vehicle should follow. Apart from technical aspects in a highly innovative field of automotive technology, participants have the opportunity of gathering important qualifications as i.e. implementation skills, acquisition and comprehension of suitable literature, project and team work.

Nachweis: Colloquia, final race

Arbeitsaufwand: 120 hours

Literature
Dokumentation zur SW und HW werden als pdf bereitgestellt.

T 3.39 Course: Cognitive Systems [T-INFO-101356]

Responsible: Prof. Dr. Gerhard Neumann
Prof. Dr. Alexander Waibel
Organisation: KIT Department of Informatics
Part of: M-MACH-104883 - Courses of the Department of Informatics

Type	Credits	Recurrence	Version
Written examination	6	Each summer term	1

Events					
SS 2020	24572	Kognitive Systeme	4 SWS	Lecture / Practice (VÜ)	Waibel, Stüker, Meißner, Neumann
Exams					
WS 19/20	7500332	Cognitive Systems examination		Prüfung (PR)	Waibel, Dillmann

T 3.40 Course: Combined Cycle Power Plants [T-MACH-105444]

Responsible: Prof. Dr.-Ing. Thomas Schulenberg
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104878 - Specification in Mechanical Engineering
M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2170490	Combined Cycle Power Plants	2 SWS	Lecture (V)	Schulenberg
Exams					
WS 19/20	76-T-MACH-105444	Combined Cycle Power Plants		Prüfung (PR)	Schulenberg

Competence Certificate
oral exam ca. 30 min

Prerequisites
none

Recommendation
We recommend to combine the lecture with the Simulator Exercises for Combined Cycle Power Plants (T-MACH-105445).

Below you will find excerpts from events related to this course:

V Combined Cycle Power Plants

2170490, SS 2020, 2 SWS, Language: English, Open in study portal

Lecture (V)

Content
The training objective of the course is the qualification for a research-related professional activity in power plant engineering. The participants can name the most important components of the combined cycle power plant and describe their function. They can design or modify combined cycle power plants independently and creatively. They have acquired a broad knowledge of this power plant technology, including specific knowledge of gas turbine design, steam turbine design and boiler design. On this basis, they can describe and analyze the specific behavior of the power plant components as well as the entire power plant in the grid. Participants in the lecture have a trained analytical thinking and judgment in power plant design.

Layout of a combined cycle power plant, design and operation of gas turbines, of the heat recovery steam generator, of the feedwater system and cooling systems. Design and operation of steam turbines, of the generator and its electrical systems. System response to challinging grids, protection systems, water make-up and water chemistry. Design concepts of different power plant manufacturers, innovative power plant concepts.

Literature
Die gezeigten Vorlesungsfolien und weiteres Unterrichtsmaterial werden bereitgestellt.

Ferner empfohlen:

C. Lechner, J. Seume, Stationäre Gasturbinen, Springer Verlag, 2. Auflage 2010

T 3.41 Course: Combustion Engines I [T-MACH-102194]

Responsible: Prof. Dr. Thomas Koch
Dr.-Ing. Heiko Kubach

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2133113	Combustion Engines I	4 SWS	Lecture / Practice (VÜ)	Koch
Exams					
WS 19/20	76-T-MACH-102194	Combustion Engines I		Prüfung (PR)	Kubach, Koch
SS 2020	76-T-MACH-102194	Combustion Engines I		Prüfung (PR)	Koch, Kubach

Competence Certificate
oral examination, Duration: 25 min., no auxiliary means

Prerequisites
none

Below you will find excerpts from events related to this course:

V Combustion Engines I

2133113, WS 19/20, 4 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Content

Introduction, History, Concepts

Working Principle and Applications

Characteristic Parameters

Engine Parts

Drive Train

Fuels

Gasoline Engines

Diesel Engines

Exhaust Gas Aftertreatment

T 3.42 Course: Combustion Engines II [T-MACH-104609]

Responsible: Dr.-Ing. Rainer Koch
Dr.-Ing. Heiko Kubach

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Oral examination	5	Each summer term	1

Events					
SS 2020	2134151	Combustion Engines II	3 SWS	Lecture / Practice (VÜ)	Koch
Exams					
WS 19/20	76-T-MACH-104609	Combustion Engines II		Prüfung (PR)	Kubach, Koch
SS 2020	76-T-MACH-104609	Combustion Engines II		Prüfung (PR)	Koch, Kubach

Competence Certificate
oral examination, duration: 25 minutes, no auxiliary means

Prerequisites
none

Recommendation
Fundamentals of Combustion Engines I helpful

Below you will find excerpts from events related to this course:

V Combustion Engines II

Lecture / Practice (VÜ)

2134151, SS 2020, 3 SWS, Language: German, Open in study portal

T 3.43 Course: Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies [T-MACH-105535]

Responsible: Prof. Dr.-Ing. Frank Henning
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	2

Events					
SS 2020	2114053	Composite Manufacturing – Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies	2 SWS	Lecture (V)	Henning
Exams					
WS 19/20	76-T-MACH-105535	Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies		Prüfung (PR)	Henning
SS 2020	76-T-MACH-105535	Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies		Prüfung (PR)	Henning

Competence Certificate
written exam 90 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Composite Manufacturing – Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies

Lecture (V)

2114053, SS 2020, 2 SWS, Language: German, Open in study portal

Literature
Literatur Leichtbau II

[1-7]

[1] M. Flemming and S. Roth, *Faserverbundbauweisen : Eigenschaften; mechanische, konstruktive, thermische, elektrische, ökologische, wirtschaftliche Aspekte*. Berlin: Springer, 2003.

[2] M. Flemming*, et al.*, *Faserverbundbauweisen : Halbzeuge und Bauweisen*. Berlin: Springer, 1996.

[3] M. Flemming*, et al.*, *Faserverbundbauweisen : Fasern und Matrices*. Berlin: Springer, 1995.

[4] M. Flemming*, et al.*, *Faserverbundbauweisen : Fertigungsverfahren mit duroplastischer Matrix*. Berlin: Springer, 1999.

[5] H. Schürmann, *Konstruieren mit Faser-Kunststoff-Verbunden : mit ... 39 Tabellen*, 2., bearb. und erw. Aufl. ed. Berlin: Springer, 2007.

[6] A. Puck, *Festigkeitsanalyse von Faser-Matrix-Laminaten : Modelle für die Praxis*. München: Hanser, 1996.

[7] M. Knops, *Analysis of failure in fibre polymer laminates : the theory of Alfred Puck*. Berlin, Heidelberg [u.a.]: Springer, 2008.

T 3.44 Course: Computational Dynamics [T-MACH-105349]

Responsible: Prof. Dr.-Ing. Carsten Proppe
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104853 - Major Field Theoretical Foundations of Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2162246	Computational Dynamics	2 SWS		Proppe

Competence Certificate
oral exam, 30 min.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Computational Dynamics
2162246, SS 2020, 2 SWS, Language: German, Open in study portal

Content
1. Fundamentals of elasto-kinetics (Equations of motion, principle of Hamilton and principle of Hellinger-Reissner)
2. Differential equations for the vibration of structure elements (bars, plates)
3. Numerical solutions of the equations of motion
4. Numerical algorithms
5. Stability analyses

Literature
1. Ein Vorlesungsskript wird bereitgestellt!
2. M. Géradin, B. Rixen: Mechanical Vibrations, Wiley, Chichester, 1997

T 3.45 Course: Computational Homogenization on Digital Image Data [T-MACH-109302]

Responsible: Jun.-Prof. Dr. Matti Schneider
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Expansion	Version
Oral examination	6	Each winter term	1 terms	1

Events					
WS 19/20	2161123	Computational homogenization on digital image data (Lecture)	2 SWS	Lecture (V)	Schneider
WS 19/20	2161124	Computational homogenization on digital image data (Tutorial)	2 SWS	Practice (Ü)	Wicht, Schneider
Exams					
WS 19/20	76-T-MACH-109302	Computational Homogenization on Digital Image Data		Prüfung (PR)	Schneider

Competence Certificate
oral exam, 30 min

Prerequisites
nein

Below you will find excerpts from events related to this course:

V Computational homogenization on digital image data (Lecture) — Lecture (V)

2161123, WS 19/20, 2 SWS, Language: English, Open in study portal

Content

- Basic equations for computing effective elastic material properties
- Moulinec-Suquet's FFT-based computational homogenization method
- Schemes for treating highly contrasted/porous/defected media
- Treating non-linear and time dependent mechanical proplems

Literature

- Milton, G. W.: The Theory of Composites. Springer, New York, 2002

V Computational homogenization on digital image data (Tutorial) — Practice (Ü)

2161124, WS 19/20, 2 SWS, Language: English, Open in study portal

Content
Please refer to the lecture "Computational homogenization on digital image data".

T 3.46 Course: Computational Intelligence [T-MACH-105314]

Responsible: Dr. Wilfried Jakob
Prof. Dr. Ralf Mikut
PD Dr.-Ing. Markus Reischl

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104850 - Major Field Mechatronics and Microsystem Technology

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	1

Events					
WS 19/20	2105016	Computational Intelligence	2 SWS	Lecture (V)	Mikut, Jakob, Reischl
Exams					
WS 19/20	76-T-MACH-105314	Computational Intelligence		Prüfung (PR)	Mikut

Competence Certificate
Written exam (Duration: 1h)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Computational Intelligence — Lecture (V)
2105016, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
The students are able to apply the fundamental methods of computational intelligence (fuzzy logic, artificial neural networks, evolutionary algorithms) efficiently. They know the basic mathematical foundations and are able to transfer these methods to practical applications.

Content:

- Terms and definitions Computational Intelligence, application fields and examples
- Fuzzy logic: fuzzy sets; fuzzification and membership functions; inference: T-norms and -conorms, operators, aggregation, activation, accumulation; defuzzification methods, structures for fuzzy control
- Artificial Neural Nets: biology of neurons, Multi-Layer-Perceptrons, Radial-Basis-Function nets, Kohonen maps, training strategies (Backpropagation, Levenberg-Marquardt)
- Evolutionary Algorithms: Basic algorithm, Genetic Algorithms and Evolution Strategies, Evolutionary Algorithm GLEAM, integration of local search strategies, memetic algorithms, application examples

Learning objectives:

The students are able to apply the fundamental methods of computational intelligence (fuzzy logic, artificial neural networks, evolutionary algorithms) efficiently. They know the basic mathematical foundations and are able to transfer these methods to practical applications.

Literature

Kiendl, H.: Fuzzy Control. Methodenorientiert. Oldenbourg-Verlag, München, 1997

S. Haykin: Neural Networks: A Comprehensive Foundation. Prentice Hall, 1999

Kroll, A. Computational Intelligence: Eine Einführung in Probleme, Methoden und technische Anwendungen Oldenbourg Verlag, 2013

Blume, C, Jakob, W: GLEAM - General Learning Evolutionary Algorithm and Method: ein Evolutionärer Algorithmus und seine Anwendungen. KIT Scientific Publishing, 2009 (PDF frei im Internet)

H.-P. Schwefel: Evolution and Optimum Seeking. New York: John Wiley, 1995

Mikut, R.: Data Mining in der Medizin und Medizintechnik. Universitätsverlag Karlsruhe; 2008 (PDF frei im Internet)

T 3.47 Course: Computational Mechanics I [T-MACH-105351]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Dr.-Ing. Tom-Alexander Langhoff

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104853 - Major Field Theoretical Foundations of Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	6	Each winter term	2

Events					
WS 19/20	2161147	Computational Mechanics I (Tutorial)	2 SWS	Practice (Ü)	Erdle, Langhoff
WS 19/20	2161250	Computational Mechanics I	2 SWS	Lecture (V)	Langhoff, Böhlke
WS 19/20	2161312	Consultation hour Computational Mechanics I	2 SWS	Consultation-hour (Sprechst.)	Erdle, Langhoff
Exams					
WS 19/20	76-T-MACH-105351	Computational Mechanics I		Prüfung (PR)	Langhoff, Böhlke

Competence Certificate
oral examination, 30 min.

Prerequisites
none

Recommendation
The contents of the lectures "Mathematical Methods in Strength of Materials" and "Introduction to the Finite Element Method" are assumed to be known

This course is geared to MSc students.

Below you will find excerpts from events related to this course:

V Computational Mechanics I (Tutorial) — Practice (Ü)

2161147, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
Please refer to the lecture "Computational Mechanics I".

Literature
Siehe Literaturhinweise Vorlesung "Rechnerunterstützte Mechanik I".

V Computational Mechanics I — Lecture (V)

2161250, WS 19/20, 2 SWS, Language: German, Open in study portal

Literature
Simó, J.C.; Hughes, T.J.R.: Computational Inelasticity. Springer 1998.
Haupt, P.: Continuum Mechanics and Theory of Materials. Springer 2002.
Belytschko, T.; Liu,W.K.; Moran, B.: Nonlinear FE for Continua and Structures. JWS 2000.
W. S. Slaughter: The linearized theory of elasticity. Birkhäuser, 2002.
J. Betten: Finite Elemente für Ingenieure 2, Springer, 2004.

T 3.48 Course: Computational Mechanics II [T-MACH-105352]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Dr.-Ing. Tom-Alexander Langhoff

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104853 - Major Field Theoretical Foundations of Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	6	Each summer term	2

Events					
SS 2020	2162206	Consultation hour Computational Mechanics II	2 SWS	Consultation-hour (Sprechst.)	Erdle, Krause
SS 2020	2162296	Computational Mechanics II	2 SWS	Lecture (V)	Böhlke, Langhoff
SS 2020	2162297	Tutorial Computational Mechanics II	2 SWS	Practice (Ü)	Erdle, Krause, Langhoff

Competence Certificate
oral examination, 30 min.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Computational Mechanics II — Lecture (V)
2162296, SS 2020, 2 SWS, Language: German, Open in study portal

Content

- overview quasistatic nonlinear phenomena
- numerics of nonlinear systems
- foundations of nonlinear continuum mechanics
- balance equations of geometrically nonlinear solid mechanics
- finite elasticity
- infinitesimal plasicity
- linear and gemetrically nonlinear thermoelasticity

Literature

- Simó, J.C.; Hughes, T.J.R.: Computational Inelasticity. Springer 1998
- Haupt, P.: Continuum Mechanics and Theory of Materials. Springer 2002
- Belytschko, T.; Liu,W.K.; Moran, B.: Nonlinear FE for Continua and Structures. JWS 2000

V Tutorial Computational Mechanics II — Practice (Ü)
2162297, SS 2020, 2 SWS, Language: German, Open in study portal

Content
see lecture "Computational Mechanics II"

Literature
siehe Vorlesung "Rechnerunterstützte Mechanik II"

T 3.49 Course: Computational Vehicle Dynamics [T-MACH-105350]

Responsible: Prof. Dr.-Ing. Carsten Proppe
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2162256	Computational Vehicle Dynamics	2 SWS	Lecture (V)	Proppe
Exams					
WS 19/20	76-T-MACH-105350	Computational Vehicle Dynamics		Prüfung (PR)	Proppe

Competence Certificate
oral exam, 30 min.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Computational Vehicle Dynamics
2162256, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
1. Introduction
2. Models of load bearing systems
3. Contact forces between wheels and roadway
4. Simulation of roadways
5. Vehicle models
6. Methods of calculation
7. Performance indicators

Literature
1. K. Popp, W. Schiehlen: Fahrzeugdynamik, B. G. Teubner, Stuttgart, 1993
2. H.-P. Willumeit: Modelle und Modellierungsverfahren in der Fahrzeugdynamik, B. G. Teubner, Stuttgart, 1998
3. H. B. Pacejka: Tyre and Vehicle Dynamics. Butterworth Heinemann, Oxford, 2002
4. K. Knothe, S. Stichel: Schienenfahrzeugdynamik, Springer, Berlin, 2003

T 3.50 Course: Computer Engineering [T-MACH-105360]

Responsible: Dr. Hubert Keller
Dr.-Ing. Maik Lorch

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104850 - Major Field Mechatronics and Microsystem Technology

Type	Credits	Recurrence	Version
Written examination	6	Each summer term	1

Events					
SS 2020	2106002	Computer Engineering	2 SWS	Lecture (V)	Keller
Exams					
WS 19/20	76-T-MACH-105360	Computer Engineering		Prüfung (PR)	Keller

Competence Certificate
written exam (Duration: 2 hours)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Computer Engineering

2106002, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Content:

Introduction: definitions, basic concepts, introductory examples

Information coding on finite automata: numbers, characters, commands, examples

Algorithm design: definitions, complexity of algorithms, complexity classes P and NP, examples

Sorting algorithms: relevance, algorithms, simplifications, examples

Software quality assurance: terms and measures, errors, phases of quality assurance, constructive measures, analytical measures, certification

Lectures are complemented by an exercice course.

Learning objectives:

The students possess essential knowledge about information processing in digital computers. Based on information representation and calculations of complexity, students are capable to design algorithms efficiently. The students are able to apply the knowledge about efficient algorithm design to important numerical computation methods in mechanical engineering. Students have basic knowledge of real-time systems and their development. Students can use the knowledge to develop real-time systems for reliable automation of technological systems in mechanical engineering.

Literature
Vorlesungsskript (Ilias)

Becker, B., Molitor, P.: Technische Informatik : eine einführende Darstellung. München, Wien : Oldenbourg, 2008.

Hoffmann, D. W.: Grundlagen der Technischen Informatik. München: Hanser, 2007.

Balzert, H.: Lehrbuch Grundlagen der Informatik : Konzepte und Notationen in UML, Java und C++, Algorithmik und Software-Technik, Anwendungen. Heidelberg, Berlin : Spektrum, Akad. Verl., 1999.

Trauboth, H.: Software-Qualitätssicherung : konstruktive und analytische Maßnahmen. München, Wien : Oldenbourg, 1993.

Ada Reference Manual, ISO/IEC 8652:2012(E), Language and Standard Libraries. Springer Heidelberg

Benra, J.; Keller, H.B.; Schiedermeier, G.; Tempelmeier, T.: Synchronisation und Konsistenz in Echtzeitsystemen. Benra, J.T. [Hrsg.] Software-Entwicklung für Echtzeitsysteme Berlin [u.a.] : Springer, 2009, S.49-65

Färber, G.:Prozeßrechentechnik. Springer-Lehrbuch. Springer; Auflage: 3., überarb. Aufl. (7. September 1994)

Leitfaden Informationssicherheit, IT-Grundschutz kompakt. Bundesamt für Sicherheit in der Informationstechnik – BSI53133 Bonn, 2012, BSI-Bro12/311

Cooling, J.: Software Engineering for Real Time Systems. Addison-Wesley, Pearson, Harlow, 2002.

Stallings, W.: Betriebssysteme. 4. Auflage. Pearson Studium, München, 2003.

Summerville, I.: Software Engineering. Pearson Studium, München, 2007.

T 3.51 Course: Computerized Multibody Dynamics [T-MACH-105384]

Responsible: Prof. Dr.-Ing. Wolfgang Seemann
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104853 - Major Field Theoretical Foundations of Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Competence Certificate
Oral exam, 30 min.

Prerequisites
none

Recommendation
Knowledge of EM III/IV

T 3.52 Course: Constitution and Properties of Protective Coatings [T-MACH-105150]

Responsible: Prof. Dr. Sven Ulrich
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2177601	Constitution and Properties of Protective Coatings	2 SWS	Lecture (V)	Ulrich
Exams					
WS 19/20	76-T-MACH-105150	Constitution and Properties of Protective Coatings		Prüfung (PR)	Ulrich
SS 2020	76-T-MACH-105150	Constitution and Properties of Protective Coatings		Prüfung (PR)	Ulrich

Competence Certificate
oral examination (about 30 min)

no tools or reference materials

Prerequisites
none

Below you will find excerpts from events related to this course:

V Constitution and Properties of Protective Coatings

2177601, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
oral examination (about 30 min); no tools or reference materials

Teaching Content:

introduction and overview

concepts of surface modification

coating concepts

coating materials

methods of surface modification

coating methods

characterization methods

state of the art of industrial coating of tools and components

new developments of coating technology

regular attendance: 22 hours
self-study: 98 hours

Transfer of the basic knowledge of surface engineering, of the relations between constitution, properties and performance, of the manifold methods of modification, coating and characterization of surfaces.

Recommendations: none

Literature
Bach, F.-W.: Modern Surface Technology, Wiley-VCH, Weinheim, 2006

Abbildungen und Tabellen werden verteilt; Copies with figures and tables will be distributed

T 3.53 Course: Constitution and Properties of Wearresistant Materials [T-MACH-102141]

Responsible: Prof. Dr. Sven Ulrich
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	2

Events					
SS 2020	2194643	Constitution and Properties of Wear resistant materials	2 SWS	Lecture (V)	Ulrich
Exams					
WS 19/20	76-T-MACH-102141	Constitution and Properties of Wearresistant Materials		Prüfung (PR)	Ulrich
SS 2020	76-T-MACH-102141	Constitution and Properties of Wearresistant Materials		Prüfung (PR)	Ulrich

Competence Certificate
oral examination (about 30 min)

no tools or reference materials

Prerequisites
none

Below you will find excerpts from events related to this course:

V Constitution and Properties of Wear resistant materials

Lecture (V)

2194643, SS 2020, 2 SWS, Language: German, Open in study portal

Content

The assessment consists of an oral exam (ca. 30 min) taking place at the agreed date (according to Section 4(2), 2 of the examination regulation). The re-examination is offered upon agreement.

Teaching Content:

introduction

materials and wear

unalloyed and alloyed tool steels

high speed steels

stellites and hard alloys

hard materials

hard metals

ceramic tool materials

superhard materials

new developments

regular attendance: 22 hours
self-study: 98 hours

Basic understanding of constitution of wear-resistant materials, of the relations between constitution, properties and performance, of principles of increasing of hardness and toughness of materials as well as of the characteristics of the various groups of wear-resistant materials.

Recommendations: none

Literature

Laska, R. Felsch, C.: Werkstoffkunde für Ingenieure, Vieweg Verlag, Braunschweig, 1981

Schedler, W.: Hartmetall für den Praktiker, VDI-Verlage, Düsseldorf, 1988

Schneider, J.: Schneidkeramik, Verlag moderne Industrie, Landsberg am Lech, 1995

Kopien der Abbildungen und Tabellen werden verteilt; Copies with figures and tables will be distributed

T 3.54 Course: Contact Mechanics [T-MACH-105786]

Responsible: Dr. Christian Greiner
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2181220	Contact Mechanics	2 SWS	Lecture (V)	Greiner

Competence Certificate
oral exam ca. 30 minutes

Prerequisites
none

Recommendation
preliminary knowledge in mathematics, physics and materials science

Below you will find excerpts from events related to this course:

V Contact Mechanics
2181220, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
The course introduces contact mechanics of smooth and rough surface for non-adhesive and adhesive interfacial conditions. There will a computer lab held in parallel to the lecture that teaches numerical approaches to contact mechanical problems.

1. Introduction: contact area and stiffness
2. Theory of the elastic half-space
3. Contact of nonadhesive spheres: Hertz theory
4. Physics and chemistry of adhesive interactions at interfaces
5. Contact of adhesive spheres: theories of Johnson-Kendall-Roberts, Derjaguin-Muller-Toporov and Maugis-Dugdale
6. Surface roughness: topography, power spectral density, structure of real surfaces, fractal surfaces as a model, metrology
7. Contact of nonadhesive rough surfaces: theories of Greenwood-Williamson, Persson, Hyun-Pei-Robbins-Molinari
8. Contact of adhesive rough surface: theories of Fuller-Tabor, Persson and recent numerical results
9. Contact of rough spheres: theory of Greenwood-Tripp and recent numerical results
10. Lateral and sliding contact: theories of Cattaneo-Mindlin, Savkoor, Persson
11. Applications of contact mechanics

The student

- knows models for smooth and rough surfaces under non-adhesive and adhesive conditions and understands their strengths and limits
- knows fundamental scaling relations for the functional dependency between contact area, stiffness and normal force
- can apply numerical methods to study questions from materials science

preliminary knowledge in mathematics, physics and materials science recommended

regular attendance: 22,5 hours

self-study: 97,5 hours

oral exam ca. 30 minutes

Literature
K. L. Johnson, Contact Mechanics (Cambridge University Press, 1985)

D. Maugis, Contact, Adhesion and Rupture of Elastic Solids (Springer-Verlag, 2000)

J. Israelachvili, Intermolecular and Surface Forces (Academic Press, 1985)

T 3.55 Course: Control Technology [T-MACH-105185]

Responsible: Prof. Dr.-Ing. Christoph Gönnheimer
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104852 - Major Field Production Technology

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	2

Events					
SS 2020	2150683	Control Technology	2 SWS	Lecture (V)	Gönnheimer
Exams					
WS 19/20	76-T-MACH-105185	Control Technology		Prüfung (PR)	Gönnheimer
SS 2020	76-T-MACH-105185	Control Technology		Prüfung (PR)	Fleischer

Competence Certificate
Written Exam (60 min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Control Technology

2150683, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content

The lecture control technology gives an integral overview of available control components within the field of industrial production systems.
The first part of the lecture deals with the fundamentals of signal processing and with control peripherals in the form of sensors and actors which are used in production systems for the detection and manipulation of process states.
The second part handles with the function of electric control systems in the production environment. The main focus in this chapter is laid on programmable logic controls, computerized numerical controls and robot controls. Finally the course ends with the topic of cross-linking and decentralization with the help of bus systems.
The lecture is very practice-oriented and illustrated with numerous examples from different branches.

The following topics will be covered:

- Signal processing
- Control peripherals
- Programmable logic controls
- Numerical controls
- Controls for industrial robots
- Distributed control systems
- Field bus
- Trends in the area of control technology

Learning Outcomes:

The students …

- are able to name the electrical controls which occur in the industrial environment and explain their function.
- can explain fundamental methods of signal processing. This involves in particular several coding methods, error protection methods and analog to digital conversion.
- are able to choose and to dimension control components, including sensors and actors, for an industrial application, particularly in the field of plant engineering and machine tools. Thereby, they can consider both, technical and economical issues.
- can describe the approach for projecting and writing software programs for a programmable logic control named Simatic S7 from Siemens. Thereby they can name several programming languages of the IEC 1131.

Workload:

regular attendance: 21 hours
self-study: 99 hours

Literature
Medien:
Skript zur Veranstaltung wird über ilias (https://ilias.studium.kit.edu/) bereitgestellt.

Media:
Lecture notes will be provided in ilias (https://ilias.studium.kit.edu/).

T 3.56 Course: Cooling of Thermally High Loaded Gas Turbine Components [T-MACH-105414]

Responsible: Prof. Dr.-Ing. Hans-Jörg Bauer
Dr.-Ing. Achmed Schulz

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2170463	Cooling of thermally high loaded gas turbine components	2 SWS	Lecture (V)	Bauer, Elfner
Exams					
WS 19/20	76-T-MACH-105414	Cooling of Thermally High Loaded Gas Turbine Components		Prüfung (PR)	Bauer, Schulz
SS 2020	76-T-MACH-105414	Cooling of Thermally High Loaded Gas Turbine Components		Prüfung (PR)	Bauer, Schulz

Competence Certificate
oral exam, 30 min.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Cooling of thermally high loaded gas turbine components

Lecture (V)

2170463, SS 2020, 2 SWS, Language: German, Open in study portal

Content
Hot gas temperatures of modern gas turbine engines exceed the maximum tolerable material temperatures by several hundreds of K. To ensure reliability of lifetime, complex cooling technology must be applied. Various cooling methods will be introduced in this lesson. Specific pros and cons will be identified and new concepts for further improvement of cooling will be discussed. Furthermore, the fundamentals of forced convection heat transfer and film cooling wil be imparted and a simplified design process of a cooled gas turbine components will be demonstrated. Finally, experimental and numerical methods for the characterization of heat transfer will be presented.

regular attendance: 21 h
self-study: 42 h

The students are able to:

- name and differentiate beween different cooling methods and analyse them
- judge on the advantages and disadvantages of cooling methods and discuss approaches for the improvement of complex cooling methods
- to outline the basics of forces convectice heat transfer and film cooling
- design colled gas turbine components in a simplified manner
- comment on the experimental and numerical methods for the characterisation of heat transfer

Exam:

oral
Duration: approximately 30 minutes

no tools or reference materials may be used during the exam

T 3.57 Course: Data Analytics for Engineers [T-MACH-105694]

Responsible:	Nicole Ludwig Prof. Dr. Ralf Mikut PD Dr.-Ing. Markus Reischl
Organisation:	KIT Department of Mechanical Engineering
Part of:	M-MACH-104850 - Major Field Mechatronics and Microsystem Technology

Type	Credits	Recurrence	Version
Written examination	5	Each summer term	2

Events					
SS 2020	2106014	Data Analytics for Engineers	3 SWS	Lecture / Practice (VÜ)	Mikut, Reischl, Ludwig
Exams					
WS 19/20	76-T-MACH-105694	Data Analytics for Engineers		Prüfung (PR)	Mikut

Competence Certificate
Written exam (Duration: 1h)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Data Analytics for Engineers

2106014, SS 2020, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Content
Content:

- Introduction and motivation
- Terms and definitions (types of multidimensional features - time series and images, problem classes)
- Scenario: Problem formulation, feature extraction, evaluation, selection and transformation, distance measures, Bayes classifiers, Support-Vector-Machines, decision trees, clustering, regression, validation
- Biweekly computer exercises (Software practice with SciXMiner): Data import, benchmark datasets, control of hand prostheses, energy prediction
- 2 hours per week lectures, 1 hour per week computer training

Learning objectives:
The students are able to apply the methods of data analysis efficiently. They know the basic mathematical data mining foundations for the analysis of single features and time series using classifiers, clustering and regression approaches. They are able to use various relevant methods as Bayes classifiers, Support Vector Machines, decision trees, fuzzy rulebases and they can adapt application scenarios (with data preprocessing and validation techniques) to real-world applications.

Literature
Vorlesungsunterlagen (ILIAS)

Mikut, R.: Data Mining in der Medizin und Medizintechnik. Universitätsverlag Karlsruhe.

2008 (PDF frei im Internet)

Backhaus, K.; Erichson, B.; Plinke, W.; Weiber, R.: Multivariate Analysemethoden: Eine anwendungsorientierte Einführung. Berlin u.a.: Springer. 2000

Burges, C.: A Tutorial on Support Vector Machines for Pattern Recognition. Knowledge Discovery and Data Mining 2(2) (1998), S. 121–167

Tatsuoka, M. M.: Multivariate Analysis. Macmillan. 1988

Mikut, R.; Loose, T.; Burmeister, O.; Braun, S.; Reischl, M.: Dokumentation der MATLAB-Toolbox SciXMiner. Techn. Ber., Forschungszentrum Karlsruhe GmbH. 2006 (Internet)

3.58 Course: Design and Development of Mobile Machines [T-MACH-105311]

Responsible: Prof. Dr.-Ing. Marcus Geimer
Jan Siebert

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2113079	Design and Development of Mobile Machines	2 SWS	Lecture (V)	Geimer, Siebert, Lehr, Geiger
Exams					
WS 19/20	76-T-MACH-105311	Design and Development of Mobile Machines		Prüfung (PR)	Geimer
SS 2020	76-T-MACH-105311	Design and Development of Mobile Machines		Prüfung (PR)	Geimer

Competence Certificate

The assessment consists of an oral exam (20 min) taking place in the recess period. The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

A registration is mandatory, the details will be announced on the webpages of the *Institute of Vehicle System Technology / Institute of Mobile Machines.* In case of too many applications, attendance will be granted based on pre-qualification.

The course will be replenished by interestung lectures of professionals from leading hydraulic companies.

Prerequisites

Required for the participation in the examination is the preparation of a report during the semester. The partial service with the code T-MACH-108887 must have been passed.

Modeled Conditions

The following conditions have to be fulfilled:

1. The course T-MACH-108887 - Design and Development of Mobile Machines - Advance must have been passed.

Recommendation

Knowledge in Fluid Power Systems (LV 2114093)

Annotation

After completion of the lecture, studens can:

- design working and travel drive train hydraulics of mobile machines and can derive characteristic key factors.
- choose and apply suitable state of the art designing methods succesfully
- analyse a mobile machines and break its structure down from a complex system to subsystems with reduced complexity
- identify and desrcibe interactions and links between subsystems of a mobile maschine
- present and document solutions of a technical problem according to R&D standards

The number of participants is limited.

Conent:

The working scenario of a mobile machine depends strongly on the machine itself. Highly specialised machines, e.g. pavers are also as common as universal machines with a wide range of applications, e.g. hydraulic excavators. In general, all mobile machines are required to do their intended work in an optimal way and satisfy various critera at the same time. This makes designing mobile machines to a great and interesting challenge. Nevertheless, usually key factors can be derived for every mobile machine, which affect all other machine parameters. During this lecture, those key factors and designing mobile machines accordingly will be adressed. To do so, an exemplary mobile machine will be discussed and designed in the lecture an as a semester project.

Literature:

See german recommendations

Below you will find excerpts from events related to this course:

V **Design and Development of Mobile Machines** **Lecture (V)**
2113079, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
Wheel loaders and excavators are highly specialized mobile machines. Their function is to detach, pick up and deposit materials near by. Significant size for dimensioning of the machines is the content of their standard shovel. In this lecture the main steps in dimensioning a wheel loader or excavator are beeing thought. This includes among others:

- Defining the size and dimensions,
- the dimensioning of the electric drive train,
- the dimensioning of the primary energy supply,
- Determining the kinematics of the equipment,
- the dimension of the working hydraulics and
- Calculations of strength

The entire design process of these machines is strongly influenced by the use of standards and guidelines (ISO/DIN-EN). Even this aspect is dealt with.

The lecture is based on the knowledge from the fields of mechanics, strength of materials, machine elements, propulsion and fluid technique. The lecture requires active participation and continued collaboration.

Recommendations:

Knowledge in Fluid Technology (SoSe, LV 21093)

- regular attendance: 21 hours
- self-study: 99 hours

Literature
Keine.

T 3.59 Course: Design and Development of Mobile Machines - Advance [T-MACH-108887]

Responsible: Prof. Dr.-Ing. Marcus Geimer
Jan Siebert

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Completed coursework	0	Each term	1

Exams				
WS 19/20	76-T-MACH-108887	Design and Development of Mobile Machines - Advance	Prüfung (PR)	Geimer
SS 2020	76-T-MACH-108887	Design and Development of Mobile Machines - Advance	Prüfung (PR)	Geimer

Competence Certificate
Preparation of semester report

Prerequisites
none

T 3.60 Course: Design of Highly Stresses Components [T-MACH-105310]

Responsible: Prof. Dr.-Ing. Jarir Aktaa
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2181745	Design of highly stresses components	2 SWS	Lecture (V)	Aktaa
Exams					
WS 19/20	76-T-MACH-105310	Design of Highly Stresses Components		Prüfung (PR)	Aktaa
SS 2020	76-T-MACH-105310	Design of Highly Stresses Components		Prüfung (PR)	Aktaa

Competence Certificate
oral exam

Below you will find excerpts from events related to this course:

V Design of highly stresses components

2181745, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Contents of the lecture:

rules of common design codes

classical models for elasto-plasticity and creep

lifetime rules for creep, fatigue and creep-fatigue interaction

unified constitutive models for thermo-elasto-viscoplasticity

continuum mechanical models for damage at high temperatures

application of advanced material models in FE-codes

The students know about the rules of established design codes for the assessment of components which under operation are subjected to high thermo-mechanical and/or irradiation loadings. They understnd which constitutive equations are used according to state-of-the-art of technology and research to estimate deformation and damage appearing under these loadings and to predict expected lifetime. They gained insight into the application of these generally non-linear constitutive equations in finite element codes and can judge the major issues which shall be thereby taken into account.

Qualification: Materials Sciense, solid mechanics II

regular attendance: 22,5 hours
self-study: 97,5 hours

oral exam ca. 30 minutes

Literature
Viswanathan, Damage Mechanisms and Life Assessment of High-Temperature Components, ASM International, 1989.

Lemaitre, J.; Chaboche J.L.: Mechanics of Solid Materials, Cambridge University Press, Cambridge, 1990.

T 3.61 Course: Design with Plastics [T-MACH-105330]

Responsible: Markus Liedel
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104851 - Major Field Product Development and Construction

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2174571	Design with Plastics	2 SWS	Lecture (V)	Liedel

Competence Certificate
Oral exam, about 20 minutes

Prerequisites
none

Recommendation
Poly I

Below you will find excerpts from events related to this course:

V Design with Plastics

2174571, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content

Structure and properties of plastics materials,

Processing of plastics,

Behavior of plastics under environmental impacts,

Classic strength dimensioning,

Geometric dimensioning,

Plastic appropriate design,

Failure examples,

Joining of plastic parts,

Supporting simulation tools,

Structural foams,

Plastics Technology trends.

learning objectives:

Students will be able to

- distinguish polymer compounds from other construction materials regarding chemical differences, thermal behavior and solid conditions.
- discuss main plastics processes regarding advantages and disadvantages of materials selection and part geometry design and to make appropriate selections.
- analyze complex application requirements concerning material impacts on strength and to use the classic dimensioning method specific to the application to evaluate the lifetime part strength limit.
- evaluate part tolerances and geometry by appropriate methods considering molding shrinkage, production tolerances, post shrinkage, heat expansion, swelling, elastic and creep deformation.
- design plastic specific joining geometries like snap fits, screw bosses, weld seams and film hinges.
- detect classic molding failures and understand potential causes as well as to reduce the probability of molding failures by defining an optimized design.
- understand benefits and limits of selected simulation tools in the plastic technology discipline (strength, deformation, filling, warpage).
- assess polymer classes and plastic part designs with respect to suitable recycling concepts and ecological consequences.

requirements:

none,

recommendation: Polymerengineering I

workload:

The workload for the lecture Design with Plastics is 120 h per semester and consists of the presence during the lecture (21 h) as well as preparation and rework time at home (99 h).

Literature

Materialien werden in der Vorlesung ausgegeben.
Literaturhinweise werden in der Vorlesung gegeben.

T 3.62 Course: Designing with Composites [T-MACH-108721]

Responsible: Prof. Dr. Eckart Schnack
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Exams				
WS 19/20	76-T-MACH-108721	Designing with Composites	Prüfung (PR)	
SS 2020	76-T-MACH-108721	Designing with Composites	Prüfung (PR)	

Competence Certificate
Oral exam, 20 minutes

Prerequisites
None

Annotation
The lecture notes are made available via ILIAS.

T 3.63 Course: Development of Oil-Hydraulic Powertrain Systems [T-MACH-105441]

Responsible: Dr.-Ing. Isabelle Ays
Dr.-Ing. Gerhard Geerling

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2113072	Development of Oil-Hydraulic Powertrain Systems	2 SWS	Block (B)	Geerling, Becker
Exams					
WS 19/20	76-T-MACH-105441	Development of Oil-Hydraulic Powertrain Systems		Prüfung (PR)	Geimer

Competence Certificate
oral exam (20 min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Development of Oil-Hydraulic Powertrain Systems

2113072, WS 19/20, 2 SWS, Language: German, Open in study portal

Block (B)

Content
The bloc course offered by the Chair of Mobile Machines (Mobima) conveys the basics of planning and development of mobile and industrial hydrostatic systems. The lecturer works for a market leading company producing fluid power drives and controls and gives a deep view into the process of planning and development using real life examples. The contents of the course are:

- marketing, project planning
- hydrostatic circuits
- heat balance, hydraulic accumulators
- filtration, noise lowering
- development exercises + laboratory tutorial

knowledge in the fluidics

- regular attendance: 19 hours
- self-study: 90 hours

T 3.64 Course: Digital Control [T-MACH-105317]

Responsible: Dr.-Ing. Michael Knoop
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104850 - Major Field Mechatronics and Microsystem Technology

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	1

Events					
WS 19/20	2137309	Digital Control	2 SWS	Lecture (V)	Knoop
Exams					
WS 19/20	76-T-MACH-105317	Digital Control		Prüfung (PR)	Stiller

Competence Certificate
written exam

60 min.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Digital Control

2137309, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Lehrinhalt (EN):

1. Introduction into digital control:
Motivation for digital implementation of controllers Structure of digital feedback control loops Sample and hold units
2. State space analysis and design:
Discretisation of continuous-time systems Discrete-time state space equations Stability - definition and criteria State feedback design by eigenvalue assignment PI state feedback controller Luenberger observer, separation theorem
Systems with dead-time Deadbeat design
3. Analysis and design based on z-transform: z-transform - definition and theorems Control loop description in the z domain Stability criteria Root locus controller design Transfer of continuous-time controllers into discrete-time controllers

Voraussetzungen (EN):

Basic studies and preliminary examination; basic lectures in automatic control

Lernziele (EN):

The lecture intoduces key methods for the analysis and design of digital feedback control systems. Starting point is the discretisation of linear, continuous-time models. State space based and z-transform based controller design techniques are presented for discrete-time, single-input single-output systems. Furthermore, plants with dead-time and deadbeat design are covered.

Nachweis: written examination; duration: 60 minutes; no tools or reference materials may be used during the exam.

Arbeitsaufwand: 120 hours

Literature

- Lunze, J.: Regelungstechnik 2, 9. Auflage, Springer Verlag, Berlin Heidelberg 2016.
- Unbehauen, H.: Regelungstechnik, Band 2: Zustandsregelungen, digitale und nichtlineare Regelsysteme. 8. Auflage, Vieweg Verlag, Braunschweig 2000
- Föllinger, O.: Lineare Abtastsysteme. 4. Auflage, R. Oldenbourg Verlag, München Wien 1990
- Ogata, K.: Discrete-Time Control Systems. 2nd edition, Prentice-Hall, Englewood Cliffs 1994
- Ackermann, J.: Abtastregelung, Band I, Analyse und Synthese. 3. Auflage, Springer Verlag, Berlin Heidelberg 1988

T 3.65 Course: Digital microstructure characterization and modeling [T-MACH-110431]

Responsible: Jun.-Prof. Dr. Matti Schneider
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	6	Each winter term	1

Competence Certificate
oral examination

T 3.66 Course: Digital Technology [T-ETIT-101918]

Responsible: Prof. Dr.-Ing. Jürgen Becker
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the Department of Electrical Engineering and Information Technology

Type	Credits	Recurrence	Version
Written examination	6	Each winter term	1

Events					
WS 19/20	2311615	Digital Technology	3 SWS	Lecture (V)	Becker
WS 19/20	2311617	Tutorial for 2311615 Digital Technology	1 SWS	Practice (Ü)	Kempf
Exams					
WS 19/20	7311615	Digital Technology		Prüfung (PR)	Becker
SS 2020	7311615	Digital Technology		Prüfung (PR)	Becker

Prerequisites
none

T 3.67 Course: Dimensioning and Optimization of Power Train System [T-MACH-105536]

Responsible: Prof. Dr.-Ing. Albert Albers
Dr.-Ing. Hartmut Faust
Dr. Eckhard Kirchner
Prof. Dr.-Ing. Sven Matthiesen

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2146208	Design and Optimization of Conventional and Electrified Automotive Transmissions	2 SWS	Lecture (V)	Faust

Competence Certificate
oral exam (20 min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Design and Optimization of Conventional and Electrified Automotive Transmissions

Lecture (V)

2146208, SS 2020, 2 SWS, Language: German, Open in study portal

Content

- Transmission types: Manual (MT) & automated manual transmissions (AMT), planetary torque converter machines (AT), double clutch (DCT), continuously variable (CVT) and geared neutral transmissions (IVT), hybrid transmissions (serial, parallel, multimode, Powersplit hybrid), E-axles
- Torsional vibration damper: damped clutch disc, dual mass flywheel, centrifugal pendulum (FKP), lock-up damper for torque converter
- Starting elements: dry single clutch, dry and wet double clutch, hydrodynamic torque converter, special shapes, e-motor
- Power transmission: countershaft transmission, planetary gear set, CVT variator, chain, synchronization, shift and claw clutches, reversing, differentials and locking systems, coaxial and axially parallel E-axis drives
- Transmission control: shift systems for MT, actuators for clutches and gear shifting, hydraulic control, electronic control, software application, comfort and sportiness
- Special designs: drive trains of commercial vehicles, hydrostat with power split, torque vectoring
- E-mobility: Classification into 5 stages of electrification, 4 hybrid configurations, 7 parallel hybrid architectures, hybridized transmissions (P2, P2.5, P3, P4), dedicated hybrid transmissions (DHT; serial / parallel / multimode, powersplit, new ones Concepts), gearbox for electric vehicles (E-axle gearbox, coaxial and axially parallel)

T 3.68 Course: Do it! – Service-Learning for prospective mechanical engineers [T-MACH-106700]

Responsible: Prof. Dr.-Ing. Barbara Deml
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Completed coursework	2	Each winter term	1

Events					
WS 19/20	2109039	Do it! – Service-Learning for prospective mechanical engineers	2 SWS	Seminar (S)	Deml
Exams					
WS 19/20	76-T-MACH-106700	Do it! – Service-Learning for prospective mechanical engineers		Prüfung (PR)	Deml

Competence Certificate
Active and regular participation (compulsory attendance) in all appointments; no marking.

Prerequisites
Timely enrollment in ILIAS; limited number of participants.

Below you will find excerpts from events related to this course:

V Do it! – Service-Learning for prospective mechanical engineers
Seminar (S)
2109039, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
The course combines university learning with social engagement. The students leave the well-known academic working conditions and apply engineering skills (such as the ergonomic workplace design) within a social institution.

The course will take place every two weeks with each session lasting three hours. A part of the course will not be held at KIT, but at a workshop for persons with disabilities.

1) Introductory session

Technical and generic preparation of the work assignment

2) Work assignment (3 sessions)

Getting to know the working conditions in a workshop for persons with disabilities and conducting a work analysis in small groups

3) Interim review session

Sharing about the experiences

4) Implementation phase (2 sessions)

Implementing improvement measures concerning workplace/-process design in small groups

5) Evaluation session

Evaluating and reflecting as well as transfering and integrating the new experiences in their student and working life

Learning target:

The aim of this course is to enable students to get to know different social living and working conditions (such as a workshop for persons with disabilities), to engage in society as prospective mechanical engineers, and in doing so to develop their personality.

The overall goal is to learn by service for people, which again is an important factor for client-oriented behavior. This kind of experience and action oriented learning by social engagement is also called “service-learning”. This is supposed to encourage students’ willingness to change their perspective and to achieve some level of understanding for other living and working conditions in order to enhance their social skills such as empathy, communication skills, individual initiative, and conflict management as well as to support self-organized learning.

This course is carried out in cooperation with external partners; the concept also exists at other universities *(http://www.agentur-mehrwert.de/de/hochschulen/do-it-studierendenprojekte.html).*

Literature
Die Kursmaterialien stehen auf ILIAS zum Download zur Verfügung.

T 3.69 Course: Drive Systems and Possibilities to Increase Efficiency [T-MACH-105451]

Responsible: Dr.-Ing. Hans-Peter Kollmeier

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	2	Each winter term	1

Competence Certificate
Oral examination, time duration 30 min., no aids

Prerequisites
none

T 3.70 Course: Drive Train of Mobile Machines [T-MACH-105307]

Responsible: Prof. Dr.-Ing. Marcus Geimer
Marco Wydra
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2113077	Drive Train of Mobile Machines	2 SWS	Lecture (V)	Geimer, Herr
WS 19/20	2113078	Übung zu 'Antriebsstrang mobiler Arbeitsmaschinen'	1 SWS	Practice (Ü)	Geimer, Herr
Exams					
WS 19/20	76-T-MACH-105307	Drive Train of Mobile Machines		Prüfung (PR)	Geimer
SS 2020	76-T-MACH-105307	Drive Train of Mobile Machines		Prüfung (PR)	Geimer

Competence Certificate
The final assessment will be an oral examination (20 min) taking place during the recess period. The examination will be offered in ervery semester and can be repeated at any regular examination date.

Prerequisites
none

Recommendation

- General principles of mechanicals engineering
- Basic knowledge of hydraulics
- Interest in mobile machinery

Annotation
At the end of the lecture, participants can explain the structure and function of all discussed drive trains of mobile machines. They can analyze complex gearbox schematics and synthesize simple transmission functions using rough calculations.

Content:

In this course the different drive trains of mobile machinery will be discussed. The focus of this course is:

- mechanical gears
- torque converter
- hydrostatic drives
- power split drives
- electrical drives
- hybrid drives
- axles
- terra mechanics

Media: projector presentation

Literature: Download of lecture slides from ILIAS. Further literature recommendations during lectures.

Below you will find excerpts from events related to this course:

V Drive Train of Mobile Machines

Lecture (V)

2113077, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
In this course will be discussed the different drive train of mobile machinerys. The fokus of this course is:
- improve knowledge of fundamentals
- mechanical gears
- torque converter
- hydrostatic drives
- continuous variable transmission
- eletrical drives
- hybrid drives
- axles
- terra mechanic

Recommendations:

- general basics of mechanical engineering
- basic knowledge in hydraulics
- interest in mobile machines

- regular attendance: 21 hours
- self-study: 89 hours

Literature
Skriptum zur Vorlesung downloadbar über ILIAS

T 3.71 Course: Dynamics of the Automotive Drive Train [T-MACH-105226]

Responsible: Prof. Dr.-Ing. Alexander Fidlin
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Oral examination	5	Each winter term	1

Events					
WS 19/20	2163111	Dynamics of the Automotive Drive Train	2 SWS	Lecture (V)	Fidlin
WS 19/20	2163112	Übungen zu Dynamik des Kfz-Antriebsstrangs	2 SWS	Practice (Ü)	Fidlin, Yüzbasioglu
Exams					
WS 19/20	76-T-MACH-105226	Dynamics of the Automotive Drive Train		Prüfung (PR)	Fidlin
SS 2020	76-T-MACH-105226	Dynamics of the Automotive Drive Train		Prüfung (PR)	Fidlin

Competence Certificate
Oral examination, 30 min.

Prerequisites
none

Recommendation
Powertrain Systems Technology A: Automotive SystemsMachine DynamicsVibration Theory

Below you will find excerpts from events related to this course:

V Dynamics of the Automotive Drive Train — Lecture (V)
2163111, WS 19/20, 2 SWS, Language: German, Open in study portal

Content

- Main components of the vehicle powertrain and their modelling
- Typical driving situations
- Problemoriented models for particular driving situations
- System analysis and optimization with respect to dynamic behavior

Literature

- Dresig H. Schwingungen mechanischer Antriebssysteme, 2. Auflage, Springer, 2006
- Pfeiffer F., Mechanical System Dynamics, Springer, 2008
- Laschet A., Simulation von Antriebssystemen:Modellbildung der Schwingungssysteme und Beispiele aus der Antriebstechnik, Springer, 1988

V Übungen zu Dynamik des Kfz-Antriebsstrangs — Practice (Ü)
2163112, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
Exercises related to the lecture

T 3.72 Course: Electric Energy Systems [T-ETIT-101923]

Responsible: Prof. Dr.-Ing. Thomas Leibfried
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the Department of Electrical Engineering and Information Technology

Type	Credits	Recurrence	Version
Written examination	5	Each summer term	1

Events					
SS 2020	2307391	Electric Energy Systems	2 SWS	Lecture (V)	Leibfried
SS 2020	2307393	Übungen zu 2307391 Elektroenergiesysteme	1 SWS	Practice (Ü)	Steinle
Exams					
WS 19/20	7307391	Electric Energy Systems		Prüfung (PR)	Leibfried

Prerequisites
none

T 3.73 Course: Electric Rail Vehicles [T-MACH-102121]

Responsible: Prof. Dr.-Ing. Peter Gratzfeld
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2114346	Electric Rail Vehicles	2 SWS	Lecture (V)	Gratzfeld
Exams					
WS 19/20	76-T-MACH-102121	Electric Rail Vehicles		Prüfung (PR)	Gratzfeld
WS 19/20	76-T-MACH-102122	Electric Rail Vehicles		Prüfung (PR)	Gratzfeld
SS 2020	76-T-MACH-102121	Electrical Railway Traction Systems		Prüfung (PR)	Gratzfeld

Competence Certificate
Oral examination

Duration: ca. 20 minutes

No tools or reference materials may be used during the exam.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Electric Rail Vehicles
2114346, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content

1. Introduction: history of electric traction in railway vehicles, economic impact
2. Wheel-rail-contact: carrying of vehicle mass, adhesion, current return
3. Vehicle dynamics: tractive and brake effort, driving resistance, inertial force, load cycles
4. Electric drives: purpose of electric drive and basic configurations, traction motors (induction machine, synchronous machine with permanent magnets), drives for vehicles at dc and ac lines, drives for vehicle without contact wire, hybrids, conventional drives for existing vehicles
5. Train control management system: definitions, networks, bus systems, components, examples
6. Vehicle concepts: modern vehicle concepts for mass transit and electric main line
7. Traction power supply: dc and ac networks, energy management, design aspects

Literature
Eine Literaturliste steht den Studierenden auf der Ilias-Plattform zum Download zur Verfügung.

A bibliography is available for download (Ilias-platform).

T 3.74 Course: Electrical Engineering and Electronics [T-ETIT-108386]

Responsible: Dr.-Ing. Klaus-Peter Becker
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the Department of Electrical Engineering and Information Technology

Type	Credits	Recurrence	Version
Written examination	8	Each winter term	1

Events					
WS 19/20	2306350	Electrical Engineering and Electronics for Mechanical Engineers	4 SWS	Lecture (V)	De Carne
WS 19/20	2306351	Tutorial for 2306339 Electrical Engineering and Electronics for Mechanical Engineers	2 SWS	Practice (Ü)	Stahl
Exams					
WS 19/20	7306350	Electrical Engineering and Electronics for Mechanical Engineers		Prüfung (PR)	Becker

Competence Certificate
Written exam, duration 3 hours.

Prerequisites
none

Annotation
Exam will be held in english language.

T 3.75 Course: Electrical Engineering and Electronics [T-ETIT-109820]

Responsible: Dr.-Ing. Klaus-Peter Becker
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the Department of Electrical Engineering and Information Technology

Type	Credits	Recurrence	Version
Written examination	8	Each winter term	1

Events					
WS 19/20	2306339	Electrical Engineering and Electronics foir Mechanical Engineers	4 SWS	Lecture (V)	Becker
WS 19/20	2306340	Electrical Engineering and Electronics foir Mechanical Engineers	2 SWS	Lecture (V)	Becker
Exams					
WS 19/20	7306351	Electrical Engineering and Electronics for Mechanical Engineers		Prüfung (PR)	Becker

Annotation
Exam will be held in german language

T 3.76 Course: Electrical Machines [T-ETIT-100807]

Responsible: Dr.-Ing. Klaus-Peter Becker

Organisation: KIT Department of Electrical Engineering and Information Technology

Part of: M-MACH-104878 - Specification in Mechanical Engineering
M-MACH-104882 - Courses of the Department of Electrical Engineering and Information Technology

Type	Credits	Version
Oral examination	4	1

T 3.77 Course: Electrical Machines and Power Electronics [T-ETIT-101954]

Responsible: Dr.-Ing. Klaus-Peter Becker
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the Department of Electrical Engineering and Information Technology

Type	Credits	Recurrence	Version
Written examination	6	Each winter term	1

Events					
WS 19/20	2306387	Electrical Machines and Power Electronics	2 SWS	Lecture (V)	Hiller
WS 19/20	2306389	Tutorial for 2306387 Electrical Machines and Power Electronics	2 SWS	Practice (Ü)	Hiller
Exams					
WS 19/20	7306307	Electrical Machines and Power Electronics		Prüfung (PR)	Braun

Prerequisites
none

T 3.78 Course: Electronic Devices and Circuits [T-ETIT-109318]

Responsible: Prof. Dr. Michael Siegel
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the Department of Electrical Engineering and Information Technology

Type	Credits	Recurrence	Expansion	Version
Written examination	6	Each summer term	1 terms	2

Events					
SS 2020	2312655	Electronic Devices and Circuits	3 SWS	Lecture (V)	Ulusoy
SS 2020	2312657	Übungen zu 2312655 Elektronische Schaltungen	1 SWS	Practice (Ü)	Ulusoy
SS 2020	2312658	Tutorien zu 2312655 Elektronische Schaltungen	SWS		Ulusoy
Exams					
WS 19/20	7312655	Electronic Devices and Circuits		Prüfung (PR)	Siegel

Prerequisites
none

T 3.79 Course: Energy and Process Technology I [T-MACH-102211]

Responsible: Prof. Dr.-Ing. Hans-Jörg Bauer
Dr.-Ing. Corina Schwitzke
Dr. Amin Velji
Heiner Wirbser

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Written examination	9	Each winter term	1

Events					
WS 19/20	2157961	Energy and Process Technology I	6 SWS	Lecture / Practice (VÜ)	Wirbser, Bauer, Mitarbeiter, Wagner
Exams					
WS 19/20	76-T-MACH-102211	Energy and Process Technology I		Prüfung (PR)	Bauer, Wirbser, Schwitzke
SS 2020	76-T-MACH-102211	Energy and Process Technology I		Prüfung (PR)	Bauer, Wirbser, Schwitzke

Competence Certificate
The assessment consists of a written exam (120 minutes) (following §4(2), 1 of the examination regulation).

Prerequisites
none

Below you will find excerpts from events related to this course:

V Energy and Process Technology I
2157961, WS 19/20, 6 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Content
The last thrid of the lecture deals with the topic **Thermal Turbomachinery**. The basic principles, the functionality and the scope of application of gas and steam tubrines for the generation of electrical power and propulsion technology are addressed.

The students are able to:

- describe and calculate the basic physical-technical processes
- apply the mathematical and thermodynamical description
- reflect on and explain the diagrams and schematics
- comment on diagrams
- explain the functionality of gas and steam turbines and their components
- name the applications of thermal turbomachinery and their role in the field of electricity generation and propulsion technology

T 3.80 Course: Energy and Process Technology II [T-MACH-102212]

Responsible: Dr.-Ing. Corina Schwitzke
Heiner Wirbser

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Written examination	9	Each summer term	1

Events					
SS 2020	2170832	Energy and Process Technology II	6 SWS	Lecture / Practice (VÜ)	Schwitzke, Wirbser, Pritz
Exams					
WS 19/20	76-T-MACH-102212	Energy and Process Technology II		Prüfung (PR)	Schwitzke, Wirbser, Bauer
SS 2020	76-T-MACH-102212	Energy and Process Technology II		Prüfung (PR)	Wirbser, Schwitzke, Bauer

Competence Certificate
The assessment consists of a written exam (120 minutes) (following §4(2), 1 of the examination regulation).

Prerequisites
none

Below you will find excerpts from events related to this course:

V Energy and Process Technology II

2170832, SS 2020, 6 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Content
Thermal Turbomaschinery - In the first part of the lecture deals with energy systems. Questions regarding global energy resources and their use, especially for the generation and provision of electrical energy, are addressed. Common fossile and nuclear power plants for the centralized supply with electrical power as well as concepts of power-heat cogeneration for the decentralized electrical power supply by means of block-unit heat and power plants, etc. are discussed. Moreover, the characteristics and the potential of renewable energy conversion concepts, such as wind and hydro-power, photovoltaics, solar heat, geothermal energy and fuel cells are compare and evaluated. The focus is on the description of the potentials, the risks and the economic feasibility of the different strategies aimed to protect resources and reduce CO2 emissions.

The students are able to:

- discuss and evaluate energy resources and reserves and their utility
- review the use of energy carriers for electrical power generation
- explain the concepts and properties of power-heat cogeneration, renewable energy conversion and fuel cells and their fields of application
- comment on and compare centralized and decentralized supply concepts
- calculate the potentials, riskis and economic feasibility of different strategies aiming at the protection of resources and the reduction of CO2 emissions
- name and judge on the options for solar energy utilization
- discuss the potential of geothermal energy and its utilization

T 3.81 Course: Energy Conversion and Increased Efficiency in Internal Combustion Engines [T-MACH-105564]

Responsible: Prof. Dr. Thomas Koch
Dr.-Ing. Heiko Kubach

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2133121	Energy Conversion and Increased Efficiency in Internal Combustion Engines	2 SWS	Lecture (V)	Koch
Exams					
WS 19/20	76-T-MACH-105564	Energy Conversion and Increased Efficiency in Internal Combustion Engines		Prüfung (PR)	Koch
SS 2020	76-T-MACH-105564	Energy Conversion and Increased Efficiency in Internal Combustion Engines		Prüfung (PR)	Koch, Kubach

Competence Certificate
oral exam, 25 minutes, no auxillary means

Prerequisites
none

Below you will find excerpts from events related to this course:

V Energy Conversion and Increased Efficiency in Internal Combustion Engines

Lecture (V)

2133121, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
1. Introduction
2. Thermodynamics of combustion engines
3. Fundamentals
4. gas exchange
5. Flow field
6. Wall heat losses
7. Combustion in gasoline engines
8. Pressure Trace Analysis
9. Combustion in Diesel engines
10. Waste heat recovery

T 3.82 Course: Energy demand of buildings – fundamentals and applications, with building simulation exercises [T-MACH-105715]

Responsible: Dr. Ferdinand Schmidt
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Oral examination	6	Each summer term	1

Events					
SS 2020	2158203	Energy demand of buildings – fundamentals and applications, with building simulation exercises	4 SWS	Lecture / Practice (VÜ)	Schmidt
Exams					
WS 19/20	76-T-MACH-105715	Energy demand of buildings – fundamentals and applications, with building simulation exercises		Prüfung (PR)	Schmidt
SS 2020	76-T-MACH-105715	Energy demand of buildings – fundamentals and applications, with building simulation exercises		Prüfung (PR)	Schmidt

Competence Certificate
oral exam, 30 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Energy demand of buildings – fundamentals and applications, with building simulation exercises

Lecture / Practice (VÜ)

2158203, SS 2020, 4 SWS, Language: German, Open in study portal

Content

- Selected topics of building physics regarding energy demand of buildings for heating and cooling
- Occupants' comfort in buildings
- Ventilation demand and ventilation concepts
- The passive house concept
- Passive use of solar energy in buildings
- Passive systems / concepts for cooling of buildings
- Exergetic evaluation of building systems
- Heat transfer systems to rooms for heating and cooling, "low-ex" systems
- Numerical methods in building simulation
- Generation of load series, simulation of technical building equipment

Learning outcomes:

The students know the influencing factors on the energy demand of buildings. They know the requirements and prerequisites for low energy and passive houses. They are familiar with methods for setting up energy balances for buildings and the relevant technical building equipment. Students are able to judge under which circumstances zero-energy or plus-energy buildings (with respect to the annual primary energy balance) are attainable. They know the requirements and criteria for occupants' comfort in buildings and they are able to estimate the influence of different renovation and retrofit measures on the energy demand and occupants' comfort. They know use cases and limits of different heat transfer systems for heating and cooling of rooms and are familiar with low exergy concepts for building energy systems.
Through integrated computer exercises, students learn to set up energy models of buildings, perform simulations and sensitivity analysis using these models and to evaluate and present their results.

Exam conditions:

- Project work as prerequisite for oral exam (solution of assigned building simulation task, including presentation in front of class)
- Mode of examination: oral (30 min.)
- Conditions: Cannot be combined with the following courses:
- Building Simulation [2157109]

Literature

- M. Pehnt (Hrsg.), Energieeffizienz (Kap. 6-8). Springer, 2010.
- J. Clarke, Energy Simulation in Building Design. Butterworth-Heinemann, 2nd Ed. 2001.
- D. Kalz / J. Pfafferott, Thermal Comfort and Energy-Efficient Cooling of Nonresidential Buildings, Springer, 2014.

T 3.83 Course: Energy Market Engineering [T-WIWI-107501]

Responsible: Prof. Dr. Christof Weinhardt
Organisation: KIT Department of Economics and Management
Part of: M-MACH-104884 - Courses of the Department of Economics and Management

Type	Credits	Recurrence	Version
Written examination	4,5	Each summer term	1

Events					
SS 2020	2540464	Energy Market Engineering	2 SWS	Lecture (V)	Staudt, vom Scheidt
SS 2020	2540465	Übung zu Energy Market Engineering	1 SWS	Practice (Ü)	Staudt, Richter
Exams					
WS 19/20	7901171	Energy Market Engineering (Nachklausur aus dem SS19)		Prüfung (PR)	Weinhardt

Competence Certificate
The assessment consists of a written exam (60 min) (according to §4(2), 1 of the examination regulations). By successful completion of the exercises (§4 (2), 3 SPO 2007 respectively §4 (3) SPO 2015) a bonus can be obtained. If the grade of the written exam is at least 4.0 and at most 1.3, the bonus will improve it by one grade level (i.e. by 0.3 or 0.4).

Prerequisites
None

Recommendation
None

Annotation
Former course title until summer term 2017: T-WIWI-102794 "eEnergy: Markets, Services, Systems".

The lecture has also been added in the IIP Module *Basics of Liberalised Energy Markets*.

Below you will find excerpts from events related to this course:

V Energy Market Engineering
2540464, SS 2020, 2 SWS, Language: German, Open in study portal — **Lecture (V)**

Literature

- Erdmann G, Zweifel P. *Energieökonomik, Theorie und Anwendungen*. Berlin Heidelberg: Springer; 2007.
- Grimm V, Ockenfels A, Zoettl G. Strommarktdesign: Zur Ausgestaltung der Auktionsregeln an der EEX *. *Zeitschrift für Energiewirtschaft*. 2008:147-161.
- Stoft S. *Power System Economics: Designing Markets for Electricity*. IEEE; 2002.,
- Ströbele W, Pfaffenberger W, Heuterkes M. *Energiewirtschaft: Einführung in Theorie und Politik*. 2nd ed. München: Oldenbourg Verlag; 2010:349.

T 3.84 Course: Energy Storage and Network Integration [T-MACH-105952]

Responsible: Dr.-Ing. Wadim Jäger
Prof. Dr. Robert Stieglitz

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2189487	Energy Storage and Grid Integration	2 SWS	Lecture (V)	Jäger, Stieglitz
Exams					
WS 19/20	76-T-MACH-105952	Energiespeicher und Netzintegration		Prüfung (PR)	Jäger, Stieglitz
SS 2020	76-T-MACH-105952	Energiespeicher und Netzintegration		Prüfung (PR)	Jäger, Stieglitz

Competence Certificate
oral exam, about 30 minutes

Prerequisites
The courses T-MACH-105952 Energiespeicher und Netzintegration and T-ETIT-104644 - Energy Storage and Network Integration can not be combined.

Below you will find excerpts from events related to this course:

V Energy Storage and Grid Integration

Lecture (V)

2189487, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
The lecture provides an overview of the different storage types and their fundamental integration into the power supply grid.

Thereby, within the scope of this lecture, the necessity and the motivation for converting and storing energy will be given. Starting from the definition of fundamental terms different physical and chemical storage types along with their theoretical and practical basis are described. In particular, the decoupling of energy production and energy consumption, and the provision of different energy scales (time, power, density) will be discussed. Furthermore, the challenge of energy transport and re-integration into the different grid types is considered.

Students understand the different types of energy storage and apply their knowledge for the selection and principal dimensioning of relevant energy storage tasks.

Furthermore, students can reflect the state-of-the-art of most important energy storage types, their fundamental characterisitics and viability at given boundary conditions and they are enabled to elaborate and apply basic integration issues dependent on the grid structure for the different network types.

Oral exam, duration approximately 30 min, tools: non

T 3.85 Course: Energy Systems I: Renewable Energy [T-MACH-105408]

Responsible: apl. Prof. Dr. Ron Dagan
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	2

Events					
WS 19/20	2129901	Energy Systems I - Renewable Energy	3 SWS	Lecture (V)	Dagan
Exams					
WS 19/20	76-T-MACH-105408	Energy Systems I: Renewable Energy		Prüfung (PR)	Dagan
SS 2020	76-T-MACH-105408	Energy Systems I: Renewable Energy		Prüfung (PR)	Dagan

Competence Certificate
oral exam, 1/2 hour

Prerequisites
none

Below you will find excerpts from events related to this course:

V Energy Systems I - Renewable Energy

2129901, WS 19/20, 3 SWS, Language: German, Open in study portal

Lecture (V)

Content
The course deals with fundamental aspects of renewable energies.

1. The first part deals with the basic concepts of absorbing solar beans, in an efficient manner accounting for the minimization of heat losses. In this context, selective topics on thermodynamics as well as fluid dynamics are introduced. In the second part few applications are discussed and optimizations techniques of solar collectors construction and their heat transfer are presented.
2. The use of solar energy as a source for heat generation is followed by the idea of electricity generation. Introductive aspects of Photovoltaic technologies are illuminated.
3. The last part presents additional regenerative energy sources such as wind and geothermal energy.

The student knows the principles of the feasibility of energy gain by means of renewable energies, in particular the solar energy.

regular attendance: 34 hours
self-study: 146 hours

Oral examination – as an elective course 30 minutes, in combination with Energiesysteme-II or other courses within the energy courses, as a major course 1 hour

T 3.86 Course: Energy systems II: Reactor Physics [T-MACH-105550]

Responsible: Dr. Aurelian Florin Badea
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2130929	Energy systems II: Reactor Physics	2 SWS	Lecture (V)	Badea
Exams					
WS 19/20	76-T-MACH-105550	Energy Systems II: Reactor Physics		Prüfung (PR)	Badea
WS 19/20	76-T-MACH-105551	Energy systems II: Reactor Physics		Prüfung (PR)	Badea
SS 2020	76-T-MACH-105550	Energy Systems II: Reactor Physics		Prüfung (PR)	Badea

Competence Certificate
oral exam, 20 min

Prerequisites
none

Below you will find excerpts from events related to this course:

V Energy systems II: Reactor Physics

2130929, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
The goal of the course is to train the students for the field of nuclear energy using fission reactors. The students acquire comprehensive knowledge on the physics of nuclear fission reactors: neutron flux, cross sections, fission, breeding processes, chain reaction, critical size of a nuclear system, moderation, reactor dynamics, transport- and diffusion-equation for the neutron flux distribution, power density distributions in reactor, one-group, two-group and multi-group theories for the neutron spectrum. Students are able to analyze and understand the obtained results. Based on the reactor physics knowledge, the students are able to understand, compare and evaluate the capabilities of different types of reactors - LWR, heavy water reactors, nuclear power systems of generation IV – as well as their fundamental nuclear safety concepts. The students are qualified for further training in nuclear energy and safety field and for (also research-related) professional activity in the nuclear industry.

- nuclear fission & fusion,
- radioactive decay, neutron excess, fission, fast and thermal neutrons, fissile and fertile nuclei,
- neutron flux, cross section, reaction rate, mean free path, chain reaction, critical size, moderation,
- reactor dynamics,
- transport- and diffusion-equation for the neutron flux distribution, power distributions in reactor,
- one-group and two-group theories,
- light-water reactors,
- reactor safety,
- design of nuclear reactors,
- breeding processes,
- nuclear power systems of generation IV

Literature
Dieter Schmidt, Reaktortechnik, Band 1: Grundlagen, ISBN 3 7650 2003 6

Dieter Schmidt, Reaktortechnik, Band 2: Anwendungen, ISBN 3 7650 2004 4

T 3.87 Course: Engine Laboratory [T-MACH-105337]

Responsible: Dr.-Ing. Uwe Wagner
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Completed coursework	4	Each summer term	1

Events					
SS 2020	2134001	Engine Laboratory	2 SWS	Practical course (P)	Wagner
Exams					
SS 2020	76-T-MACH-105337	Engine Laboratory		Prüfung (PR)	Koch

Competence Certificate
written documentation of every experiment, certificate of successful attendance, no grading

Prerequisites
none

Below you will find excerpts from events related to this course:

V Engine Laboratory
2134001, SS 2020, 2 SWS, Language: German, Open in study portal

Practical course (P)

Literature
Versuchsbeschreibungen

T 3.88 Course: Engine Measurement Techniques [T-MACH-105169]

Responsible: Dr.-Ing. Sören Bernhardt
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2134137	Engine measurement techniques	2 SWS	Lecture (V)	Bernhardt
Exams					
WS 19/20	76-T-MACH-105169	Engine Measurement Techniques		Prüfung (PR)	Koch
SS 2020	76-T-MACH-105169	Engine Measurement Techniques		Prüfung (PR)	Koch

Competence Certificate
oral examination, Duration: 0,5 hours, no auxiliary means

Prerequisites
none

Recommendation
T-MACH-102194 Combustion Engines I

Below you will find excerpts from events related to this course:

V Engine measurement techniques

2134137, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Literature

1. Grohe, H.:Messen an Verbrennungsmotoren
2. Bosch: Handbuch Kraftfahrzeugtechnik
3. Veröffentlichungen von Firmen aus der Meßtechnik
4. Hoffmann, Handbuch der Meßtechnik
5. Klingenberg, Automobil-Meßtechnik, Band C

T 3.89 Course: Entrepreneurship [T-WIWI-102864]

Responsible: Prof. Dr. Orestis Terzidis
Organisation: KIT Department of Economics and Management
Part of: M-MACH-104884 - Courses of the Department of Economics and Management

Type	Credits	Recurrence	Version
Written examination	3	Each term	1

Events					
SS 2020	2545001	Entrepreneurship	2 SWS	Lecture (V)	Terzidis
Exams					
WS 19/20	7900045	Entrepreneurship		Prüfung (PR)	Terzidis
WS 19/20	7900229	Entrepreneurship		Prüfung (PR)	Terzidis

Competence Certificate
The assessment consists of a written exam (60 minutes) (following §4(2), 1 of the examination regulation).

Prerequisites
None

Recommendation
None

Below you will find excerpts from events related to this course:

V Entrepreneurship

2545001, SS 2020, 2 SWS, Language: English, Open in study portal

Lecture (V)

Literature
Füglistaller, Urs, Müller, Christoph und Volery, Thierry (2008): Entrepreneurship

Ries, Eric (2011): The Lean Startup

Osterwalder, Alexander (2010): Business Model Generation

T 3.90 Course: Excercises - Fatigue of Welded Components and Structures [T-MACH-109304]

Responsible: Dr. Majid Farajian
Prof. Dr. Peter Gumbsch

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Completed coursework	1	Each winter term	1

Events					
WS 19/20	2181731	Fatigue of Welded Components and Structures	2 SWS	Block (B)	Farajian, Gumbsch

Competence Certificate
successful solving of all exercises

Prerequisites
none

Below you will find excerpts from events related to this course:

V Fatigue of Welded Components and Structures

2181731, WS 19/20, 2 SWS, Language: German, Open in study portal

Block (B)

Content
The lecture gives an introduction to the following topics:

- weld quality
- typical damages of welded joints
- evaluation of notches, defects and residual stresses
- strength concepts: nominal, structural and notch stress concepts, fracture mechanics
- life cycle analysis
- post-treatment methods for an extented lifetime
- maintenance, reconditioning and repair

The student can

- describe the influence of welding induced notches, defects and residual stresses on component behavior
- explain the basics of numerical and experimental methods for the evaluation of statically or cyclically loaded welds explain and can apply them
- derive measures in order to increase the lifetime of structures with welded joints under cyclical load

preliminary knowlegde materials science and mechanics recommended

regular attendance: 22,5 hours
self-study: 97,5 hours

Exercise sheets are handed out regularly.

oral examination (ca. 30 min)

no tools or reference materials

Literature

1. D. Radaj, C.M. Sonsino and W. Fricke, Fatigue assessment of welded joints by local approaches, Second edition.Woodhead Publishing, Cambridge 2006.
2. FKM-Richtlinie, Bruchmechanischer Festigkeitsnachweis, Forschungskuratorium Maschinenbau, VDMA Verlag, 2009

T 3.91 Course: Excercises in Technical Thermodynamics and Heat Transfer I [T-MACH-105204]

Responsible: Prof. Dr. Ulrich Maas
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104847 - Major Field Fundamentals of Engineering

Type	Credits	Recurrence	Version
Completed coursework (written)	0	Each winter term	1

Events					
WS 19/20	2165502	Exercise course Technical Thermodynamics and Heat Transfer I	2 SWS	Practice (Ü)	Maas
WS 19/20	3165015	Technical Thermodynamics and Heat Transfer I (Tutorial)	2 SWS	Tutorial (Tu)	Schießl, Maas
Exams					
WS 19/20	76-T-MACH-105204	Excercises in Technical Thermodynamics and Heat Transfer I		Prüfung (PR)	Maas

Competence Certificate
Homework is mandatory.

T 3.92 Course: Excercises in Technical Thermodynamics and Heat Transfer II [T-MACH-105288]

Responsible: Prof. Dr. Ulrich Maas
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104847 - Major Field Fundamentals of Engineering

Type	Credits	Recurrence	Version
Completed coursework	0	Each summer term	1

Events					
SS 2020	2166556	Technical Thermodynamics and Heat Transfer II (Tutorial)	2 SWS	Practice (Ü)	Maas
SS 2020	3166033	Technical Thermodynamics and Heat Transfer II (Tutorial)	2 SWS	Practice (Ü)	Schießl, Maas
Exams					
WS 19/20	76-T-MACH-105288	Excercises in Technical Thermodynamics and Heat Transfer II		Prüfung (PR)	Maas

Competence Certificate
Homework is mandatory.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Technical Thermodynamics and Heat Transfer II (Tutorial)
2166556, SS 2020, 2 SWS, Language: German, Open in study portal

Practice (Ü)

Content
Calculation of thermodynamical problems

Literature
Vorlesungsskriptum
Elsner, N.; Dittmann, A.: Energielehre und Stoffverhalten (Grundlagen der technischen Thermodynamik Bd. 1 und 2), 8. Aufl., Akademie-Verlag, 680 S. 1993.
Baehr, H.D.: Thermodynamik: eine Einführung in die Grundlagen und ihre technischen Anwendungen, 9. Aufl., Springer-Verlag, 460 S., 1996.

T 3.93 Course: Exercices - Tribology [T-MACH-109303]

Responsible: Prof. Dr. Martin Dienwiebel
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Expansion	Version
Completed coursework	0	Each winter term	1 terms	1

Events					
WS 19/20	2181114	Tribology	5 SWS	Lecture / Practice (VÜ)	Dienwiebel, Scherge
Exams					
WS 19/20	76-T-MACH-109303	Exercices - Tribology		Prüfung (PR)	Dienwiebel

Competence Certificate
successful solving of all exercises

Prerequisites
none

Below you will find excerpts from events related to this course:

V Tribology
2181114, WS 19/20, 5 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Content

- Chapter 1: Friction
  adhesion, geometrical and real area of contact, Friction experiments, friction powder, tribological stressing, evironmental influences, tribological age, contact models, Simulation of contacts, roughness.
- Chapter 2: Wear
  plastic deformation at the asperity level, dissipation modes, mechanical mixing, Dynamics of the third body, running-in, running- in dynamics, shear stress.
- Chapter 3: Lubrication
  base oils, Stribeck plot, lubrication regimes (HD, EHD, mixed lubrication), additives, oil characterization, solid lubrication.
- Chapter 4: Measurement Techniques
  friction measurement, tribometer, dissipated frictional power, conventional wear measurement, continuous wear measurement(RNT)
- Chapter 5: Roughness
  profilometry, surface roughness parameters, evaluation length and filters, bearing ratio curve, measurement error
- Chapter 6: Accompanying Analysis
  multi-scale topography measurement, chemical surface analysis, structural analysis, mechanical analysis

Exercises are used for complementing and deepening the contents of the lecture as well as for answering more extensive questions raised by the students.

The student can

- describe the fundamental friction and wear mechanisms, which occur in tribologically stressed systems
- evaluate the friction and wear behavior of tribological systems
- explain the effects of lubricants and their most important additives
- identify suitable approaches to optimize tribological systems
- explain the most important experimental methods for the measurement of friction and wear, and is able to use them for the characterisation of tribo pairs
- choose suitable methods for the evaluation of roughness and topography from the nm-scale to the mm-scale and is able to interpret the determined values in respect to their effect on the tribological behavior
- describe the most important surface-analytical methods and their physical principles for the characterization of tribologically stressed sliding surfaces

preliminary knowlegde in mathematics, mechanics and materials science recommended

regular attendance: 45 hours
self-study: 195 hours

oral examination (ca. 40 min)

no tools or reference materials

admission to the exam only with successful completion of the exercises

Literature

1. Fleischer, G. ; Gröger, H. ; Thum: Verschleiß und Zuverlässigkeit. 1. Auflage. Berlin : VEB-Verlag Technik, 1980
2. Persson, B.J.N.: Sliding Friction, Springer Verlag Berlin, 1998
3. M. Dienwiebel, and M. Scherge, Nanotribology in automotive industry, In:Fundamentals of Friction and Wear on the Nanoscale; Editors: E. Meyer and E. Gnecco, Springer, Berlin, 2007.
4. Scherge, M., Shakhvorostov, D., Pöhlmann, K.: Fundamental wear mechanism of metals. Wear 255, 395–400 (2003)
5. Shakhvorostov, D., Pöhlmann, K., Scherge, M.: An energetic approach to friction, wear and temperature. Wear 257, 124–130 (2004)

T 3.94 Course: Exercises for Applied Materials Simulation [T-MACH-107671]

Responsible: Prof. Dr. Peter Gumbsch
Dr. Katrin Schulz
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Completed coursework	2	Each summer term	2

Events					
SS 2020	2182614	Applied Materials Modelling	4 SWS	Lecture / Practice (VÜ)	Schulz, Gumbsch
Exams					
SS 2020	76-T-MACH-107671	Exercises for Applied Materials Simulation		Prüfung (PR)	Schulz

Competence Certificate
successful solving of all exercises

Prerequisites
none

Below you will find excerpts from events related to this course:

V Applied Materials Modelling

2182614, SS 2020, 4 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Content
This lecture should give the students an overview of different simulation methods in the field of materials science and engineering. Numerical methods are presented and their use in different fields of application and size scales shown and discussed. On the basis of theoretical as well as practical aspects, a critical examination of the opportunities and challenges of numerical material simulation shall be carried out.

The student can

- define different numerical methods and distinguish their range of application
- approach issues by applying the finite element method and discuss the processes and results
- understand complex processes of metal forming and crash simulation and discuss the structural and material behavior
- define and apply the physical fundamentals of particle-based simulation techniques to applications of materials science
- illustrate the range of application of atomistic simulation methods and distinguish between different models

preliminary knowlegde in mathematics, physics and materials science recommended

regular attendance: 34 hours

exercise: 11 hours

self-study: 165 hours

oral exam ca. 35 minutes

no tools or reference materials

admission to the exam only with successful completion of the exercises

Literature

1. D. Frenkel, B. Smit: Understanding Molecular Simulation: From Algorithms to Applications, Academic Press, 2001
2. W. Kurz, D.J. Fisher: Fundamentals of Solidification, Trans Tech Publications, 1998
3. P. Haupt: Continuum Mechanics and Theory of Materials, Springer, 1999
4. M. P. Allen, D. J. Tildesley: Computer simulation of liquids, Clarendon Press, 1996

T 3.95 Course: Exercises for Materials Characterization [T-MACH-107685]

Responsible: Dr.-Ing. Jens Gibmeier
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Completed coursework	2	Each winter term	3

Events					
WS 19/20	2174586	materials characterization	2 SWS	Lecture (V)	Schneider, Gibmeier
Exams					
WS 19/20	76-T-MACH-107685	Exercises for Materials Characterization		Prüfung (PR)	Heilmaier, Gibmeier
SS 2020	76-T-MACH-107685	Exercises for Materials Characterization		Prüfung (PR)	Heilmaier, Gibmeier

Competence Certificate
Regular attendance

Prerequisites
none

Below you will find excerpts from events related to this course:

V materials characterization
2174586, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
The following methods will be introduced within this lecture:

- microscopic methods: optical microscopy, electron microscopy (SEM/TEM), atomic force microscopy
- material and microstructure analyses by means of X-ray, neutron and electron beams
- analysis methods at SEM/TEM (e.g. EELS)
- spectroscopic methods (e.g. EDS / WDS)

learning objectives:
The students have fundamental knowledge about methods of material analysis. They have a basic understanding to transfer this fundamental knowledge on problems in engineering science. Furthermore, the students have the ability to describe technical material by its microscopic and submicroscopic structure.
requirements:
none
workload:

The workload for the module "Materials Characterization" is 180 h per semester and consists of the presence during the lectures (21 h) and tutorials (12 h) as well as self-study for the lecture (99 h) and for the tutorials (48 h).

Literature
Vorlesungsskript (wird zu Beginn der Veranstaltung ausgegeben).

Literatur wird zu Beginn der Veranstaltung bekanntgegeben.

T 3.96 Course: Exercises for Solid State Reactions and Kinetics of Phase Transformations [T-MACH-107632]

Responsible: Dr. Peter Franke
Prof. Dr. Hans Jürgen Seifert

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Completed coursework	2	Each winter term	3

Events					
WS 19/20	2193004	Exercises for Solid State Reactions and Kinetics of Phase Transformations	1 SWS	Practice (Ü)	Franke, Ziebert
Exams					
WS 19/20	76-T-MACH-107632	Exercises for Solid State Reactions and Kinetics of Phase Transformations		Prüfung (PR)	Seifert, Franke

Competence Certificate
successful processing of exercises

Prerequisites
none

Below you will find excerpts from events related to this course:

V Exercises for Solid State Reactions and Kinetics of Phase Transformations

Practice (Ü)

2193004, WS 19/20, 1 SWS, Language: German, Open in study portal

Content
1. Fick's laws of diffusion
2. Calculation of diffusion coefficients
3. Diffusion and solidification

Recommendations: Lecture in Solid State Reactions and Kinetics of Phase Transformations; Basic course in materials science and engineering; physical chemistry

Reinforcement of the lecture by the solution of practical and lecture-relevant exercises

regular attendance: 14 hours

self-study: 46 hours

Literature
Vorlesungsskript;

Lecture notes

3.97 Course: Experimental Dynamics [T-MACH-105514]

Responsible: Prof. Dr.-Ing. Alexander Fidlin
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104853 - Major Field Theoretical Foundations of Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	5	Each summer term	1

Events					
SS 2020	2162225	Experimental Dynamics	3 SWS	Lecture (V)	Fidlin
SS 2020	2162228	Übungen zu Experimentelle Dynamik	2 SWS	Practice (Ü)	Fidlin, Keller
Exams					
WS 19/20	76-T-MACH-105514	Experimental Dynamics		Prüfung (PR)	Fidlin
SS 2020	76-T-MACH-105514	Experimental Dynamics		Prüfung (PR)	Fidlin

Competence Certificate
oral exam, 30 min.

Prerequisites
Can not be combined with Practical Training in Measurement of Vibrations (T-MACH-105373).

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105373 - Practical Training in Measurement of Vibrations must not have been started.

Below you will find excerpts from events related to this course:

Experimental Dynamics
2162225, SS 2020, 3 SWS, Language: German, Open in study portal

Lecture (V)

Content

1. Introduction
2. Measurement principles
3. Sensors as coopled multi-physical systems
4. Digital signal processing, measurements in frequency domain
5. Forced non-linear vibrations
6. Stability problems (Mathieu oscillator, friction induces vibrations)
7. Elementary rotor dynamics
8. Modal analysis

T 3.98 Course: Experimental Fluid Mechanics [T-MACH-105512]

Responsible: Dr. Jochen Kriegseis
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
WS 19/20	2153530	Experimental Fluid Mechanics	2 SWS	Lecture (V)	Kriegseis
SS 2020	2154446	Experimental Fluid Mechanics	2 SWS	Lecture (V)	Kriegseis
Exams					
WS 19/20	76-T-MACH-105512	Experimental Fluid Mechanics		Prüfung (PR)	Kriegseis
SS 2020	76-T-MACH-105512	Experimental Fluid Mechanics		Prüfung (PR)	Kriegseis

Competence Certificate
oral exam - 30 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Experimental Fluid Mechanics

2153530, WS 19/20, 2 SWS, Language: English, Open in study portal

Lecture (V)

Content
The students can describe the relevant physical principles of experimental fluid mechanics. They are qualified to comparatively discuss the introduced measurement techniques. Furthermore, they are able to distinguish (dis-)advantages of the respective approaches. The students can evaluate and discuss measurment signal and data obtained with the common fluid mechanical measuring techniques.

This lecture focuses on experimental methods of fluid mechanics and their application to solve flow problems of practical relevance. In addition, measurement signals and data, obtained with the discussed measuring techniques, are evaluated, presented and discussed.

The lecture covers a selection of the following topics:

- measuring techniques and measureable quantities
- measurements in turbulent flows
- pressure measurements
- hot wire measurements
- optical measuring techniques
- error analysis
- scaling laws
- signal and data evaluation

Literature

Tropea, C., Yarin, A.L., Foss, J.F.: Springer Handbook of Experimental Fluid Mechanics, Springer 2007

Nitsche, W., Brunn, A.: Strömungsmesstechnik, Springer, 2006

Spurk, J.H.: Strömungslehre, Springer, 1996

Tropea, C., Yarin, A.L., Foss, J.F.: Springer Handbook of Experimental Fluid Mechanics, Springer 2007

Spurk, J.H.:Fluid Mechanics, Springer, 1997

V

Experimental Fluid Mechanics

2154446, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content

This lecture focuses on experimental methods of fluid mechanics and their application to solve flow problems of practical relevance. In addition, measurement signals and data, obtained with the discussed measuring techniques, are evaluated, presented and discussed.

The lecture covers a selection of the following topics:

- measuring techniques and measureable quantities
- measurements in turbulent flows
- pressure measurements
- hot wire measurements
- optical measuring techniques
- error analysis
- scaling laws
- signal and data evaluation

Literature

Tropea, C., Yarin, A.L., Foss, J.F.: Springer Handbook of Experimental Fluid Mechanics, Springer 2007

Nitsche, W., Brunn, A.: Strömungsmesstechnik, Springer, 2006

Spurk, J.H.: Strömungslehre, Springer, 1996

T 3.99 Course: Experimental Lab Class in Welding Technology, in Groups [T-MACH-102099]

Responsible: Dr.-Ing. Stefan Dietrich
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Completed coursework	4	Each winter term	2

Events					
WS 19/20	2173560	Welding Lab Course, in groupes	3 SWS	Practical course (P)	Dietrich, Schulze
Exams					
WS 19/20	76-T-MACH-102099	Experimental Lab Class in Welding Technology, in Groups		Prüfung (PR)	Heilmaier, Dietrich

Competence Certificate
Certificate to be issued after evaluation of the lab class report.

Prerequisites
Certtificate of attendance for Welding technique (The participation in the course Welding Technology I/II is assumed.).

Annotation
The lab takes place at the beginning of the winter semester break once a year. The registration is possible during the lecture period in the secretariat of the Institute of Applied Materials (IAM – WK). The lab is carried out in the Handwerkskammer Karlsruhe.

You need sturdy shoes and long clothes!

Below you will find excerpts from events related to this course:

V Welding Lab Course, in groupes

Practical course (P)

2173560, WS 19/20, 3 SWS, Language: German, Open in study portal

Content
The lab takes place at the beginning of the winter semester break once a year. The registration is possible during the lecture period in the secretariat of the Institute of Applied Materials (IAM – WK). The lab is carried out in the Handwerkskammer Karlsruhe.

learning objectives: The students are capable to name a survey of current welding processes and their suitability for joining different metals. The students can evaluate the advantages and disadvantages of the individual procedures. The students have weld with different welding processes.

requirements:

Certificate to be issued after evaluation of the lab class report
You need sturdy shoes and long clothes!

workload:

regular attendance: 31,5 hours
preparation: 8,5 hours
lab report: 80 hours

Literature
wird im Praktikum ausgegeben

T 3.100 Course: Fabrication Processes in Microsystem Technology [T-MACH-102166]

Responsible: Dr. Klaus Bade
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104850 - Major Field Mechatronics and Microsystem Technology

Type	Credits	Recurrence	Version
Oral examination	4	Each term	1

Events					
WS 19/20	2143882	Fabrication Processes in Microsystem Technology	2 SWS	Lecture (V)	Bade
SS 2020	2143882	Fabrication Processes in Microsystem Technology	2 SWS	Lecture (V)	Bade
Exams					
WS 19/20	76-T-MACH-102166	Fabrication Processes in Microsystem Technology		Prüfung (PR)	Bade

Competence Certificate
Oral examination, 20 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Fabrication Processes in Microsystem Technology
2143882, WS 19/20, 2 SWS, Language: German, Open in study portal **Lecture (V)**

Literature
M. Madou
Fundamentals of Microfabrication

CRC Press, Boca Raton, 1997

W. Menz, J. Mohr, O. Paul

Mikrosystemtechnik für Ingenieure

Dritte Auflage, Wiley-VCH, Weinheim 2005

L.F. Thompson, C.G. Willson, A.J. Bowden
Introduction to Microlithography
2^{nd} Edition, ACS, Washington DC, 1994

V Fabrication Processes in Microsystem Technology
2143882, SS 2020, 2 SWS, Language: German, Open in study portal **Lecture (V)**

Content
The lecture offers an advanced understanding of manufacturing processes in microsystem technology. Basic aspects of microtechnological processing will be introduced. With examples from semiconductor microfabrication and microsystem technology the base processing steps for conditioning and finishing, patterning, removal are imparted. Nano-patterning is covered is also included and the micro-nano interface is discussed. By the help of typical processing steps elementary mechanisms, process execution, and equipment are explained. Additionally quality control, process control and environmental topics are included

Literature

M. Madou
Fundamentals of Microfabrication

CRC Press, Boca Raton, 1997

W. Menz, J. Mohr, O. Paul

Mikrosystemtechnik für Ingenieure

Dritte Auflage, Wiley-VCH, Weinheim 2005

L.F. Thompson, C.G. Willson, A.J. Bowden
Introduction to Microlithography
2nd Edition, ACS, Washington DC, 1994

T 3.101 Course: Failure Analysis [T-MACH-105724]

Responsible: Dr. Christian Greiner
Dr.-Ing. Johannes Schneider

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	2

Events					
WS 19/20	2182572	Failure Analysis	2 SWS	Lecture (V)	Greiner, Schneider
Exams					
WS 19/20	76-T-MACH-105724	Failure Analysis		Prüfung (PR)	Schneider, Greiner
SS 2020	76-T-MACH-105724	Failure Analysis		Prüfung (PR)	Schneider

Competence Certificate
oral examination, ca. 30 min

Prerequisites
none

Recommendation
basic knowledge in materials science (e.g. lecture materials science I and II)

Below you will find excerpts from events related to this course:

V Failure Analysis
2182572, WS 19/20, 2 SWS, Open in study portal

Lecture (V)

Content
Aim, procedure and content of examining failure
Examination methods
Types of failure:
Failure due to mechanical loads
Failure due to corrosion in electrolytes
Failure due to thermal loads
Failure due to tribological loads
Damage systematics

The students are able to discuss damage evaluation and to perform damage investigations. They know the common necessary investigation
methods and can regard failures considering load and material resistance. Furthermore they can describe and discuss the most important types of failure and damage appearance.

basic knowledge in materials science (e.g. lecture materials science I and II) recommended

regular attendance: 21 hours
self-study: 99 hours

oral exam, duration: ca. 30 minutes
no notes

Literature

1. G. Lange: Systematische Beurteilung technischer Schadensfälle, 6. Auflage, WILEY-VCH Verlag, 2014, ISBN 978-3-527-68316-1, In der KIT-BIB online verfügbar!
2. A. Neidel, et al.: Handbuch Metallschäden -- REM-Atlas und Fallbeispiele zur Ursachenanalyse und Vermeidung, 2. Auflage, Hanser Verlag, 2011, ISBN 978-3-446-42966-6
3. J. Grosch, et al.: Schadenskunde im Maschinenbau: Charakteristische Schadensursachen – Analyse und Aussagen von Schadensfällen, 6. Auflage, Expert-Verlag, 2014, ISBN 978-3-816-93172-0
4. E. Wendler-Kalsch, H. Gräfen: Korrosionsschadenkunde, Springer-Verlag, 1998, ISBN 3-540-63377-4

T 3.102 Course: Failure of Structural Materials: Deformation and Fracture [T-MACH-102140]

Responsible: Prof. Dr. Peter Gumbsch
Dr. Daniel Weygand

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2181711	Failure of structural materials: deformation and fracture	3 SWS	Lecture / Practice (VÜ)	Gumbsch, Weygand
Exams					
WS 19/20	76-T-MACH-102140	Failure of Structural Materials: Deformation and Fracture		Prüfung (PR)	Weygand, Gumbsch, Kraft
SS 2020	76-T-MACH-102140	Failure of Structural Materials: Deformation and Fracture		Prüfung (PR)	Kraft, Weygand, Gumbsch

Competence Certificate
oral exam ca. 30 minutes

no tools or reference materials

Prerequisites
none

Recommendation
preliminary knowlegde in mathematics, mechanics and materials science

Below you will find excerpts from events related to this course:

V Failure of structural materials: deformation and fracture

Lecture / Practice (VÜ)

2181711, WS 19/20, 3 SWS, Language: German, Open in study portal

Content

1. Introduction
2. linear elasticity
3. classification of stresses
4. Failure due to plasticity
    - tensile test
    - dislocations
    - hardening mechanisms
    - guidelines for dimensioning
5. composite materials
6. fracture mechanics
    - hypotheses for failure
    - linear elasic fracture mechanics
    - crack resitance
    - experimental measurement of fracture toughness
    - defect measurement
    - crack propagation
    - application of fracture mechanics
    - atomistics of fracture

The student

- has the basic understanding of mechanical processes to explain the relationship between externally applied load and materials strength.
- can explain the foundation of linear elastic fracture mechanics and is able to determine if this concept can be applied to a failure by fracture.
- can decribe the main empirical materials models for deformation and fracture and can apply them.
- has the physical understanding to describe and explain phenomena of failure.

preliminary knowlegde in mathematics, mechanics and materials science recommended

regular attendance: 22,5 hours
self-study: 97,5 hours

The assessment consists of an oral examination (ca. 30 min) according to Section 4(2), 2 of the examination regulation.

Literature

- Engineering Materials, M. Ashby and D.R. Jones (2nd Edition, Butterworth-Heinemann, Oxford, 1998); sehr lesenswert, relativ einfach aber dennoch umfassend, verständlich
- Mechanical Behavior of Materials, Thomas H. Courtney (2nd Edition, McGraw Hill, Singapur); Klassiker zu den mechanischen Eigenschaften der Werkstoffe, umfangreich, gut
- Bruchvorgänge in metallischen Werkstoffen, D. Aurich (Werkstofftechnische Verlagsgesellschaft Karlsruhe), relativ einfach aber dennoch umfassender Überblick für metallische Werkstoffe

T 3.103 Course: Failure of Structural Materials: Fatigue and Creep [T-MACH-102139]

Responsible: Dr. Patric Gruber
Prof. Dr. Peter Gumbsch

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2181715	Failure of Structural Materials: Fatigue and Creep	2 SWS	Lecture (V)	Gruber, Gumbsch
Exams					
WS 19/20	76-T-MACH-102139	Failure of Structural Materials: Fatigue and Creep		Prüfung (PR)	Kraft, Gumbsch, Gruber
SS 2020	76-T-MACH-102139	Failure of Structural Materials: Fatigue and Creep		Prüfung (PR)	Gruber, Gumbsch

Competence Certificate
oral exam ca. 30 minutes

no tools or reference materials

Prerequisites
none

Recommendation
preliminary knowlegde in mathematics, mechanics and materials science

Below you will find excerpts from events related to this course:

V Failure of Structural Materials: Fatigue and Creep

Lecture (V)

2181715, WS 19/20, 2 SWS, Language: German, Open in study portal

Content

1 Fatigue
1.1 Introduction
1.2 Lifetime
1.3 Fatigue Mechanisms
1.4 Material Selection
1.5 Notches and Shape Optimization
1.6 Case Studies: ICE-Accidents

2 Creep
2.1 Introduction
2.2 High Temperature Plasticity
2.3 Phänomenological DEsciption of Creep
2.4 Creep Mechanisms
2.5 Alloying Effects

The student

- has the basic understanding of mechanical processes to explain the relationships between externally applied load and materials strength.
- can describe the main empirical materials models for fatigue and creep and can apply them.
- has the physical understanding to describe and explain phenomena of failure.
- can use statistical approaches for reliability predictions.
- can use its acquired skills, to select and develop materials for specific applications.

preliminary knowlegde in mathematics, mechanics and materials science recommended

regular attendance: 22,5 hours
self-study: 97,5 hours

The assessment consists of an oral examination (ca. 30 min) according to Section 4(2), 2 of the examination regulation.

Literature

- Engineering Materials, M. Ashby and D.R. Jones (2nd Edition, Butterworth-Heinemann, Oxford, 1998); sehr lesenswert, relativ einfach aber dennoch umfassend, verständlich
- Mechanical Behavior of Materials, Thomas H. Courtney (2nd Edition, McGraw Hill, Singapur); Klassiker zu den mechanischen Eigenschaften der Werkstoffe, umfangreich, gut
- Bruchvorgänge in metallischen Werkstoffen, D. Aurich (Werkstofftechnische Verlagsgesellschaft Karlsruhe), relativ einfach aber dennoch umfassender Überblick für metallische Werkstoffe
- Fatigue of Materials, Subra Suresh (2nd Edition, Cambridge University Press); Standardwerk über Ermüdung, alle Materialklassen, umfangreich, für Einsteiger und Fortgeschrittene

T 3.104 Course: Fatigue of Metallic Materials [T-MACH-105354]

Responsible: Dr.-Ing. Stefan Guth
Dr. Karl-Heinz Lang

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	2

Events					
WS 19/20	2173585	Fatigue of Metallic Materials	2 SWS	Lecture (V)	Guth, Lang
Exams					
WS 19/20	76-T-MACH-105354	Fatigue of Metallic Materials		Prüfung (PR)	Lang, Guth
SS 2020	76-T-MACH-105354	Fatigue of Metallic Materials		Prüfung (PR)	Lang, Guth

Competence Certificate
Oral exam, about 20 minutes

Prerequisites
none

Recommendation
Basic knowledge in Materials Science will be helpful.

Below you will find excerpts from events related to this course:

V Fatigue of Metallic Materials

Lecture (V)

2173585, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
Introduction: some interesting cases of damage

Cyclic Stress Strain Behaviour

Crack Initiation

Crack Propagation

Lifetime Behaviour under Cyclic Loading

Fatigue of Notched Components

Influence of Residual Stresses

Structural Durability

learning objectives:

The students are able to recognise the deformation and the failure behaviour of metallic materials under cyclic loading and to assign it to the basic microstructural processes. They know the sequence and the development of fatigue damages and can evaluate the initiation and the growth of fatigue cracks.

The students can assess the cyclic strength behaviour of metallic materials and components both qualitatively and quantitatively and know the procedures for the assessment of single-stage, multistage and stochastic cyclical loadings. Furthermore, they can take into account the influence of residual stresses.

requirements:

none, basic knowledge in Material Science will be helpful

workload:

regular attendance: 21 hours
self-study: 99 hours

Literature
Ein Manuskript, das auch aktuelle Literaturhinweise enthällt, wird in der Vorlesung verteilt.

T 3.105 Course: Fatigue of Welded Components and Structures [T-MACH-105984]

Responsible: Dr. Majid Farajian
Prof. Dr. Peter Gumbsch

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Oral examination	3	Each winter term	1

Events					
WS 19/20	2181731	Fatigue of Welded Components and Structures	2 SWS	Block (B)	Farajian, Gumbsch

Competence Certificate
oral examination (ca. 30 min)

no tools or reference materials

Prerequisites
admission to the exam only with successful completion of the exercises [T-MACH-109304]

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-109304 - Excercises - Fatigue of Welded Components and Structures must have been passed.

Recommendation
preliminary knowlegde materials science and mechanics

Below you will find excerpts from events related to this course:

V Fatigue of Welded Components and Structures

2181731, WS 19/20, 2 SWS, Language: German, Open in study portal

Block (B)

Content
The lecture gives an introduction to the following topics:

- weld quality
- typical damages of welded joints
- evaluation of notches, defects and residual stresses
- strength concepts: nominal, structural and notch stress concepts, fracture mechanics
- life cycle analysis
- post-treatment methods for an extented lifetime
- maintenance, reconditioning and repair

The student can

- describe the influence of welding induced notches, defects and residual stresses on component behavior
- explain the basics of numerical and experimental methods for the evaluation of statically or cyclically loaded welds explain and can apply them
- derive measures in order to increase the lifetime of structures with welded joints under cyclical load

preliminary knowlegde materials science and mechanics recommended

regular attendance: 22,5 hours
self-study: 97,5 hours

Exercise sheets are handed out regularly.

oral examination (ca. 30 min)

no tools or reference materials

Literature

1. D. Radaj, C.M. Sonsino and W. Fricke, Fatigue assessment of welded joints by local approaches, Second edition.Woodhead Publishing, Cambridge 2006.
2. FKM-Richtlinie, Bruchmechanischer Festigkeitsnachweis, Forschungskuratorium Maschinenbau, VDMA Verlag, 2009

T 3.106 Course: FEM Workshop - Constitutive Laws [T-MACH-105392]

Responsible: Dr. Katrin Schulz
Dr. Daniel Weygand

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Completed coursework	4	Each term	1

Events					
SS 2020	2183716	FEM Workshop -- Constitutive Laws	2 SWS	Block (B)	Schulz, Weygand
Exams					
WS 19/20	76-T-MACH-105392	FEM Workshop - Constitutive Laws		Prüfung (PR)	Schulz, Weygand
SS 2020	76-T-MACH-105392	FEM Workshop - Constitutive Laws		Prüfung (PR)	Weygand, Schulz

Competence Certificate
solving of a FEM problem

preparation of a report

preparation of a short presentation

Prerequisites
none

Recommendation
Engineering Mechanics; Advanced Mathematics; Introduction to Theory of Materials

Below you will find excerpts from events related to this course:

V FEM Workshop -- Constitutive Laws

2183716, SS 2020, 2 SWS, Language: German, Open in study portal

Block (B)

Content
The course repeats the fundamentals of the theory of materials. It leads to the characterization and classification of material behavior as well as the specification by adequate material models. Here we focus on elastic, viscoelastic, plastic, and viscoplastic deformation behavior. Introducing the finite element program ABAQUS, the students learn how to analyze the material models numerically. Therefore ABAQUS-own and continuative constitutive equations are chosen.

The student

- has the basic understanding of the materials theory and the classification of materials
- is able to independently generate numerical models using ABAQUS and can choose and apply adequate constitutive equations

Engineering Mechanics; Advanced Mathematics; Introduction to Theory of Materials recommended

regular attendance: 28 hours
self-study: 92 hours

Oral examination (ca. 20 min) in the elective module MSc, otherwise no grading

solving of a FEM problem

preparation of a report

preparation of a short presentation

T 3.107 Course: Financial Analysis [T-WIWI-102900]

Responsible: Dr. Torsten Luedecke
Organisation: KIT Department of Economics and Management
Part of: M-MACH-104884 - Courses of the Department of Economics and Management

Type	Credits	Recurrence	Version
Written examination	4,5	Each summer term	1

Events					
SS 2020	2530205	Financial Analysis	2 SWS	Lecture (V)	Luedecke
SS 2020	2530206	Übungen zu Financial Analysis	2 SWS	Practice (Ü)	Luedecke
Exams					
WS 19/20	7900059	Financial Analysis		Prüfung (PR)	Luedecke, Ruckes
SS 2020	7900075	Financial Analysis		Prüfung (PR)	Luedecke

Competence Certificate
See German version.

Prerequisites
None

Recommendation
Basic knowledge in corporate finance, accounting, and valuation is required.

Below you will find excerpts from events related to this course:

V Financial Analysis

2530205, SS 2020, 2 SWS, Language: English, Open in study portal

Lecture (V)

Literature

- Alexander, D. and C. Nobes (2017): Financial Accounting – An International Introduction, 6th ed., Pearson.
- Penman, S.H. (2013): Financial Statement Analysis and Security Valuation, 5th ed., McGraw Hill.

T 3.108 Course: Finite Difference Methods for Numerial Solution of Thermal and Fluid Dynamical Problems [T-MACH-105391]

Responsible: Prof. Dr. Claus Günther
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2153405	Finite Difference Methods for numerial solution of thermal and fluid dynamical problems	2 SWS	Lecture (V)	Günther

Competence Certificate
oral exam, Duration: 30 minutes

no auxiliary means

Prerequisites
none

Below you will find excerpts from events related to this course:

V Finite Difference Methods for numerial solution of thermal and fluid dynamical problems

Lecture (V)

2153405, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
This lecture will be omitted until further.

The students can apply the most important difference schemes for the numerical solution of steady and transient problems which are typical for thermal and fluid flow problems. They are able to discuss the most relevant properties of difference schemes such as consistency, stability and convergence. Furthermore, they can estimate the order of the numerical error and non-appearance of numerical oscillations.

The students get a basic knowledge of relevant numerical algorithms and the use of them in commercial and open fluid flow codes.

The lecture initially presents an overview and then the most important difference schemes for the numerical solution of steady and transient problems which are typical for thermal and fluid flow problems. The most relevant properties of difference schemes at one side as consistency, stability and convergence, at the other side the order of the numerical error and non-appearance of numerical oscillations are described. Algorithms for the solution of coupled systems of equations, characteristic for fluid flow and thermal problems, are reviewed.

- Spatial and temporal discretization
- Properties of difference schemes
- Numerical stability, consistency, convergence
- Nonhomogeneous meshes
- Coupled and noninteracting calculation methods

Literature
Folienkopien

T 3.109 Course: Finite Element Workshop [T-MACH-105417]

Responsible: Prof. Dr. Claus Mattheck
Dr. Daniel Weygand

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Completed coursework	4	Each summer term	1

Events					
SS 2020	2182731	Finite Element Workshop	2 SWS	Block (B)	Weygand, Mattheck, Tesari

Competence Certificate
attendance certificate for participation in all course dates

Prerequisites
none

Recommendation
Continuum Mechanics

Below you will find excerpts from events related to this course:

V Finite Element Workshop

2182731, SS 2020, 2 SWS, Language: German, Open in study portal

Block (B)

Content
The students will learn the foundations of the FEM stress analysis and the optimization methode 'Zugdreiecke'.

The student can

- perform stress analysis for simple components using the commercial software package ANSYS
- utilise the method of the tensile triangle to optimize the shape of components with respect to stress distribution

Fundamentals of Continuum Mechanics are required.

regular attendance: 22,5 hours

certificate in case of regular attendance

T 3.110 Course: Flow Simulations [T-MACH-105458]

Responsible: Prof. Dr.-Ing. Bettina Frohnapfel
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104853 - Major Field Theoretical Foundations of Mechanical Engineering

Type	Credits	Recurrence	Version
Completed coursework	4	Each winter term	1

Events					
WS 19/20	2154447	Flow Simulations	2 SWS	Practical course (P)	Bruzzese, Frohnapfel, Mitarbeiter
Exams					
WS 19/20	76-T-MACH-105458	Flow Simulations		Prüfung (PR)	Bruzzese

Competence Certificate
ungraded homework and colloquium

Prerequisites
none

Below you will find excerpts from events related to this course:

V Flow Simulations
2154447, WS 19/20, 2 SWS, Language: German, Open in study portal

Practical course (P)

Content
Flow Simulations with OpenFOAM(R)

- Basic elements of a simulation with OPENFOAM(R)
- Simulation of 'classic' incompressible, stationary/unstationary, laminar/turbulent (in RANS context) flows (special types of flows, e.g. reactive flows, multi-phase flows, magnetohydrodynamics, ... are not covered)
- Visualization of results
- Evaluation and interpretation of results
- Necessary basics of turbulence modelling with RANS models in OPENFOAM(R)
- Basics of the structure and the numerics of OPENFOAM(R) and possibilities for extending the software

(This offering is not approved or endorsed by OpenCFD Limited, producer and distributor of the OpenFOAMsoftware via www.openfoam.com, and owner of the OPENFOAM(R) and OpenCFD(R) trade marks. OPENFO-AM(R) is a registered trade mark of OpenCFD Limited, producer and distributor of the OpenFOAM software via www.openfoam.com.)

Literature
H. Ferziger, M. Peric, *Numerische Strömungsmechanik*, Springer-Verlag, ISBN: 978-3-540-68228-8, 2008

E. Laurien, H. Oertel jr, *Numerische Strömungsmechanik*, Vieweg+Teubner Verlag, ISBN: 973-3-8348-0533-1, 2009

T 3.111 Course: Flows and Heat Transfer in Energy Technology [T-MACH-105403]

Responsible: Prof. Dr.-Ing. Xu Cheng
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2189911	Tutorial 'Flows and Heat Transfer in Energy Technology '	1 SWS	Practice (Ü)	Cheng, Mitarbeiter
Exams					
WS 19/20	76-T-MACH-105403	Flows and Heat Transfer in Energy Technology		Prüfung (PR)	Cheng

Competence Certificate
oral exam, 20 min

Prerequisites
none

T 3.112 Course: Flows with Chemical Reactions [T-MACH-105422]

Responsible: Prof. Dr. Andreas Class
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2153406	Flows with chemical reactions	2 SWS	Lecture (V)	Class

Competence Certificate
oral exam, duration 30 minutes

Auxiliary none

Prerequisites
none

Recommendation
Fluid Mechanics (T-MACH-105207)

Mathematical Methods in Fluid Mechanics (T-MACH-105295)

Below you will find excerpts from events related to this course:

V Flows with chemical reactions

Lecture (V)

2153406, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
The students can describe flow scenarios, where a chemical reaktion is confined to a thin layer. They can choose simplifying approaches for the underlying chemistry and discuss the problems with focus on the fluid mechanic aspects. The students are able to solve simple problems analytically. Furthermore, they are qualified to discuss simplifications as relevant for an efficent numerical solution of complex problems.

In the lecture we mainly consider problems, where chemical reaktion is confined to a thin layer.
The problems are solved analytically or they are at least simplified allowing for efficent numerical
sollution procedures. We apply simplified chemistry and focus on the fluid mechanic aspects of the problems.

Literature
Vorlesungsskript

Buckmaster, J.D.; Ludford, G.S.S.: Lectures on Mathematical Combustion, SIAM 1983

T 3.113 Course: Fluid Mechanics 1&2 [T-MACH-105207]

Responsible: Prof. Dr.-Ing. Bettina Frohnapfel
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104847 - Major Field Fundamentals of Engineering

Type	Credits	Recurrence	Version
Written examination	8	Each summer term	2

Events					
WS 19/20	2153512	Fluid Mechanics II	3 SWS	Lecture / Practice (VÜ)	Frohnapfel
WS 19/20	3153511	Fluid Mechanics II	3 SWS	Lecture / Practice (VÜ)	Frohnapfel
SS 2020	2154512	Fluid Mechanics I	3 SWS	Lecture / Practice (VÜ)	Frohnapfel
SS 2020	3154510	Fluid Mechanics I	3 SWS	Lecture / Practice (VÜ)	Frohnapfel
Exams					
WS 19/20	76-T-MACH-105207	Fluid Mechanics (1+2)		Prüfung (PR)	Frohnapfel
SS 2020	76-T-MACH-105207	Fluid Mechanics (1+2)		Prüfung (PR)	Frohnapfel, Kriegseis

Competence Certificate
written exam 3 hours

Prerequisites
none

Below you will find excerpts from events related to this course:

V Fluid Mechanics II
2153512, WS 19/20, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Content
The students know how to derive the fundamental equations for mass and momentum conservation and can introduce material laws for fluids into those. They can discuss the physical meaning of the different terms in the Navier-Stokes-Equations. They are capable of simplifying the mathematical equations that describe the motion of fluids and can compute flow quantities for generic problems based on these simplified equations. This includes the calculation of static and dynamic forces acting from the fluid onto the solid as well as the detailed analysis of two-dimensional viscous flows.

tensor notation, fluid elements in continuum, Reynolds transport theorem, conservation of mass and momentum, continuity equation, constitutive law for Newtonian fluids, Navier-Stokes equations, angular momentum and energy conservation, integral form of the conservation equations, forces between fluids and solids, analytical solutions of the Navier-Stokes equations

Literature
Kundu, P.K., Cohen, K.M.: Fluid Mechanics, Elsevier, 4th Edition, 2008

Durst, F.: Grundlagen der Strömungsmechanik, Springer, 2006

Oertel, H.: Strömungsmechanik, Vieweg-Verlag, 4. Auflage 2006
Oertel, H., Böhle, M.: Übungsbuch Strömungsmechanik, Vieweg-Verlag, 5. Auflage 2006

Zierep, J., Bühler, K.: Strömungsmechanik, Springer Lehrbuch bzw. entsprechende Kapitel in Hütte.Das Ingenieurwissen, Springer

V Fluid Mechanics II
3153511, WS 19/20, 3 SWS, Language: English, Open in study portal

Lecture / Practice (VÜ)

Content
The students know how to derive the fundamental equations for mass and momentum conservation and can introduce material laws for fluids into those. They can discuss the physical meaning of the different terms in the Navier-Stokes-Equations. They are capable of simplifying the mathematical equations that describe the motion of fluids and can compute flow quantities for generic problems based on these simplified equations. This includes the calculation of static and dynamic forces acting from the fluid onto the solid as well as the detailed analysis of two-dimensional viscous flows.

tensor notation, fluid elements in continuum, Reynolds transport theorem, conservation of mass and momentum, continuity equation, constitutive law for Newtonian fluids, Navier-Stokes equations, angular momentum and energy conservation, integral form of the conservation equations, forces between fluids and solids, analytical solutions of the Navier-Stokes equations

Literature
Kundu, P.K., Cohen, K.M.: Fluid Mechanics, Elsevier, 4th Edition, 2008

Durst, F.: Grundlagen der Strömungsmechanik, Springer, 2006

Oertel, H.: Strömungsmechanik, Vieweg-Verlag, 4. Auflage 2006
Oertel, H., Böhle, M.: Übungsbuch Strömungsmechanik, Vieweg-Verlag, 5. Auflage 2006

Zierep, J., Bühler, K.: Strömungsmechanik, Springer Lehrbuch bzw. entsprechende Kapitel in Hütte.Das Ingenieurwissen, Springer

V **Fluid Mechanics I** — **Lecture / Practice (VÜ)**
2154512, SS 2020, 3 SWS, Language: German, Open in study portal

Content
Introduction to the fundamentals of fluid mechanics for students of mechanical engineering and related fields, physics and mathematics. The lecture is complemented by a tutorial.

- Introduction
- Flows in Nature and Technologie
- Fundamentals of Fluid Mechanics
- Properties of Fluids and Characteristic Fluid Regimes
- Fundamental Equations of Fluid Mechanics (Conservation of Mass, Momentum and Energy)
    - Continuity equation
    - Navier-Stokes equations (Euler Equations)
    - Energy equation
- Hydro- und Aerostatics
- Flows without dissipation (lossless)
- Technical Flows with Losses
- Introduction to Similarity Analysis
- Two-Dimensional Viscous Flows
- Integral Form of the Governing Equations
- Introduction to Gas Dynamics

Literature
Kundu, P.K., Cohen, K.M.: Fluid Mechanics, Elsevier, 4th Edition, 2008

Durst, F.: Grundlagen der Strömungsmechanik, Springer, 2006

Oertel, H.: Strömungsmechanik, Vieweg-Verlag, 4. Auflage 2006
Oertel, H., Böhle, M.: Übungsbuch Strömungsmechanik, Vieweg-Verlag, 5. Auflage 2006

Zierep, J., Bühler, K.: Strömungsmechanik, Springer Lehrbuch bzw. entsprechende Kapitel in Hütte.Das Ingenieurwissen, Springer

V **Fluid Mechanics I** — **Lecture / Practice (VÜ)**
3154510, SS 2020, 3 SWS, Language: English, Open in study portal

Content
Introduction to the fundamentals of fluid mechanics for students of mechanical engineering and related fields, physics and mathematics. The lecture is complemented by a tutorial.

- Introduction
- Flows in Nature and Technologie
- Fundamentals of Fluid Mechanics
- Properties of Fluids and Characteristic Fluid Regimes
- Fundamental Equations of Fluid Mechanics (Conservation of Mass, Momentum and Energy)
    - Continuity equation
    - Navier-Stokes equations (Euler Equations)
    - Energy equation
- Hydro- und Aerostatics
- Flows without dissipation (lossless)
- Technical Flows with Losses
- Introduction to Similarity Analysis
- Two-Dimensional Viscous Flows
- Integral Form of the Governing Equations
- Introduction to Gas Dynamics

Literature
Kundu, P.K., Cohen, K.M.: Fluid Mechanics, Elsevier, 4th Edition, 2008

Durst, F.: Grundlagen der Strömungsmechanik, Springer, 2006

Oertel, H.: Strömungsmechanik, Vieweg-Verlag, 4. Auflage 2006
Oertel, H., Böhle, M.: Übungsbuch Strömungsmechanik, Vieweg-Verlag, 5. Auflage 2006

Zierep, J., Bühler, K.: Strömungsmechanik, Springer Lehrbuch bzw. entsprechende Kapitel in Hütte. Das Ingenieurwissen, Springer

T 3.114 Course: Fluid Mechanics of Turbulent Flows [T-BGU-109581]

Responsible: Prof. Dr.-Ing. Markus Uhlmann
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-MACH-105405 - Courses of the Department of Civil Engineering, Geo and Environmental Sciences

Type	Credits	Recurrence	Expansion	Version
Oral examination	4	Each summer term	1 terms	1

Events					
SS 2020	6221806	Fluid Mechanics of Turbulent Flows	4 SWS	Lecture / Practice (VÜ)	Uhlmann

Competence Certificate
oral exam, appr. 30 min.

Prerequisites
none

Recommendation
none

Annotation
none

T 3.115 Course: Fluid Power Systems [T-MACH-102093]

Responsible: Prof. Dr.-Ing. Marcus Geimer
Felix Pult

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	2

Events					
WS 19/20	2114093	Fluid Technology	2 SWS	Lecture (V)	Geimer, Pult
Exams					
WS 19/20	76T-MACH-102093	Fluid Power Systems		Prüfung (PR)	Geimer
SS 2020	76-T-MACH-102093	Fluid Power Systems		Prüfung (PR)	Geimer

Competence Certificate
The assessment consists of a writen exam (90 minutes) taking place in the recess period. The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Fluid Technology

2114093, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
In the range of hydrostatics the following topics will be introduced:

- Hydraulic fluids
- Pumps and motors
- Valves
- Accessories
- Hydraulic circuits.

In the range of pneumatics the following topics will be introduced:

- Compressors
- Motors
- Valves
- Pneumatic circuits.

- regular attendance: 21 hours
- self-study: 92 hours

Literature
Skriptum zur Vorlesung *Fluidtechnik*
Institut für Fahrzeugsystemtechnik
downloadbar

T 3.116 Course: Fluid-Structure-Interaction [T-MACH-105474]

Responsible: Prof. Dr.-Ing. Bettina Frohnapfel
Dr.-Ing. Mark-Patrick Mühlhausen

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104853 - Major Field Theoretical Foundations of Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2154453	Fluid-Structure-Interaction with Python	2 SWS		Mühlhausen
Exams					
WS 19/20	76-T-MACH-105474	Fluid-Structure-Interaction		Prüfung (PR)	Mühlhausen

Competence Certificate
oral exam 30 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Fluid-Structure-Interaction with Python

2154453, SS 2020, 2 SWS, Language: German, Open in study portal

Content
„The lecture provides the basics for the description and modeling of flows, structures and their interaction. In the practical part, the covered methods and procedures are deepened with various exercises and examples with Python and Ansys Fluent.

- Brief introduction to Python and Ansys Fluent
- Basic equations of continuum mechanics
- Smoothing and remeshing algorithms for mesh deformation
- Finite volume and finite element method
- Methods of fluid-structure interaction
- coupling conditions
- Monolithic and partitioned coupling methods
- Coupling algorithms for partitioned methods
- Stability and convergence of coupled systems"

Literature
wird in der Vorlesung vorgestellt

T 3.117 Course: Foundations of Nonlinear Continuum Mechanics [T-MACH-105324]

Responsible: apl. Prof. Marc Kamlah
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104853 - Major Field Theoretical Foundations of Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2181720	Foundations of nonlinear continuum mechanics	2 SWS	Lecture (V)	Kamlah
Exams					
WS 19/20	76-T-MACH-105324	Foundations of Nonlinear Continuum Mechanics		Prüfung (PR)	Gruber
SS 2020	76-T-MACH-105324	Foundations of Nonlinear Continuum Mechanics		Prüfung (PR)	Kamlah

Competence Certificate
oral exam

Below you will find excerpts from events related to this course:

V Foundations of nonlinear continuum mechanics

Lecture (V)

2181720, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
The lecture is organized in three parts. In the first part, the mathematical foundations of tensor algebra and tensor analysis are introduced, usually in cartesian representation. In the second part of the lecture, the kinematics, i.e. the geometry of deformation is presented. Besides finite deformation, geometric linearization is discussed. The thrid part of the lecture deals with the physical balance laws of thermomechanics. It is shown, how a special classical theory of continuum mechanics can be derived by adding a corresponding constitutive model. For the illustration of the theory, elementary examples are discussed repeatedly.

The students understand the fundamental structure of a continuum theory consisting of kinematics, balance laws and constitutive model. In particular, they recognize non-linear continuum mechanics as a common structure including all continuum theories of thermomechanics, which are obtained by adding a corresponding constitutive model. The students understand in detail the kinematics of finite deformation and know the transition to the geometrically linear theory they are familiar with. The students know the spatial and material representation of the theory and the different related tensors. The students take the balance laws as physical postulates and understand their respective physical motivation.

Qualification: Engineering Mechanics - Advanced Mathematics

regular attendance: 22,5 hours
self-study: 97,5 hours

oral exam ca. 30 minutes

Literature
Vorlesungsskript

T 3.118 Course: Foundry Technology [T-MACH-105157]

Responsible: Dr.-Ing. Christian Wilhelm
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	2

Events					
SS 2020	2174575	Foundry Technology	2 SWS	Lecture (V)	Wilhelm

Competence Certificate
oral exam; about 25 minutes

Prerequisites
Materials Science I & II must be passed.

Below you will find excerpts from events related to this course:

V Foundry Technology

2174575, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content

Moulding and casting processes

Solidifying of melts

Castability

Fe-Alloys

Non-Fe-Alloys

Moulding and additive materials

Core production

Sand reclamation

Design in casting technology

Casting simulation

Foundry Processes

learning objectives:

The students know the specific moulding and casting techniques and are able to describe them in detail. The students know the application of moulding and casting techniques concerning castings and metals, their advantages and disadvantages in comparison, their application limits and are able to describe these in detail.

The students know the applied metals and are able to describe advantages and disadvantages as well as the specific range of use.

The students are able, to describe detailled mould and core materials, technologies, their application focus and mould-affected casting defects.

The students know the basics of casting process of any casting parts concerning the above mentioned criteria and are able to describe detailled.

requirements:
Required: Material Science and Engineering I and II
workload:

The workload for the lecture Foundry Technology is 120 h per semester and consists of the presence during the lecture (21 h) as well as preparation and rework time at home (99 h).

Literature
Literaturhinweise werden in der Vorlesung gegeben

Reference to literature, documentation and partial lecture notes given in lecture

T 3.119 Course: Fuels and Lubricants for Combustion Engines [T-MACH-105184]

Responsible: Dr.-Ing. Bernhard Ulrich Kehrwald
Dr.-Ing. Heiko Kubach

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2133108	Fuels and Lubricants for Combustion Engines	2 SWS	Lecture (V)	Kehrwald
Exams					
WS 19/20	76-T-MACH-105184	Fuels and Lubricants for Combustion Engines		Prüfung (PR)	Kehrwald
SS 2020	76-T-MACH-105184	Fuels and Lubricants for Combustion Engines		Prüfung (PR)	Kehrwald

Competence Certificate
oral examination, Duration: ca. 25 min., no auxiliary means

Prerequisites
none

Below you will find excerpts from events related to this course:

V Fuels and Lubricants for Combustion Engines

Lecture (V)

2133108, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
Introduction and basics

Fuels for Gasoline and Diesel engines

Hydrogen

Lubricants for Gasoline and Diesel engines

Coolants for combustion engines

Literature
Skript

T 3.120 Course: Functional Ceramics [T-MACH-105179]

Responsible: Dr. Manuel Hinterstein
Dr.-Ing. Wolfgang Rheinheimer

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2126784	Functional Ceramics	2 SWS	Lecture (V)	Hinterstein

Competence Certificate
The assessment consists of an oral exam (20 min) taking place at the agreed date.

Auxiliary means: none

The re-examination is offered upon agreement.

Prerequisites
none

T 3.121 Course: Fundamentals for Design of Motor-Vehicle Bodies I [T-MACH-102116]

Responsible: Horst Dietmar Bardehle
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Oral examination	2	Each winter term	1

Events					
WS 19/20	2113814	Fundamentals for Design of Motor-Vehicles Bodies I	1 SWS	Lecture (V)	Bardehle
Exams					
WS 19/20	76-T-MACH-102116	Fundamentals for Design of Motor-Vehicle Bodies I		Prüfung (PR)	Unrau, Bardehle
SS 2020	76-T-MACH-102116	Fundamentals for Design of Motor-Vehicle Bodies I		Prüfung (PR)	Bardehle, Unrau

Competence Certificate
Oral group examination

Duration: 30 minutes

Auxiliary means: none

Prerequisites
none

Below you will find excerpts from events related to this course:

V Fundamentals for Design of Motor-Vehicles Bodies I — Lecture (V)
2113814, WS 19/20, 1 SWS, Language: German, Open in study portal

Content
1. History and design

2. Aerodynamics

3. Design methods (CAD/CAM, FEM)

4. Manufacturing methods of body parts

5. Fastening technologie

6. Body in white / body production, body surface

Learning Objectives:

The students have an overview of the fundamental possibilities for design and manufacture of motor-vehicle bodies. They know the complete process, from the first idea, through the concept to the dimensioned drawings (e.g. with FE-methods). They have knowledge about the fundamentals and their correlations, to be able to analyze and to judge relating components as well as to develop them accordingly.

Literature
1. Automobiltechnische Zeitschrift ATZ, Friedr. Vieweg & Sohn Verlagsges. mbH, Wiesbaden
2. Automobil Revue, Bern (Schweiz)
3. Automobil Produktion, Verlag Moderne Industrie, Landsberg

T 3.122 Course: Fundamentals for Design of Motor-Vehicle Bodies II [T-MACH-102119]

Responsible: Horst Dietmar Bardehle
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Oral examination	2	Each summer term	1

Events					
SS 2020	2114840	Fundamentals for Design of Motor-Vehicles Bodies II	1 SWS	Lecture (V)	Bardehle
Exams					
WS 19/20	76-T-MACH-102119	Fundamentals for Design of Motor-Vehicle Bodies II		Prüfung (PR)	Bardehle
SS 2020	76-T-MACH-102119	Fundamentals for Design of Motor-Vehicle Bodies II		Prüfung (PR)	Bardehle, Gauterin

Competence Certificate
Oral group examination

Duration: 30 minutes

Auxiliary means: none

Prerequisites
none

Below you will find excerpts from events related to this course:

V Fundamentals for Design of Motor-Vehicles Bodies II

2114840, SS 2020, 1 SWS, Language: German, Open in study portal

Lecture (V)

Content
1. Body properties/testing procedures
2. External body-parts
3. Interior trim
4. Compartment air conditioning
5. Electric and electronic features
6. Crash tests
7. Project management aspects, future prospects

Learning Objectives:

The students know that, often the design of seemingly simple detail components can result in the solution of complex problems. They have knowledge in testing procedures of body properties. They have an overview of body parts such as bumpers, window lift mechanism and seats. They understand, as well as, parallel to the normal electrical system, about the electronic side of a motor vehicle. Based on this they are ready to analyze and to judge the relation of these single components. They are also able to contribute competently to complex development tasks by imparted knowledge in project management.

Literature
1. Automobiltechnische Zeitschrift ATZ, Friedr. Vieweg & Sohn Verlagsges. mbH, Wiesbaden
2. Automobil Revue, Bern (Schweiz)
3. Automobil Produktion, Verlag Moderne Industrie, Landsberg

T 3.123 Course: Fundamentals in the Development of Commercial Vehicles I [T-MACH-105160]

Responsible: Prof. Dr.-Ing. Jörg Zürn
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Oral examination	2	Each winter term	1

Events					
WS 19/20	2113812	Fundamentals in the Development of Commercial Vehicles I	1 SWS	Lecture (V)	Zürn
Exams					
WS 19/20	76-T-MACH-105160	Fundamentals in the Development of Commercial Vehicles I		Prüfung (PR)	Zürn
SS 2020	76-T-MACH-105160	Fundamentals in the Development of Commercial Vehicles I		Prüfung (PR)	Zürn

Competence Certificate
Oral group examination

Duration: 30 minutes

Auxiliary means: none

Prerequisites
none

Below you will find excerpts from events related to this course:

V Fundamentals in the Development of Commercial Vehicles I

2113812, WS 19/20, 1 SWS, Language: German, Open in study portal

Lecture (V)

Content
1. Introduction, definitions, history
2. Development tools
3. Complete vehicle
4. Cab, bodyshell work
5. Cab, interior fitting
6. Alternative drive systems
7. Drive train
8. Drive system diesel engine
9. Intercooled diesel engines

Learning Objectives:

The students have proper knowledge about the process of commercial vehicle development starting from the concept and the underlying original idea to the real design. They know that the customer requirements, the technical realisability, the functionality and the economy are important drivers.

The students are able to develop parts and components. Furthermore they have knowledge about different cab concepts, the interior and the interior design process. Consequently they are ready to analyze and to judge concepts of commercial vehicles as well as to participate competently in the commercial vehicle development.

Literature

1. Marwitz, H., Zittel, S.: ACTROS -- die neue schwere Lastwagenbaureihe von Mercedes-Benz, ATZ 98, 1996, Nr. 9

2. Alber, P., McKellip, S.: ACTROS -- Optimierte passive Sicherheit, ATZ 98, 1996

3. Morschheuser, K.: Airbag im Rahmenfahrzeug, ATZ 97, 1995, S. 450 ff.

T 3.124 Course: Fundamentals in the Development of Commercial Vehicles II [T-MACH-105161]

Responsible: Prof. Dr.-Ing. Jörg Zürn
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Oral examination	2	Each summer term	1

Events					
SS 2020	2114844	Fundamentals in the Development of Commercial Vehicles II	1 SWS	Lecture (V)	Zürn
Exams					
WS 19/20	76-T-MACH-105161	Fundamentals in the Development of Commercial Vehicles II		Prüfung (PR)	Zürn
SS 2020	76-T-MACH-105161	Fundamentals in the Development of Commercial Vehicles II		Prüfung (PR)	Zürn

Competence Certificate
Oral group examination

Duration: 30 minutes

Auxiliary means: none

Prerequisites
none

Below you will find excerpts from events related to this course:

V Fundamentals in the Development of Commercial Vehicles II

2114844, SS 2020, 1 SWS, Language: German, Open in study portal

Lecture (V)

Content
1. Gear boxes of commercial vehicles
2. Intermediate elements of the drive train
3. Axle systems
4. Front axles and driving dynamics
5. Chassis and axle suspension
6. Braking System
7. Systems
8. Excursion

Learning Objectives:

The students know the advantages and disadvantages of different drives. Furthermore they are familiar with components, such as transfer box, propeller shaft, powered and non-powered frontaxle etc. Beside other mechanical components, such as chassis, axle suspension and braking system, also electric and electronic systems are known. Consequently the student are able to analyze and to judge the general concepts as well as to adjust them precisely with the area of application.

Literature

1. Schittler, M., Heinrich, R., Kerschbaum, W.: Mercedes-Benz Baureihe 500 -- neue V-Motorengeneration für schwere Nutzfahrzeuge, MTZ 57 Nr. 9, S. 460 ff., 1996

2. Robert Bosch GmbH (Hrsg.): Bremsanlagen für Kraftfahrzeuge, VDI-Verlag, Düsseldorf, 1. Auflage, 1994

3. Rubi, V., Strifler, P. (Hrsg. Institut für Kraftfahrwesen RWTH Aachen): Industrielle Nutzfahrzeugentwicklung, Schriftenreihe Automobiltechnik, 1993

T 3.125 Course: Fundamentals of Automobile Development I [T-MACH-105162]

Responsible: Prof.Dipl.-Ing. Rolf Frech
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering
M-MACH-104878 - Specification in Mechanical Engineering
M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Written examination	2	Each winter term	1

Events					
WS 19/20	2113810	Fundamentals of Automobile Development I	1 SWS	Lecture (V)	Frech
WS 19/20	2113851	Principles of Whole Vehicle Engineering I	1 SWS	Lecture (V)	Frech
Exams					
WS 19/20	76-T-MACH-105162	Fundamentals of Automobile Development I		Prüfung (PR)	Frech, Unrau

Competence Certificate
Written examination

Duration: 90 minutes

Auxiliary means: none

Prerequisites
none

Below you will find excerpts from events related to this course:

V Fundamentals of Automobile Development I

Lecture (V)

2113810, WS 19/20, 1 SWS, Language: German, Open in study portal

Content
1. Process of automobile development
2. Conceptual dimensioning and design of an automobile
3. Laws and regulations – National and international boundary conditions
4. Aero dynamical dimensioning and design of an automobile I
5. Aero dynamical dimensioning and design of an automobile II
6. Thermo-management in the conflict of objectives between styling, aerodynamic and packaging guidelines I
7. Thermo-management in the conflict of objectives between styling, aerodynamic and packaging guidelines II

Learning Objecitves:

The students have an overview of the fundamentals of the development of automobiles. They know the development process, the national and the international legal requirements that are to be met. They have knowledge about the thermo-management, aerodynamics and the design of an automobile. They are ready to judge goal conflicts in the field of automobile development and to work out approaches to solving a problem.

Literature
Skript zur Vorlesung wird zu Beginn des Semesters ausgegeben

The scriptum will be provided during the first lessons

V Principles of Whole Vehicle Engineering I

Lecture (V)

2113851, WS 19/20, 1 SWS, Language: English, Open in study portal

Content

1. Process of automobile development
2. Conceptual dimensioning and design of an automobile
3. Laws and regulations – National and international boundary conditions
4. Aero dynamical dimensioning and design of an automobile I
5. Aero dynamical dimensioning and design of an automobile II
6. Thermo-management in the conflict of objectives between styling, aerodynamic and packaging guidelines I
7. Thermo-management in the conflict of objectives between styling, aerodynamic and packaging guidelines II

Learning Objectives:

The students have an overview of the fundamentals of the development of automobiles. They know the development process, the national and the international legal requirements that are to be met. They have knowledge about the thermo-management, aerodynamics and the design of an automobile. They are ready to judge goal conflicts in the field of automobile development and to work out approaches to solving a problem.

Literature

Skript zur Vorlesung wird zu Beginn des Semesters ausgegeben

The scriptum will be provided during the first lessons

T 3.126 Course: Fundamentals of Automobile Development II [T-MACH-105163]

Responsible: Prof.Dipl.-Ing. Rolf Frech
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering
M-MACH-104878 - Specification in Mechanical Engineering
M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Written examination	2	Each summer term	2

Events					
SS 2020	2114842	Fundamentals of Automobile Development II	1 SWS	Lecture (V)	Frech
SS 2020	2114860	Principles of Whole Vehicle Engineering II	1 SWS		Frech
Exams					
WS 19/20	76-T-MACH-105163	Fundamentals of Automobile Development II		Prüfung (PR)	Unrau, Frech

Competence Certificate
Written examination

Duration: 90 minutes

Auxiliary means: none

Prerequisites
none

Below you will find excerpts from events related to this course:

V Fundamentals of Automobile Development II

2114842, SS 2020, 1 SWS, Language: German, Open in study portal

Lecture (V)

Content
1. Application-oriented material and production technology I
2. Application-oriented material and production technology II
3. Overall vehicle acoustics in the automobile development
4. Drive train acoustics in the automobile development
5. Testing of the complete vehicle
6. Properties of the complete automobile

Learning Objectives:

The students are familiar with the selection of appropriate materials and the choice of adequate production technology. They have knowledge of the acoustical properties of the automobiles, covering both the interior sound and exterior noise. They have an overview of the testing procedures of the automobiles. They know in detail the evaluation of the properties of the complete automobile. They are ready to participate competently in the development process of the complete vehicle.

Literature
Skript zur Vorlesung ist über ILIAS verfügbar.

V Principles of Whole Vehicle Engineering II

2114860, SS 2020, 1 SWS, Language: English, Open in study portal

Content

1. Application-oriented material and production technology I
2. Application-oriented material and production technology II
3. Overall vehicle acoustics in the automobile development
4. Drive train acoustics in the automobile development
5. Testing of the complete vehicle
6. Properties of the complete automobile

Learning Objectives:

The students are familiar with the selection of appropriate materials and the choice of adequate production technology. They have knowledge of the acoustical properties of the automobiles, covering both the interior sound and exterior noise. They have an overview of the testing procedures of the automobiles. They know in detail the evaluation of the properties of the complete automobile. They are ready to participate competently in the development process of the complete vehicle.

Literature

Das Skript zur Vorlesung ist über ILIAS verfügbar.

T 3.127 Course: Fundamentals of Catalytic Exhaust Gas Aftertreatment [T-MACH-105044]

Responsible: Prof. Dr. Olaf Deutschmann
Prof. Dr. Jan-Dierk Grunwaldt
Dr.-Ing. Heiko Kubach
Prof. Dr.-Ing. Egbert Lox

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2134138	Fundamentals of catalytic exhaust gas aftertreatment	2 SWS	Lecture (V)	Lox, Grunwaldt, Deutschmann
Exams					
WS 19/20	76-T-MACH-105044	Fundamentals of Catalytic Exhaust Gas Aftertreatment		Prüfung (PR)	Lox
SS 2020	76-T-MACH-105044	Fundamentals of Catalytic Exhaust Gas Aftertreatment		Prüfung (PR)	Lox

Competence Certificate
oral examination, Duration: 25 min., no auxiliary means

Prerequisites
none

Below you will find excerpts from events related to this course:

V Fundamentals of catalytic exhaust gas aftertreatment

Lecture (V)

2134138, SS 2020, 2 SWS, Language: German, Open in study portal

Literature
Skript, erhältlich in der Vorlesung

1. "Environmental Catalysis" Edited by G.Ertl, H. Knötzinger, J. Weitkamp Wiley-VCH Verlag GmbH, Weinheim, 1999 ISBN 3-527-29827-4
2. "Cleaner Cars- the history and technology of emission control since the 1960s" J. R. Mondt Society of Automotive Engineers, Inc., USA, 2000 Publication R-226, ISBN 0-7680-0222-2
3. "Catalytic Air Pollution Control - commercial technology" R. M. Heck, R. J. Farrauto John Wiley & Sons, Inc., USA, 1995 ISBN 0-471-28614-1
4. "Automobiles and Pollution" P. Degobert Editions Technic, Paris, 1995 ISBN 2-7108-0676-2
5. "Reduced Emissions and Fuel Consumption in Automobile Engines" F. Schaeder, R. van Basshuysen, Springer Verlag Wien New York, 1995 ISBN 3-211-82718-8
6. "Autoabgaskatalysatoren : Grudlagen - Herstellung - Entwicklung - Recycling - Ökologie" Ch. Hagelüken und 11 Mitautoren, Expert Verlag, Renningen, 2001 ISBN 3-8169-1932-4

T 3.128 Course: Fundamentals of Combustion Engine Technology [T-MACH-105652]

Responsible: Dr.-Ing. Sören Bernhardt
Dr.-Ing. Heiko Kubach
Jürgen Pfeil
Dr.-Ing. Olaf Toedter
Dr.-Ing. Uwe Wagner

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	5	Each winter term	1

Events					
WS 19/20	2133123	Fundamentals of Combustion Engine Technology	2 SWS	Lecture (V)	Kubach, Wagner, Toedter, Pfeil, Bernhardt, Velji
Exams					
WS 19/20	76-T-MACH-105652	Fundamentals of Combustion Engine Technology		Prüfung (PR)	Kubach
SS 2020	76-T-MACH-105652	Fundamentals of Combustion Engine Technology		Prüfung (PR)	Kubach

Competence Certificate
oral exam, 30 min

Prerequisites
none

Below you will find excerpts from events related to this course:

V Fundamentals of Combustion Engine Technology

2133123, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content

Fundamentals of engine processes

Components of combustion engines

Mixture formation systems

Gasexchange systems

Injection systems

Exhaust Gas Aftertreatment Systems

Cooling systems

Ignistion Systems

T 3.129 Course: Fundamentals of Energy Technology [T-MACH-105220]

Responsible: Dr. Aurelian Florin Badea
Prof. Dr.-Ing. Xu Cheng

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering
M-MACH-104878 - Specification in Mechanical Engineering

Type	Credits	Recurrence	Version
Written examination	8	Each summer term	1

Events					
SS 2020	2130927	Fundamentals of Energy Technology	3 SWS	Lecture (V)	Cheng, Badea
SS 2020	3190923	Fundamentals of Energy Technology	3 SWS	Lecture (V)	Badea
Exams					
WS 19/20	76-MACH-105220 Fundamentals of Energy Technology	Fundamentals of Energy Technology		Prüfung (PR)	Badea
WS 19/20	76-T-MACH-105220	Fundamentals of Energy Technology		Prüfung (PR)	Badea, Cheng
SS 2020	76-T-MACH-105220	Fundamentals of Energy Technology		Prüfung (PR)	Cheng, Badea

Competence Certificate
Written examination, 90 min

Prerequisites
none

Below you will find excerpts from events related to this course:

V Fundamentals of Energy Technology

Lecture (V)

2130927, SS 2020, 3 SWS, Language: German, Open in study portal

Content
The objective of the course is to train the students on state of the art knowledge about the challenging fields of energy industry and the permanent competition between the economical profitability and the long-term sustainability. The students obtain basic knowledge on thermodynamics relevant to the energy sector and comprehensive knowledge on the energy sector: demand, energy types, energy mix, installations for energy production (conventional, nuclear and renewable), transport and energy storage, environmental impact and future tendencies. Students are able to use methods of economic efficiency optimization for the energy sector in a creative way, practice oriented, also specifically trained during the corresponding tutorial. The students are qualified for further training in energy engineering related fields and for (also research-related) professional activity in the energy sector.

The following relevant fields of the energy industry are covered:
- Energy demand and energy situation
- Energy types and energy mix
- Basics. Thermodynamics relevant to the energy sector
- Conventional fossil-fired power plants
- Combined Cycle Power Plants
- Cogeneration
- Nuclear energy
- Regenerative energies: hydropower, wind energy, solar energy, other energy systems
- Energy demand structures. Basics of economic efficiency and calculus. Optimization
- Energy storage
- Transport of energy
- Power generation and environment. Future of the energy industry

V **Fundamentals of Energy Technology** **Lecture (V)**
3190923, SS 2020, 3 SWS, Language: English, Open in study portal

Content
The objective of the course is to train the students on state of the art knowledge about the challenging fields of energy industry and the permanent competition between the economical profitability and the long-term sustainability. The students obtain basic knowledge on thermodynamics relevant to the energy sector and comprehensive knowledge on the energy sector: demand, energy types, energy mix, installations for energy production (conventional, nuclear and renewable), transport and energy storage, environmental impact and future tendencies. Students are able to use methods of economic efficiency optimization for the energy sector in a creative way, practice oriented, also specifically trained during the corresponding tutorial. The students are qualified for further training in energy engineering related fields and for (also research-related) professional activity in the energy sector.

The following relevant fields of the energy industry are covered:
- Energy forms
- Thermodynamics relevant to energy industry
- Energy sources: fossil fuels, nuclear energy, renewable sources
- Energy industry in Germany, Europe and worldwide
- Power generation and environment
- Evaluation of energy conversion processes
- Thermal/electrical power plants and processes
- Transport of energy / energy carriers
- Energy storage
- Systems utilizing renewable energy sources
- Basics of economic efficiency and calculus / Optimisation
- Future of the energy industry

T 3.130 Course: Fundamentals of reactor safety for the operation and dismantling of nuclear power plants [T-MACH-105530]

Responsible: Dr. Victor Hugo Sanchez-Espinoza
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-105134 - Elective Module Mechanical Engineering
M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2190465	Fundamentals of reactor safety for the operation and dismantling of nuclear power plants	2 SWS		Sanchez-Espinoza
Exams					
WS 19/20	76-T-MACH-105530	Fundamentals of reactor safety for the operation and dismantling of nuclear power plants		Prüfung (PR)	Sanchez-Espinoza

Competence Certificate
oral exam about 30 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Fundamentals of reactor safety for the operation and dismantling of nuclear power plants
2190465, WS 19/20, 2 SWS, Language: English, Open in study portal

Content
This lecture describes the fundamentals of reactor safety for both the operation and the decommissioning of nuclear power plants. The first part will be focused on reactor safety issues important for the operation of a NPP:

- Safety fundamentals as defense in depth, multi-barrier concepts
- Operational modes of nuclear power plants
- Main components for heat removal, safety systems of selected NPP designs
- Thermal characterization of the core and plant under normal operation conditions
- Accident analysis in nuclear power plants- initiation, methods of evaluations and safety implications

The second part of this lecture will be devoted to explain the neutron physical, radiation protection and safety aspects to be considered for the safe and economical decommissioning of nuclear power plants:

- Life cycle of a nuclear power plant and main strategies and challenges in the NPP decommissioning
- Physical processes responsible for the activation of reactor components during the operation of a nuclear power plant
- Radioactive waste generation in the core, classification and radiological relevance
- Waste classification, minimization methods and intermediate and final disposal
- Risk analysis and prevention, radiation protection issues and the regulatory framework for decommissioning
- Computational methods for the estimation of nuclei inventories, activation and dose rates of reactor components

Knowledge in energy technology, nuclear power plants, reactor physics, radiation protection is welcomed

Time of attendance: 30 hours

Self-study: 90 hours

oral examination; duration: about 30 minutes

Literature

Bibliography related to the Block Course *"Fundamentals of Reactor Safety for the Operation and Dismantling of NPPs"*

1. **M. Laraia, "Nuclear decommissioning: planning, execution and international experience", Woodhead Publishing (2012).**
2. **"Radiological Characterization of Shut Down Nuclear Reactors for Decommissioning Purposes", IAEA Technical Report Series No. 389**
3. **"Classification of radioactive waste", IAEA Safety Standards No. GSG-1.**
4. **"Innovative and Adaptive Technologies in Decommissioning of Nuclear Facilities", IAEA-TECDOC-1602.**
5. **"Planning, Management and Organizational Aspects of the Decommissioning of Nuclear Facilities", IAEA-TECDOC-1702.**
6. **"Managing Low Radioactivity Material from the Decommissioning of Nuclear Facilities", IAEA Technical Report Series No. 462.**
7. **"Safe and effective nuclear power plant life cycle management towards decommissioning", IAEA-TECDOC-1305.**
8. **"Radiological Characterisation for Decommissioning of Nuclear Installations", NEA/RWM/WPDD(2013)2.**
9. **"Proceedings of the ICOND16/International Conference on Nuclear Decommissioning", October 2014 (Aachen, Germany).**
10. **M. Cumo, "Experiences and Techniques in the Decommissioning of Old Nuclear Power Plants, Workshop on Nuclear Reaction Data and Nuclear Reactors: Physics, Design and Safety", 25 February – 28 March 2002 (Trieste, Italy).**
11. **"Safety considerations in the Transition from Operation to Decommissioning of Nuclear Facilities", IAEA Technical Report Series 36.**
12. **"State of the Art Technology for Decontamination and Dismantling of Nuclear Facilities", IAEA Technical Report Series395.**
13. **"A review of the situation of decommissioning of nuclear installations in Europe", European Commission Report EUR 17622**
14. **"Radiation Protection Ordinance", (*http://www.bfs.de*).**

T 3.131 Course: Fusion Technology A [T-MACH-105411]

Responsible: Prof. Dr. Robert Stieglitz
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2169483	Fusion Technology A	2 SWS	Lecture / Practice (VÜ)	Stieglitz
WS 19/20	2169484	Exercise Fusion Technology A	2 SWS	Practice (Ü)	Stieglitz
Exams					
WS 19/20	76-T-MACH-105411	Fusion Technology A		Prüfung (PR)	Stieglitz
SS 2020	76-T-MACH-105411	Fusion Technology A		Prüfung (PR)	Stieglitz

Competence Certificate
oral exam of about 30 minutes

Prerequisites
none

Recommendation
appreciated is knowldege in heat ans mass transfer as well as in electrical engineering,

basic knowledge in fluid mechanics, material sciences and physics

Below you will find excerpts from events related to this course:

V Fusion Technology A

2169483, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Content
To transfer the basic physical concepts of particle physics, fusion and nuclear fission; this includes fundamental questions such as how: What is a plasma? How can it be ignited? What is the difference between magnetic and inertial fusion? Based on this, aspects of the stability of plasmas, their control and particle transport are discussed. After characterizing the plasma, the "fire" of fusion, the confinement in magnetic fields is sketched, which are built up with the help of magnetic technology. Here, knowledge of superconductivity, production and design of magnets is imparted. A reactor operation with a plasma as energy source requires a continuous operation of a tritium and fuel cycle, which is generated by the fusion reactor itself. Since fusion plasmas require small material densities, vacuum technology plays a central role. Finally, the heat generated in the fusion power plant must be converted into a power plant process and the reaction products removed. The functional basics and the structure of these fusion-typical in-vessel components are presented and the current challenges and the state of the art are demonstrated.

The course describes the essential functional principles of a fusion reactor, beginning with plasma, magnet technology, the tritium and fuel cycle, vacuum technology and the associated material sciences. The physical basics will be taught and the engineering laws of scaling will be demonstrated. Special importance is attached to the understanding of the interfaces between the different subject areas, which essentially determine the engineering technical interpretations. Methods for identifying and evaluating the central parameters will be demonstrated. Based on the acquired perception skills, methods for the design of solution strategies will be taught and technical solutions will be identified, their weak points discussed and evaluated.

Recommendations/Pre-knowledge:

Basic knowledge of fluid mechanics, materials engineering and physics. Knowledge of heat and mass transfer and electrical engineering is helpful.

Presence time: 21 h
Self-study: 90 h

Oral examination:
Duration: approx. 30 minutes, aids: none

Literature
Innerhalb jedes Teilblockes wird eine Literaturliste der jeweiligen Fachliteratur angegeben. Zusätzlich erhalten die Studenten/-innen das Studienmaterial in gedruckter und elektronischer Version.

T 3.132 Course: Fusion Technology B [T-MACH-105433]

Responsible: Prof. Dr. Robert Stieglitz
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2190492	Fusion Technology B	2 SWS	Lecture (V)	Stieglitz
SS 2020	2190493	Übungen zu Fusionstechnologie B	2 SWS	Practice (Ü)	Stieglitz
Exams					
WS 19/20	76-T-MACH-105433	Fusion Technology B		Prüfung (PR)	Stieglitz
SS 2020	76-T-MACH-105433	Fusion Technology B		Prüfung (PR)	Stieglitz

Competence Certificate
oral exam of about 30 minutes

Prerequisites
none

Recommendation
attendance of fusion technology A lecture

reliable capability to use fundamental knowledge communicated in the bachelor study in physics, material sciences , electrical engineering and engineering design

Annotation
none

Below you will find excerpts from events related to this course:

V Fusion Technology B

2190492, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Fusion Technology B is a continuation of Fusion Technology A lecture and includes the following topics:

Fusion neutronics, materials science of thermally and neutronically highly loaded components, reactor scaling and safety as well as plasma heating and current drive. The section fusion neutronics develops the basics of fusion neutronics and its calculation methods, the nuclear physical design of a fusion reactor and the corresponding components (blankets, shielding, activation, tritium breeding ratio and dose rate). Since both neutron fluxes and area power density in a fusion power plant are significantly higher than those of other power plants, they require special materials. After an extension of existing material knowledge by fundamentals and methods for the calculation of radiation damage in materials, strategies for the material selection of functional and structural materials are shown and deepened by examples. The arrangement of components close to the plasma in a fusion power plant means changed requirements for system integration and energy conversion; these questions are the subject of the block reactor scaling and safety. In addition to the explanation of the safety objectives, the methods for achieving the objectives and the computational tools required to achieve them are dealt with in particular. To ignite the plasma, extreme temperatures of several million degrees are required. Special plasma heating methods are used for this purpose, such as electron cyclotron resonance heating (ECRH), ion cyclotron resonance heating (ICRH), current drive at the lower hybrid frequency and neutral particle injection. Their basic mode of action, design criteria, transmission options and performance are presented and discussed. In addition, the heating processes can also be used for plasma stabilization. Some considerations and limitations are presented.

The lecture, which runs over 2 semesters, is aimed at students of engineering sciences and physics after the bachelor. The aim is an introduction to the current research and development on fusion and its long-term goal of a promising energy source. After a short insight into fusion physics, the lecture focuses on key technologies for a future fusion reactor. The lecture will be accompanied by exercises at Campus Nord (block event, 2-3 afternoons per topic).

Recommendations/Prerequisites:

Knowledge of physics, heat and mass transfer, and design theory taught in the bachelor's degree. Attendance of the lecture Fusion technology A

Presence time: 21 h
Self-study: 49 h

Oral proof of participation in the exercises
Duration: approx. 25 minutes, aids: none

Literature
Lecture notes

McCracken, Peter Scott, Fusion, The Energy of Universe, Elsevier Academic Press, ISBN: 0-12-481851-X

T 3.133 Course: Gasdynamics [T-MACH-105533]

Responsible: Dr.-Ing. Franco Magagnato
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2154200	Gasdynamics	2 SWS	Lecture (V)	Magagnato
Exams					
WS 19/20	76-T-MACH-105533	Gasdynamics		Prüfung (PR)	Magagnato

Competence Certificate
oral exam - 30 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Gasdynamics
2154200, WS 19/20, 2 SWS, Language: English, Open in study portal

Lecture (V)

Content
The student can describe the governing equations of Gas Dynamics and the associated basics in Thermodynamics. He will know different flow phenomena of applied Gas Dynamics. He can calculate compressible flows analytically. He is familiar with the Rankine-Hugoniot curve. They can derive the continuity-, the momentum- and the energy equations in differential form. With the help of the stationary flow filament theory they can calculate the normal shock wave and the associated increase of the entropy along past the shock wave. They are able to calculate the stagnation values of the Gas Dynamical variables and to determine their critical values. The students can apply the flow filament theory for variable cross-sectional areas and can distinguish between the different flow fields inside the Laval nozzle that forms with different boundary conditions. He can calculate the values behind an oblique shock wave and can distinguish between detached and attached shock waves. The student can calculate the Prandtl-Meyer expansion wave.

This lecture covers the following topics:

- Introduction to gas dynamics
- Numerical and experimental examples
- Governing equations of gas dynamics
- The transport equations in differential and integral form
- Stationary flow filament theory with and without normal shock waves
- Discussion of the energy equation: Stagnation and critical values
- Flow filament theory at variable cross-sectional area. Flow inside a Laval nozzle
- Oblique shock waves, detached shock waves
- Prandtl-Meyer expansion wave
- Viscous flows (Fanno flow)

Literature
Zierep, J.: Theoretische Gasdynamik, Braun Verlag, Karlsruhe. 1991

Ganzer, U.: Gasdynamik. Springer-Verlag, Berlin, Heidelberg. 1988

John, J., and Keith T. Gas Dynamics. 3rd ed. Harlow: Prentice Hall, 2006

Rathakrishnan, E. *Gas Dynamics*. Prentice Hall of India Pvt. Ltd, 2006

T 3.134 Course: Gear Cutting Technology [T-MACH-102148]

Responsible: Dr.-Ing. Markus Klaiber
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104852 - Major Field Production Technology

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2149655	Gear Technology	2 SWS	Lecture (V)	Klaiber
Exams					
WS 19/20	76-T-MACH-102148	Gear Technology		Prüfung (PR)	Klaiber
SS 2020	76-T-MACH-102148	Gear Cutting Technology		Prüfung (PR)	Schulze

Competence Certificate
Oral Exam (20 min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Gear Technology

Lecture (V)

2149655, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
Based on the gearing theory, manufacturing processes and machine technologies for producing gearings, the needs of modern gear manufacturing will be discussed in the lecture. For this purpose, various processes for various gear types are taught which represent the state of the art in practice today. A classification in soft and hard machining and furthermore in cutting and non-cutting technologies will be made. For comprehensive understanding the processes, machine technologies, tools and applications of the manufacturing of gearings will be introduced and the current developments presented. For assessment and classification of the applications and the performance of the technologies, the methods of mass production and manufacturing defects will be discussed. Sample parts, reports from current developments in the field of research and an excursion to a gear manufacturing company round out the lecture.

Learning Outcomes:

The students …

- can describe the basic terms of gearings and are able to explain the imparted basics of the gearwheel and gearing theory.
- are able to specify the different manufacturing processes and machine technologies for producing gearings. Furthermore they are able to explain the functional principles and the dis-/advantages of these manufacturing processes.
- can apply the basics of the gearing theory and manufacturing processes on new problems.
- are able to read and interpret measuring records for gearings. are able to make an appropriate selection of a process based on a given application
- can describe the entire process chain for the production of toothed components and their respective influence on the resulting workpiece properties.

Workload:

regular attendance: 21 hours
self-study: 99 hours

Literature
Medien:
Skript zur Veranstaltung wird über (https://ilias.studium.kit.edu/) bereitgestellt.

Media:
Lecture notes will be provided in Ilias (https://ilias.studium.kit.edu/).

T 3.135 Course: Global Logistics [T-MACH-105379]

Responsible: Prof. Dr.-Ing. Kai Furmans
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104878 - Specification in Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	3118095	Global Logistics	2 SWS		Furmans, Kivelä, Jacobi

Competence Certificate
oral exam (20 min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Global Logistics
3118095, SS 2020, 2 SWS, Language: English, Open in study portal

Content
Conveyor Systems

- Basic elements of conveyor systems
- Key figures
- Branching elements
- continuous/partially-continuous
- deterministic/stochastic switch
- Integration elements
- continuous/partially-continuous
- dispatching rules

Queueing Theory and Production Logistics

- Basic queueing systems
- Distributions
- M|M|1 and M|G|1 model
- Application on production logistics

Distribution Centers and Order Picking

- The location problem
- Distribution centers
- Inventory management
- Order picking

Vehicle Routing

- Types of vehicle routing problems
- Linear programming model and graph theoretic model
- Heuristics
- Supporting technologies

Optimization of Logistical Networks

- Objectives
- Cooperative strategies
- Supply chain management
- Implementation

Literature
Arnold, Dieter; Furmans, Kai : Materialfluss in Logistiksystemen; Springer-Verlag Berlin Heidelberg

T 3.136 Course: Global Production and Logistics - Part 2: Global Logistics [T-MACH-105159]

Responsible: Prof. Dr.-Ing. Kai Furmans
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104852 - Major Field Production Technology

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	1

Events					
SS 2020	2149600	Global Production and Logistics - Part 2: Global Logistics	2 SWS	Lecture (V)	Furmans
Exams					
WS 19/20	76-T-MACH-105159	Global Production and Logistics - Part 2: Global Logistics		Prüfung (PR)	Furmans
SS 2020	76-T-MACH-105159	Global Production and Logistics - Part 2: Global Logistics		Prüfung (PR)	Furmans

Competence Certificate
The assessment consists of a 60 minutes written examination (according to §4(2), 1 of the examination regulation).

Prerequisites
none

Below you will find excerpts from events related to this course:

V Global Production and Logistics - Part 2: Global Logistics

Lecture (V)

2149600, SS 2020, 2 SWS, Language: German, Open in study portal

Content
Content:

Characteristics of global trade

- Incoterms
- Customs clearance, documents and export control

Global transport and shipping

- Maritime transport, esp. container handling
- Air transport

Modeling of supply chains

- SCOR model
- Value stream analysis

Location planning in cross-border-networks

- Application of the Warehouse Location Problem
- Transport Planning

Inventory Management in global supply chains

- Stock keeping policies
- Inventory management considering lead time and shipping costs

Media:

presentations, black board

Workload:

regular attendance: 21 hours
self-study: 99 hours

Students are able to:

- assign basic problems of planning and operation of global supply chains and plan them with apropriate methods,
- describe requirements and characteristics of global trade and transport, and
- evaluate characteristics of the design from logistic chains regarding their suitability.

Exam:

The exam consists of a 60 minutes written examination (according to §4(2), 1 of the examination regulation).

The main exam is offered every summer semester. A second date for the exam is offered in winter semester only for students that did not pass the main exam.

Literature
Weiterführende Literatur:

- Arnold/Isermann/Kuhn/Tempelmeier. HandbuchLogistik, Springer Verlag, 2002 (Neuauflage in Arbeit)
- Domschke. Logistik, Rundreisen und Touren,Oldenbourg Verlag, 1982
- Domschke/Drexl. Logistik, Standorte, OldenbourgVerlag, 1996
- Gudehus. Logistik, Springer Verlag, 2007
- Neumann-Morlock. Operations-Research,Hanser-Verlag, 1993
- Tempelmeier. Bestandsmanagement in SupplyChains, Books on Demand 2006
- Schönsleben. IntegralesLogistikmanagement, Springer, 1998

T 3.137 Course: Handling Characteristics of Motor Vehicles I [T-MACH-105152]

Responsible: Dr.-Ing. Hans-Joachim Unrau
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2113807	Handling Characteristics of Motor Vehicles I	2 SWS	Lecture (V)	Unrau
Exams					
WS 19/20	76-T-MACH-105152	Handling Characteristics of Motor Vehicles I		Prüfung (PR)	Unrau
SS 2020	76-T-MACH-105152	Handling Characteristics of Motor Vehicles I		Prüfung (PR)	Unrau

Competence Certificate
Verbally

Duration: 30 up to 40 minutes

Auxiliary means: none

Prerequisites
none

Below you will find excerpts from events related to this course:

V Handling Characteristics of Motor Vehicles I

2113807, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
1. Problem definition: Control loop driver - vehicle - environment (e.g. coordinate systems, modes of motion of the car body and the wheels)

2. Simulation models: Creation from motion equations (method according to D'Alembert, method according to Lagrange, programme packages for automatically producing of simulation equations), model for handling characteristics (task, motion equations)

3. Tyre behavior: Basics, dry, wet and winter-smooth roadway

Learning Objectives:

The students know the basic connections between drivers, vehicles and environment. They can build up a vehicle simulation model, with which forces of inertia, aerodynamic forces and tyre forces as well as the appropriate moments are considered. They have proper knowledge in the area of tyre characteristics, since a special meaning comes to the tire behavior during driving dynamics simulation. Consequently they are ready to analyze the most importent influencing factors on the driving behaviour and to contribute to the optimization of the handling characteristics.

Literature
1. Willumeit, H.-P.: Modelle und Modellierungsverfahren in der Fahrzeugdynamik,
B. G. Teubner Verlag, 1998

2. Mitschke, M./Wallentowitz, H.: Dynamik von Kraftfahrzeugen, Springer-Verlag, Berlin, 2004

3. Gnadler, R.; Unrau, H.-J.: Umdrucksammlung zur Vorlesung Fahreigenschaften von Kraftfahrzeugen I

T 3.138 Course: Handling Characteristics of Motor Vehicles II [T-MACH-105153]

Responsible: Dr.-Ing. Hans-Joachim Unrau
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2114838	Handling Characteristics of Motor Vehicles II	2 SWS	Lecture (V)	Unrau
Exams					
WS 19/20	76-T-MACH-105153	Handling Characteristics of Motor Vehicles II		Prüfung (PR)	Unrau
SS 2020	76-T-MACH-105153	Handling Characteristics of Motor Vehicles II		Prüfung (PR)	Unrau

Competence Certificate
Oral Examination

Duration: 30 up to 40 minutes

Auxiliary means: none

Prerequisites
none

Below you will find excerpts from events related to this course:

V Handling Characteristics of Motor Vehicles II

2114838, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
1. Vehicle handling: Bases, steady state cornering, steering input step, single sine, double track switching, slalom, cross-wind behavior, uneven roadway

2. stability behavior: Basics, stability conditions for single vehicles and for vehicles with trailer

Learning Objectives:

The students have an overview of common test methods, with which the handling of vehicles is gauged. They are able to interpret results of different stationary and transient testing methods. Apart from the methods, with which e.g. the driveability in curves or the transient behaviour from vehicles can be registered, also the influences from cross-wind and from uneven roadways on the handling characteristics are well known. They are familiar with the stability behavior from single vehicles and from vehicles with trailer. Consequently they are ready to judge the driving behaviour of vehicles and to change it by specific vehicle modifications.

Literature
1. Zomotor, A.: Fahrwerktechnik: Fahrverhalten, Vogel Verlag, 1991

2. Mitschke, M./Wallentowitz, H.: Dynamik von Kraftfahrzeugen, Springer-Verlag, Berlin, 2004

3. Gnadler, R.; Unrau, H.-J.: Umdrucksammlung zur Vorlesung Fahreigenschaften von Kraftfahrzeugen II

T 3.139 Course: Hands-on BioMEMS [T-MACH-106746]

Responsible: Prof. Dr. Andreas Guber
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Examination of another type	4	Each term	1

Events					
WS 19/20	2143874	Hands-on BioMEMS	2 SWS	Lecture (V)	Rajabi, Guber
SS 2020	2143874	Hands-on BioMEMS	2 SWS	Lecture (V)	Guber
Exams					
WS 19/20	76-T-MACH-106746	Hands-on BioMEMS		Prüfung (PR)	Guber

Competence Certificate
Oral presentation and discussion (30 Min.)

Prerequisites
none

T 3.140 Course: Heat and Mass Transfer [T-MACH-105292]

Responsible: Prof. Dr.-Ing. Henning Bockhorn
Prof. Dr. Ulrich Maas

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Written examination	4	Each term	1

Events					
WS 19/20	2165512	Heat and mass transfer	2 SWS	Lecture (V)	Maas
SS 2020	3122512	Heat and Mass Transfer	2 SWS	Lecture (V)	Bockhorn
Exams					
WS 19/20	76-T-MACH-105292	Heat and Mass Transfer		Prüfung (PR)	Maas

Competence Certificate
Written exam, 3 h

Prerequisites
none

Below you will find excerpts from events related to this course:

V Heat and mass transfer

2165512, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Literature

- Maas ; Vorlesungsskript "Wärme- und Stoffübertragung"
- Baehr, H.-D., Stephan, K.: "Wärme- und Stoffübertragung" , Springer Verlag, 1993
- Incropera, F., DeWitt, F.: "Fundamentals of Heat and Mass Transfer" , John Wiley & Sons, 1996
- Bird, R., Stewart, W., Lightfoot, E.: "Transport Phenomena" , John Wiley & Sons, 1960

T 3.141 Course: Heat Transfer in Nuclear Reactors [T-MACH-105529]

Responsible: Prof. Dr.-Ing. Xu Cheng
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104878 - Specification in Mechanical Engineering
M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2189907	Flow and heat transfer in nuclear reactors	2 SWS	Lecture (V)	Cheng
Exams					
WS 19/20	76-T-MACH-105529	Heat Transfer in Nuclear Reactors		Prüfung (PR)	Cheng

Competence Certificate
oral exam, 20 min

Prerequisites
none

Below you will find excerpts from events related to this course:

V Flow and heat transfer in nuclear reactors — Lecture (V)
2189907, WS 19/20, 2 SWS, Language: English, Open in study portal

Content
This lecture is designed for students of mechanical engineering and other engineering disciplines in their Bachelor or Master studies. The students will understand the most important heat transfer processes and learn the methods for the analysis of flow and heat transfer in nuclear reactors. Students are capable of explaining the thermal-hydraulic processes occurring in nuclear reactors and of selecting suitable models or simulation codes for thermal-hydraulic design and analysis.

1. Reactor types and thermal-hydraulic design criteria
2. Heat transfer processes and modeling
3. Pressure drop calculation
4. Temperature distribution in nuclear reactor
5. Numerical analysis methods for nuclear reactor thermal-hydraulics

Literature

1. L.S. Tong, J. Weisman, Thermal-hydraulics of pressurized water reactors, American Nuclear Society, La Grande Park, Illinois, USA
2. R.T. Lahey, F.J. Moody, The Thermal-Hydraulics of a Boiling Water Nuclear Reactor, 2nd edition, ANS, La Grande Park, Illinois, USA, 1993

T 3.142 Course: Heatpumps [T-MACH-105430]

Responsible: Prof. Dr. Ulrich Maas
Heiner Wirbser

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2166534	Heatpumps	2 SWS	Lecture (V)	Wirbser
Exams					
WS 19/20	76-T-MACH-105430	Heatpumps		Prüfung (PR)	Maas, Wirbser
SS 2020	76-T-MACH-105430	Heatpumps		Prüfung (PR)	Maas, Wirbser

Competence Certificate
Oral exam (20 min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Heatpumps

Lecture (V)

2166534, SS 2020, 2 SWS, Language: German, Open in study portal

Content
The aim of this lecture is to promote heat pumps as heating systems for small an medium scale facilities and to discuss their advantages as well as their drawbacks. After considering the actual energy situation and the political requirements the different aspects of heat pumps are elucidated. The requirements concerning heat sources, the different components and the various types of heat pumps are discussed. In addition ecological and economical aspects are taken into consideration. The coupling of heat pumps with heat accumulators in heating systems will also be part of the lecture.

Literature
Vorlesungsunterlagen

Bach, K.: Wärmepumpen, Bd. 26 Kontakt und Studium, Lexika Verlag, 1979

Kirn, H., Hadenfeldt, H.: Wärmepumpen, Bd. 1: Einführung und Grundlagen, Verlag C. F. Müller, 1987

von Cube, H.L.: Lehrbuch der Kältetechnik, Verlag C.F. Müller, Karlsruhe, 1975.

von Cube, H.L., Steimle,F.: Wärmepumpen, Grunglagen und Praxis VDI-Verlag, Düsseldorf, 1978.

T 3.143 Course: High Performance Computing [T-MACH-105398]

Responsible: Prof. Dr. Britta Nestler
Dr.-Ing. Michael Selzer

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Written examination	5	Each term	2

Events					
WS 19/20	2183721	High Performance Computing	2 SWS	Lecture / Practice (VÜ)	Nestler, Selzer, Hötzer
Exams					
WS 19/20	76-T-MACH-105398	High Performance Computing		Prüfung (PR)	Nestler, Selzer, Hötzer

Competence Certificate
At the end of the semester, there will be a written exam (90 min).

Prerequisites
none

Recommendation
preliminary knowlegde in mathematics, physics and materials science

regular participation in the additionally offered computer exercises

Below you will find excerpts from events related to this course:

V High Performance Computing

2183721, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Content
Topics of the high performance computing courde are:

- achitectures of parallel platforms
- parallel programming models
- performance analysis of concurrent programs
- parallelization models
- MPI and OpenMP
- onte-Carlo method
- 1D & 2D heat diffusion
- raycasting
- n-body problem
- simple phase-field models

The student

- can explain the foundations and strategies of parallel programming
- can efficiently apply high performance computers for simulations by elaborating respective parallelisation techniques.
- has an overview of typical applications and the specific requirements for parallelization.
- knows the concepts of parallelisation and is capable to apply these to efficiently use high performance computing resources and the growing performance of multi core processors in science and industry.
- has experiences in programming of parallel algorithms through integrated computer exercises.

preliminary knowlegde in mathematics, physics and materials science recommended

regular attendance: 22,5 hours lecture, 11,5 hours exercises
self-study: 116 hours

We regularly discuss excercises at the computer.

At the end of the semester, there will be a written exam.

Literature

1. Vorlesungsskript; Übungsaufgabenblätter; Programmgerüste
2. Parallele Programmierung, Thomas Rauber, Gudula Rügner; Springer 2007

T 3.144 Course: High Performance Powder Metallurgy Materials [T-MACH-102157]

Responsible: Dr. Günter Schell
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2126749	Advanced powder metals	2 SWS	Lecture (V)	Schell
Exams					
WS 19/20	76-T-MACH-102157	High Performance Powder Metallurgy Materials		Prüfung (PR)	Schell

Competence Certificate
oral exam, 20- 30 min

Prerequisites
none

Below you will find excerpts from events related to this course:

V Advanced powder metals — Lecture (V)
2126749, SS 2020, 2 SWS, Language: German, Open in study portal

Literature

- W. Schatt ; K.-P. Wieters ; B. Kieback. ".Pulvermetallurgie: Technologien und Werkstoffe", Springer, 2007
- R.M. German. "Powder metallurgy and particulate materials processing. Metal Powder Industries Federation, 2005
- F. Thümmler, R. Oberacker. "Introduction to Powder Metallurgy", Institute of Materials, 1993

T 3.145 Course: High Temperature Materials [T-MACH-105459]

Responsible: Prof. Dr.-Ing. Martin Heilmaier
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104878 - Specification in Mechanical Engineering
M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	2

Events					
WS 19/20	2174600	High Temperature Structural Materials	2 SWS	Lecture (V)	Heilmaier
Exams					
WS 19/20	76-T-MACH-105459	High Temperature Materials		Prüfung (PR)	Heilmaier, Lang
SS 2020	76-T-MACH-105459	High Temperature Materials		Prüfung (PR)	Heilmaier

Competence Certificate
Oral exam, about 25 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V High Temperature Structural Materials

2174600, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content

- Phenomenology of High Temperature Deformation
- Deformation Mechanisms
- High Temperature Structural Materials

learning objectives:

Students are able to

- Define properly the term "high temperature" with respect to materials
- Describe the shape of the creep curve based on underlying deformation mechanisms
- Rationalize the influence of relevant parameters such as temperature, stress, microstructure on the high temperature deformation behavior
- Develop strategies for improving creep resistance of alloys via modifying their composition
- Select properly industrially relevant high temperature structural materials for various applications

requirements:

Relevant Bachelor degree, **Recommendations:** None

workload:

Regular attendance 28 h, self study 92 h

Literature
B. Ilschner, Hochtemperaturplastizität, Springer-Verlag, Berlin

M.E. Kassner, Fundamentals of Creep in Metals and Alloys, Elsevier, Amsterdam, 2009

T 3.146 Course: Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy [T-INFO-101262]

Responsible: Prof. Dr.-Ing. Rüdiger Dillmann
Dr. Uwe Spetzger

Organisation: KIT Department of Informatics

Part of: M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	3	Each term	1

Events					
WS 19/20	24139	Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy	2 SWS	Lecture (V)	Spetzger
SS 2020	24678	Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy	2 SWS	Lecture (V)	Spetzger
Exams					
WS 19/20	7500118	Human Brain and Central Nervous System: Snatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy		Prüfung (PR)	
SS 2020	7500145	Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy		Prüfung (PR)	Dillmann

T 3.147 Course: Human Factors Engineering I [T-MACH-105518]

Responsible: Prof. Dr.-Ing. Barbara Deml
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104852 - Major Field Production Technology

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	2

Events					
WS 19/20	2109035	Human Factors Engineering I: Ergonomics	2 SWS	Lecture (V)	Deml
Exams					
WS 19/20	76-T-MACH-105518	Human Factors Engineering I		Prüfung (PR)	Deml
SS 2020	76-T-MACH-105518	Human Factors Engineering I		Prüfung (PR)	Deml

Competence Certificate
written exam, 60 minutes

The exams are only offered in German!

Prerequisites
none

Below you will find excerpts from events related to this course:

V Human Factors Engineering I: Ergonomics

2109035, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
The course "Human Factors Engineering I: Ergonomics" takes place in the first half of the semester, **until 2019/12/05**, on Wednesday and Thursday.

In the second half of the semester, **beginning with 2019/12/11**, the course "Human Factors Engineering II: Work Organisation" takes place on Wednesday and Thursday.

Content of teaching:

1. Principles of human work
2. Behavioural-science data acquisition
3. workplace design
4. work environment design
5. work management
6. labour law and advocay groups

Learning target:

The students acquire a basic knowledge in the field of ergonomics:

- They are able to consider cognitive, physiological, anthropometric, and safety technical aspects in order to design workplaces ergonomically.
- Just as well they know physical and psycho-physical fundamentals (e. g. noise, lighting, climate) in the field of work-environmental design.
- Furthermore the students are able to evaluate workplaces by knowing and being able to apply essential methods of time studies and payment systems.
- Finally, they get a first, overall insight into the German labour law as well as into the organisation of advocacy groups beyond companies.

Further on the participants get to know basic methods of behavioral-science data acquisition (e. g. eye-tracking, ECG, dual-task-paradigm).

Literature
Die Kursmaterialien stehen auf ILIAS zum Download zur Verfügung.

T 3.148 Course: Human Factors Engineering II [T-MACH-105519]

Responsible: Prof. Dr.-Ing. Barbara Deml
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104852 - Major Field Production Technology

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	2

Events					
WS 19/20	2109036	Human Factors Engineering II: Work Organisation	2 SWS	Lecture (V)	Deml
Exams					
WS 19/20	76-T-MACH-105519	Human Factors Engineering II		Prüfung (PR)	Deml
SS 2020	76-T-MACH-105519	Human Factors Engineering II		Prüfung (PR)	Deml

Competence Certificate
written exam, 60 minutes

The exams are only offered in German!

Prerequisites
none

Below you will find excerpts from events related to this course:

V Human Factors Engineering II: Work Organisation

Lecture (V)

2109036, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
Content of teaching:

1. Fundamentals of work organization
2. Empirical research methods
3. Individual level
    - personnel selection
    - personnel development
    - personnel assessment
    - work satisfaction/motivation
4. Group level
    - interaction and communication
    - management of employees
    - team work
5. Organizational level
    - structural organization
    - process organization
    - production organization

Learning target:

The students gain a first insight into empirical research methods (e. g. experimental design, statistical data evaluation). Particularly, they acquire a basic knowledge in the field of work organisation:

- *Organizational level*. Within this module the students gain also a fundamental knowledge in the field of structural, process, and production organization.
- *Group level*. Besides, they get to know basic aspects of industrial teamwork and they know relevant theories in the field of interaction and communication, the management of employees as well as work satisfaction and motivation.
- *individual level*. Finally, the students get to know also methods in the field of personnel selection, development, and assessment.

Literature
Die Kursmaterialien stehen auf ILIAS zum Download zur Verfügung.

T 3.149 Course: Human Factors Engineering III: Empirical research methods [T-MACH-105830]

Responsible: Prof. Dr.-Ing. Barbara Deml
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104852 - Major Field Production Technology

Type	Credits	Recurrence	Version
Examination of another type	4	Each summer term	1

Events					
SS 2020	2110036	Human Factors Engineering III: Empirical research methods	2 SWS	Lecture / Practice (VÜ)	Deml
Exams					
SS 2020	76-T-MACH-105830	Human Factors Engineering III: Empirical research methods		Prüfung (PR)	Deml

Competence Certificate
Scientific report (about 6 pages), poster, and presentation

Prerequisites
In order to attend this lecture, it is necessary having completed "Arbeitswissenschaft I" or "Arbeitswissenschaft II" successfully.

Modeled Conditions
You have to fulfill one of 2 conditions:

1. The course T-MACH-105518 - Human Factors Engineering I must have been passed.
2. The course T-MACH-105519 - Human Factors Engineering II must have been passed.

Below you will find excerpts from events related to this course:

V Human Factors Engineering III: Empirical research methods

Lecture / Practice (VÜ)

2110036, SS 2020, 2 SWS, Language: German, Open in study portal

Content
The aim of the event is for the participants to know and be able to apply research methods in the field of ergonomics. The participants will get an introduction into the basics of experimental design and learn about essential methods of data collection and statistical data evaluation. Subsequently, the participants will carry out, evaluate and present their own experimental studies on topics such as "Digital Human Models", "Eyetracking" or "Driving Simulation" in the form of laboratory internships.

Translated with www.DeepL.com/Translator

T 3.150 Course: Human-Machine-Interaction [T-INFO-101266]

Responsible: Prof. Dr.-Ing. Michael Beigl
Organisation: KIT Department of Informatics
Part of: M-MACH-104883 - Courses of the Department of Informatics

Type	Credits	Recurrence	Version
Written examination	6	Each summer term	2

Events					
SS 2020	24659	Human-Computer-Interaction	2 SWS	Lecture (V)	Exler, Beigl
Exams					
WS 19/20	7500076	Human-Machine-Interaction		Prüfung (PR)	Beigl
SS 2020	7500048	Human-Machine-Interaction		Prüfung (PR)	Beigl

Prerequisites
none

T 3.151 Course: Hybrid and Electric Vehicles [T-ETIT-100784]

Responsible: Dr.-Ing. Klaus-Peter Becker
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the Department of Electrical Engineering and Information Technology

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	1

Events					
WS 19/20	2306321	Hybrid and Electric Vehicles	2 SWS	Lecture (V)	Doppelbauer
WS 19/20	2306323	Tutorial for 2306323 Hybrid and Electric Vehicles	1 SWS	Practice (Ü)	Doppelbauer
Exams					
WS 19/20	7306321	Hybrid and Electric Vehicles		Prüfung (PR)	Doppelbauer

Prerequisites
none

T 3.152 Course: Hydraulic Fluid Machinery [T-MACH-105326]

Responsible: Dr. Balazs Pritz
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Oral examination	8	Each summer term	1

Events					
SS 2020	2157432	Hydraulic Fluid Machinery	4 SWS	Lecture (V)	Pritz
Exams					
WS 19/20	7600010	Hydraulic Fluid Machinery		Prüfung (PR)	Pritz
SS 2020	7600004	Hydraulic Fluid Machinery		Prüfung (PR)	Pritz

Competence Certificate
oral exam, 40 min.

Prerequisites
None.

Below you will find excerpts from events related to this course:

V Hydraulic Fluid Machinery

2157432, SS 2020, 4 SWS, Language: German, Open in study portal

Lecture (V)

Content

1. Introduction
2. Basic equations
3. System analysis
4. Elementary Theory (Euler's equation of Fluid Machinery)
5. Operation and Performance Characteristics
6. Similarities, Specific Values
7. Control technics
8. Wind Turbines, Propellers
9. Cavitation
10. Hydrodynamic transmissions and converters

2157432 (Hydraulic Machinery) can not be combined with the event 2157451 (Wind and Hydropower)

Recommendations:

2153412 Fluid mechanics

Students get to know the basics of hydraulic fluid machinery (pumps, fans, hydroturbines, windturbines, hydrodynamic transmissions) in general. Application of the knowledge in different fields of engineering.

The lecture introduces the basics of Hydraulic Fluid Machinery. The different types and shapes are presented. The basic equations for the preservation of mass, momentum and energy are discussed. Velocity schemes in typical cascades are shown, the Euler equation of fluid machinery and performance characteristics are deduced.
Similarities and dimensionless parameters are discussed. Fundamental aspects of operation and cavitation are shown.

Students are able to understand the working principle of Hydraulic Fluid Machinery as well as the interaction with typical systems, in which they are integrated.

regular attendance: 56 hours
self-study: 150 hours

preparation for exam: 40 hours

Oral or written examination (see anouncement)
No tools or reference materials may be used during the exam.

Literature

1. Fister, W.: Fluidenergiemaschinen I & II, Springer-Verlag
2. Bohl, W.: Strömungsmaschinen I & II . Vogel-Verlag
3. Gülich, J.F.: Kreiselpumpen, Springer-Verlag
4. Pfleiderer, C.: Die Kreiselpumpen. Springer-Verlag
5. Carolus, T.: Ventilatoren. Teubner-Verlag
6. Kreiselpumpenlexikon. KSB Aktiengesellschaft
7. Zierep, J., Bühler, K.: Grundzüge der Strömungslehre. Teubner-Verlag

T 3.153 Course: Hydrogen Technologies [T-MACH-105416]

Responsible: Dr. Thomas Jordan
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2170495	Hydrogen Technologies	2 SWS	Lecture (V)	Jordan
Exams					
WS 19/20	76-T-MACH-105416	Hydrogen Technologies		Prüfung (PR)	Jordan

Competence Certificate
oral exam, Duration: approximately 30 minutes

Auxiliary: no tools or reference materials may be used during the exam

Prerequisites
none

Recommendation
Fundamentals Thermodynamics

Below you will find excerpts from events related to this course:

V Hydrogen Technologies

2170495, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
The course content is the cross-cutting issue of hydrogen as energy carrier. After successful participation the students may reflect on the fundamental technological basis of an energy system using predominantly hydrogen as an energy carrier or energy storage. Based on this knowledge they may objectify the principle idea of an hydrogen economy.

The students know the fundamental physical and chemical properties of hydrogen and may apply their knowledge on thermodynamics to compare efficiencies of different solutions with hydrogen. They can list, compare and evaluate established and future solutions for production, storage and distribution of hydrogen. They can explain advantages and disadvantages of using hydrogen in conventional combustion processes versus using hydrogen in different fuel cells. In particular the can describe the specific safety aspects related to hydrogen, compare them with other energy vectors and evaluate different measures for risk mitigation.

- Basic concepts
- Production
- Transport and storage
- Application
- Safety aspects

Literature
Ullmann's Encyclopedia of Industrial Chemistry
Hydrogen and Fuel Cells, Ed. S. Stolten, Wiley-VCH, 2010, ISBN 978-3-527-32711-9

T 3.154 Course: Industrial Aerodynamics [T-MACH-105375]

Responsible: Prof. Dr.-Ing. Thomas Breitling
Prof. Dr.-Ing. Bettina Frohnapfel

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2153425	Industrial aerodynamics	2 SWS		Breitling
Exams					
WS 19/20	76-T-MACH-105375	Industrial Aerodynamics		Prüfung (PR)	Breitling

Competence Certificate
oral exam - 30 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Industrial aerodynamics

2153425, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
This compact lecture deals with flow, mixing and combustion phenomena with significance in vehicle development. A special focus is set on the optimization of external car and truck aerodynamics, thermal comfort in passenger compartments, analyses of cooling flows and improvement of charge motion, mixing and combustion in piston engines. These fields are explained in their phenomenology, the corresponding theories are discussed and the tools for measurement and simulation are introduced and demonstrated. The focus of this lecture is on industry relevant methods for analyses and description of forces, flow structures, turbulence, flows with heat transfer and phase transition and reactive flows. In addition an introduction to modern methods in accuracy control and efficiency improvement of numerical methods for industrial use is given. The integration and interconnection of the methods in the development processes are discussed examplary.
An excursion to the Daimler AG wind tunnel and the research and development centers is planned.

- Industrial flow measurement techniques
- Flow simulation and control of numerical errors, turbulence modeling
- Cooling flows
- Flow mixing and combustation at direct injected Diesel engines
- Flow mixing and combustation at gasoline engine
- Vehicle aerodynamics
- HVAC-Systems and thermal comfort
- Aeroacoustics

Students can describe the different challenges of aerdynamical flow that occur in vehicles. They are qualified to analyze external flows around the vehicles, flows in the passenger compartments (thermal comfort), as well as cooling flows, charge motion, mixing and combustion processes in the engine.

Literature
Vorlesungsskript

T 3.155 Course: Information Processing in Sensor Networks [T-INFO-101466]

Responsible: Prof. Dr.-Ing. Uwe Hanebeck
Organisation: KIT Department of Informatics
Part of: M-MACH-104883 - Courses of the Department of Informatics

Type	Credits	Recurrence	Version
Oral examination	6	Irregular	1

Events					
WS 19/20	24102	Information Processing in Sensor Networks	3 SWS	Lecture (V)	Noack, Mayer, Hanebeck
Exams					
WS 19/20	7500030	Information Processing in Sensor Networks		Prüfung (PR)	Noack, Hanebeck
SS 2020	7500011	Information Processing in Sensor Networks		Prüfung (PR)	Hanebeck, Noack

T 3.156 Course: Information Systems and Supply Chain Management [T-MACH-102128]

Responsible: Dr.-Ing. Christoph Kilger
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104852 - Major Field Production Technology

Type	Credits	Recurrence	Version
Oral examination	3	Each summer term	2

Events					
SS 2020	2118094	Information Systems in Logistics and Supply Chain Management	2 SWS	Lecture (V)	Kilger
Exams					
WS 19/20	76T-MACH-102128	Information Systems and Supply Chain Management		Prüfung (PR)	Mittwollen
SS 2020	76-T-MACH-102128	Information Systems and Supply Chain Management		Prüfung (PR)	Mittwollen

Competence Certificate
The assessment consists of an oral exam (20 min.) taking place in the recess period according to § 4 paragraph 2 Nr. 2 of the examination regulation.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Information Systems in Logistics and Supply Chain Management

Lecture (V)

2118094, SS 2020, 2 SWS, Language: German, Open in study portal

Literature
Stadtler, Kilger: Supply Chain Management and Advanced Planning, Springer, 4. Auflage 2008

T 3.157 Course: Innovative Nuclear Systems [T-MACH-105404]

Responsible: Prof. Dr.-Ing. Xu Cheng
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2130973	Innovative Nuclear Systems	2 SWS		Cheng
Exams					
WS 19/20	76-T-MACH-105404	Innovative Nuclear Systems		Prüfung (PR)	Cheng

Competence Certificate
oral exam, 20 min

Prerequisites
none

Below you will find excerpts from events related to this course:

V Innovative Nuclear Systems
2130973, SS 2020, 2 SWS, Language: German, Open in study portal

Content
This lecture is addressed to students of mechanical engineering, chemical engineering and physics. Goal of the lecture is the explanation of state-of-the-art development of nuclear systems. Nuclear systems, that are from todays point of view promising will be presented and explained. The main characteristics of such systems and the associated challenges are also part of the lecture.

1. state of the art and development tendencies in nuclear systems
2. advanced concepts in light water cooled systems
3. new developments in fast reactors
4. development tendencies in gas-cooled plants
5. transmutation systems for waste management
6. fusionsystems

T 3.158 Course: Innvative Project [T-MACH-109185]

Responsible: Prof. Dr. Andreas Class
Prof. Dr. Orestis Terzidis

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Examination of another type	6	Each winter term	1

Events					
WS 19/20	2169466	Innovative Project	3 SWS		Class, Terzidis

Competence Certificate
Students have to deliver pitch-talk supported by slides to convience a commity about their results. A fictive project proposal of 10 to 15 pages.

Prerequisites
none

Recommendation
Participates need to bring there own laptop with Skype installed.

Recommended English profiency äquivalent to:

- IELTS Academic test
  An overall band score of at least 6.5 (with no section lower than 5.5)
- University of Cambridge
  Certificate in Advanced English, CAE (grades A – C)
  Certificate of Proficiency in English, CPE (grades A – C)
- TOEFL Internet-based test, IBT
  A total score of at least 92, with a minimum score of 22 from the writing section

Annotation
The subject of the project is provided by industry partner or the innovation department from KIT or INP Grenoble. Representatives of industry partner will be addressee for the pitch-talk.

Below you will find excerpts from events related to this course:

V Innovative Project
2169466, WS 19/20, 3 SWS, Language: English, Open in study portal

Content
The lecture will be executed with the partner university INP Grenoble. Participates need to bring there own laptop with Skype installed. Teams of 2-3 students.

- Understand the physics of the technology of the invention considered in the project
- Understand the claims of the patent considered in the project
- Apply a structured technology application selection methodology.
- Student understand the methodology of TAS, which provides the background to become a TAS coach.
- Students are enabled to prepare a proposal for funding.

The TAS (technology application selection) methodology provides tools that help to successfully advance an invention with a low technology readiness level to a higher technology readiness level. Skills that are typically provided by a classical engineering education supports both the early phase of an invention where a deep basic understanding is required and the industrial exploration building on a first prototype. The gap that arises between the invention and its later industrialized application is rarely addressed, so that many inventions will not make it to the market. In the course, we practice bridging the technology gap for the case of a real invention provided by an industry partner or University. We experiment with teams consisting of team members located at different universities and from different disciplines.

The scenario addressed is an inventor who calls some of his friends within her/his personal network. The group will work remotely via video conference employing a structured TAS process. Creativity will be fertilized by teamwork and linking the invention to a selection of potential technologies. In an in-depth analysis of these links, each group narrows down their pool of ideas to one candidate. Finally, the group will try to convince the fellow teams (and the inventor) to support their idea. For this purpose, a pitch talk is prepared and delivered in front of all teams leading to a unique vote of all teams for one technology application. In addition the students prepare fictive proposals for start-up based on their TAS.

T 3.159 Course: Integrated Information Systems for Engineers [T-MACH-102083]

Responsible: Prof. Dr.-Ing. Jivka Ovtcharova
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104852 - Major Field Production Technology

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	2

Events					
SS 2020	2121001	Integrated Information Systems for engineers	3 SWS	Lecture / Practice (VÜ)	Ovtcharova, Elstermann
Exams					
WS 19/20	76-T-MACH-102083	Integrated Information Systems for Engineers		Prüfung (PR)	Ovtcharova

Competence Certificate
Oral examination 20 min.

Prerequisites
None

Below you will find excerpts from events related to this course:

V Integrated Information Systems for engineers

2121001, SS 2020, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Content

- Information systems, information management
- CAD, CAP and CAM systems
- PPS, ERP and PDM systems
- Knowledge management and ontology
- Process modeling

Students can:

- illustrate the structure and operating mode of information systems
- describe the structure of relational databases
- describe the fundamentals of knowledge management and its application in engineering and deploy ontology as knowledge representation
- describe different types of process modelling and their application and illustrate and execute simple work flows and processes with selected tools
- explain different goals of specific IT systems in product development (CAD, CAP, CAM, PPS, ERP, PDM) and assign product development processes

Literature
Vorlesungsfolien / lecture slides

T 3.160 Course: Integrated Production Planning in the Age of Industry 4.0 [T-MACH-108849]

Responsible: Prof. Dr.-Ing. Gisela Lanza
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104852 - Major Field Production Technology

Type	Credits	Recurrence	Version
Oral examination	8	Each summer term	1

Events					
SS 2020	2150660	Integrated Production Planning in the Age of Industry 4.0	6 SWS	Lecture / Practice (VÜ)	Lanza
Exams					
WS 19/20	76-T-MACH-108849	Integrated Production Planning in the Age of Industry 4.0		Prüfung (PR)	Lanza
SS 2020	76-T-MACH-108849	Integrated Production Planning in the Age of Industry 4.0		Prüfung (PR)	Lanza

Competence Certificate
Oral Exam (40 min)

Prerequisites
"T-MACH-109054 - Integrierte Produktionsplanung im Zeitalter von Industrie 4.0" as well as "T-MACH-102106 Integrierte Produktionsplanung" must not be commenced.

Below you will find excerpts from events related to this course:

V Integrated Production Planning in the Age of Industry 4.0

Lecture / Practice (VÜ)

2150660, SS 2020, 6 SWS, Language: German, Open in study portal

Content
Integrated production planning in the age of industry 4.0 will be taught in the context of this engineering science lecture. In addition to a comprehensive introduction to Industry 4.0, the following topics will be addressed at the beginning of the lecture:

- Basics, history and temporal development of production
- Integrated production planning and integrated digital engineering
- Principles of integrated production systems and further development with Industry 4.0

Building on this, the phases of integrated production planning are taught in accordance with VDI Guideline 5200, whereby special features of parts production and assembly are dealt with in the context of case studies:

- Factory planning system
- Definition of objectives
- Data collection and analysis
- Concept planning (structural development, structural dimensioning and rough layout)
- Detailed planning (production planning and control, fine layout, IT systems in an industry 4.0 factory)
- Preparation and monitoring of implementation
- Start-up and series support

The lecture contents are rounded off by numerous current practical examples with a strong industry 4.0 reference. Within the exercises the lecture contents are deepened and applied to specific problems and tasks.

Learning Outcomes:

The students …

- can discuss basic questions of production technology.
- are able to apply the methods of integrated production planning they have learned about to new problems.
- are able to analyze and evaluate the suitability of the methods, procedures and techniques they have learned about for a specific problem.
- can apply the learned methods of integrated production planning to new problems.
- can use their knowledge targeted for efficient production technology.

Workload:

MACH:
regular attendance: 63 hours
self-study: 177 hours
WING:
regular attendance: 63 hours
self-study: 207 hours

Literature
Medien:
Skript zur Veranstaltung wird über (https://ilias.studium.kit.edu/) bereitgestellt.

Media:
Lecture notes will be provided in Ilias (https://ilias.studium.kit.edu/).

T 3.161 Course: Integrative Strategies in Production and Development of High Performance Cars [T-MACH-105188]

Responsible: Dr. Karl-Hubert Schlichtenmayer
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	1

Events					
SS 2020	2150601	Integrative Strategies in Production and Development of High Performance Cars	2 SWS	Lecture (V)	Schlichtenmayer
Exams					
WS 19/20	76-T-MACH-105188	Integrative Strategies in Production and Development of High Performance Cars		Prüfung (PR)	Schlichtenmayer
SS 2020	76-T-MACH-105188	Integrative Strategies in Production and Development of High Performance Cars		Prüfung (PR)	Lanza

Competence Certificate
Written Exam (60 min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Integrative Strategies in Production and Development of High Performance Cars Lecture (V)
2150601, SS 2020, 2 SWS, Language: German, Open in study portal

Content

The lecture deals with the technical and organizational aspects of integrated development and production of sports cars on the example of Porsche AG. The lecture begins with an introduction and discussion of social trends. The deepening of standardized development processes in the automotive practice and current development strategies follow. The management of complex development projects is a first focus of the lecture. The complex interlinkage between development, production and purchasing are a second focus. Methods of analysis of technological core competencies complement the lecture. The course is strongly oriented towards the practice and is provided with many current examples.

The main topics are:

- Introduction to social trends towards high performance cars
- Automotive Production Processes
- Integrative R&D strategies and holistic capacity management
- Management of complex projects
- Interlinkage between R&D, production and purchasing
- The modern role of manufacturing from a R&D perspective
- Global R&D and production
- Methods to identify core competencies

Learning Outcomes:

The students …

- are capable to specify the current technological and social challenges in automotive industry.
- are qualified to identify interlinkages between development processes and production systems.
- are able to explain challenges and solutions of global markets and global production of premium products.
- are able to explain modern methods to identify key competences of producing companies.

Workload:

regular attendance: 21 hours
self-study: 99 hours

Literature
Medien:
Skript zur Veranstaltung wird über (https://ilias.studium.kit.edu/) bereitgestellt.

Media:
Lecture notes will be provided in Ilias (https://ilias.studium.kit.edu/).

T 3.162 Course: Intellectual Property Rights and Strategies in Industrial Companies [T-MACH-105442]

Responsible: Prof. Dr.-Ing. Albert Albers
Prof. Dr.-Ing. Sven Matthiesen
Dipl.-Ing. Frank Zacharias

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104851 - Major Field Product Development and Construction

Type	Credits	Recurrence	Version
Oral examination	4	Each term	1

Events					
WS 19/20	2147161	Intellectual Property Rights and Strategies in Industrial Companies	2 SWS	Lecture (V)	Zacharias
SS 2020	2147160	Patents and Patentstrategies in innovative companies	2 SWS		Zacharias
Exams					
WS 19/20	7600012	Intellectual Property Rights and Strategies in Industrial Companies		Prüfung (PR)	Zacharias

Competence Certificate
oral exam (20 min)

Prerequisites
none

Recommendation
None

Below you will find excerpts from events related to this course:

V Intellectual Property Rights and Strategies in Industrial Companies

Lecture (V)

2147161, WS 19/20, 2 SWS, Language: German, Open in study portal

V Patents and Patentstrategies in innovative companies

2147160, SS 2020, 2 SWS, Language: German, Open in study portal

Content
Attendance at lectures (5 L): 24h

Personal preparation and follow-up of lecture and exercise: 5h

Preparation exam: 31h

The students understand and are able to describe the basics of intellectual property, particularly with regard to the filing and obtaining of property rights. They can name the criteria of project-integrated intellectual property management and strategic patenting in innovative companies. Students are also able to describe the key regulations of the law regarding employee invention and to illustrate the challenges of intellectual properties with reference to examples.

The lecture will describe the requirements to be fulfilled and how protection is obtained for patents, design rights and trademarks, with a particular focus on Germany, Europe and the EU. Active, project-integrated intellectual property management and the use of strategic patenting by technologically oriented companies will also be discussed. Furthermore, the significance of innovations and intellectual property for both business and industry will be demonstrated using practical examples, before going on to consider the international challenges posed by intellectual

property and current trends in the sector. Within the context of licensing and infringement, insight will be provided as to the relevance of communication, professional negotiations and dispute resolution procedures, such as mediation for example. The final item on the agenda will cover those aspects of corporate law that are relevant to intellectual property.

Lecture overview:

1. Introduction to intellectual property
2. The profession of the patent attorney
3. Filing and obtaining intellectual property rights
4. Patent literature as a source of knowledge and information
5. The law regarding employee inventions
6. Active, project-integrated intellectual property management
7. Strategic patenting
8. The significance of intellectual property
9. International challenges and trends
10. Professional negotiations and dispute resolution procedures
11. Aspects of corporate law

T 3.163 Course: Introduction into Mechatronics [T-MACH-100535]

Responsible: Moritz Böhland
Dr.-Ing. Maik Lorch
PD Dr.-Ing. Markus Reischl

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104850 - Major Field Mechatronics and Microsystem Technology

Type	Credits	Recurrence	Version
Written examination	6	Each winter term	2

Events					
WS 19/20	2105011	Introduction into Mechatronics	3 SWS	Lecture (V)	Reischl, Lorch, Böhland
Exams					
WS 19/20	76-T-MACH-100535	Introduction into Mechatronics		Prüfung (PR)	Reischl

Competence Certificate
Oral exam (Duration: 2h)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Introduction into Mechatronics

2105011, WS 19/20, 3 SWS, Language: German, Open in study portal

Lecture (V)

Content
Content:

- Introduction
- Structure of mechatronic systems
- Mathematical treatment of mechatronic systems
- Sensors and actuators
- Measurements: acquisition and interpretation
- Modelling of mechatronic systems
- Control and feedback control systems
- Information processing

Learning objectives:

The student has knowledge about the specific challenge of interdisciplinary collaboration within the framework of mechatronics. He is able to explain the origin, necessity and methodic implementation of interdisciplinary collaboration, to name the main difficulties as well as the special features within the development of mechatronic products from the point of view of development methodic.

The student has fundamental knowledge of modeling mechanical, hydraulically and electrically part systems and about suitable optimization methods.

The student knows the difference in use of the term "system" in mechatronic and mechanical use.

Literature
Heimann, B.; Gerth, W.; Popp, K.: Mechatronik. Leipzig: Hanser, 1998
Isermann, R.: Mechatronische Systeme - Grundlagen. Berlin: Springer, 1999
Roddeck, W.: Einführung in die Mechatronik. Stuttgart: B. G. Teubner, 1997
Töpfer, H.; Kriesel, W.: Funktionseinheiten der Automatisierungstechnik. Berlin: Verlag Technik, 1988
Föllinger, O.: Regelungstechnik. Einführung in die Methoden und ihre Anwendung. Heidelberg: Hüthig, 1994
Bretthauer, G.: Modellierung dynamischer Systeme. Vorlesungsskript. Freiberg: TU Bergakademie, 1997

T 3.164 Course: Introduction into the Multi-Body Dynamics [T-MACH-105209]

Responsible: Prof. Dr.-Ing. Wolfgang Seemann
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104853 - Major Field Theoretical Foundations of Mechanical Engineering

Type	Credits	Recurrence	Version
Written examination	5	Each summer term	2

Events					
SS 2020	2162235	Introduction into the multi-body dynamics	3 SWS	Lecture (V)	Seemann
Exams					
WS 19/20	76-T-MACH-105209	Introduction into the Multi-Body Dynamics		Prüfung (PR)	Seemann
SS 2020	76-T-MACH-105209	Introduction into the Multi-Body Dynamics		Prüfung (PR)	Seemann

Competence Certificate
Written examination, 180 min.

Prerequisites
none

Recommendation
Engineering Mechanics III/IV

Below you will find excerpts from events related to this course:

V Introduction into the multi-body dynamics

2162235, SS 2020, 3 SWS, Language: German, Open in study portal

Lecture (V)

Content
The role of multibody systems in engineering, kinematics of a single rigid body, Kinematics of multibody systems, rotation matrix, angular velocity, derivatives in different reference systems, holonomic and non-holonomic constraints, Newton-Euler's equations, principle of d'Alembert, principle of virtuel power, Lagrange's equations, Kane's equations, structure of the equations of motion

Literature
Wittenburg, J.: Dynamics of Systems of Rigid Bodies, Teubner Verlag, 1977
Roberson, R. E., Schwertassek, R.: Dynamics of Multibody Systems, Springer-Verlag, 1988
de Jal'on, J. G., Bayo, E.: Kinematik and Dynamic Simulation of Multibody Systems.
Kane, T.: Dynamics of rigid bodies.

T 3.165 Course: Introduction to Ceramics [T-MACH-100287]

Responsible: Prof. Dr. Michael Hoffmann
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Oral examination	6	Each winter term	1

Events					
WS 19/20	2125757	Introduction to Ceramics	3 SWS	Lecture (V)	Hoffmann
Exams					
WS 19/20	76-T-MACH-100287	Introduction to Ceramics		Prüfung (PR)	Hoffmann, Schell, Wagner

Competence Certificate
The assessment consists of an oral exam (30 min) taking place at a specific date.

The re-examination is offered at a specific date.

Prerequisites
None

Below you will find excerpts from events related to this course:

V Introduction to Ceramics
2125757, WS 19/20, 3 SWS, Language: German, Open in study portal

Lecture (V)

Literature

- H. Salmang, H. Scholze, "Keramik", Springer
- Kingery, Bowen, Uhlmann, "Introduction To Ceramics", Wiley
- Y.-M. Chiang, D. Birnie III and W.D. Kingery, "Physical Ceramics", Wiley
- S.J.L. Kang, "Sintering, Densification, Grain Growth & Microstructure", Elsevier

T 3.166 Course: Introduction to Engineering Mechanics I: Statics [T-MACH-108808]

Responsible: Prof. Dr.-Ing. Alexander Fidlin
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104853 - Major Field Theoretical Foundations of Mechanical Engineering

Type	Credits	Recurrence	Version
Written examination	3	Each summer term	1

Events					
SS 2020	2162238	Introduction to Engineering Mechanics I: Statics and Strength of Materials	2 SWS	Lecture (V)	Fidlin
SS 2020	2162239	Introduction to Engineering Mechanics I: Statics and Strength of Materials (Tutorial)	1 SWS	Practice (Ü)	Fidlin, Altoé
Exams					
WS 19/20	76-T-MACH-108808	Introduction to Engineering Mechanics I: Statics		Prüfung (PR)	Fidlin
SS 2020	76-T-MACH-108808	Introduction to Engineering Mechanics I: Statics		Prüfung (PR)	Fidlin

Competence Certificate
The assessment consists of a written examination taking place in the recess period (according to Section 4(2), 1 of the examination regulation). The examination takes place in every semester. Re-examinations are offered at eyery ordinary examination date.

Permitted utilities: none

Prerequisites
None

Below you will find excerpts from events related to this course:

V Introduction to Engineering Mechanics I: Statics and Strength of Materials — Lecture (V)
2162238, SS 2020, 2 SWS, Language: German, Open in study portal

Content
Statics: force · moment · general equilibrium condistions · center of mass · inner force in structure · plane frameworks · theory of adhesion

T 3.167 Course: Introduction to Engineering Mechanics I: Statics and Strength of Materials [T-MACH-102208]

Responsible: Prof. Dr.-Ing. Alexander Fidlin
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104853 - Major Field Theoretical Foundations of Mechanical Engineering

Type	Credits	Recurrence	Version
Written examination	5	Each summer term	2

Events					
SS 2020	2162238	Introduction to Engineering Mechanics I: Statics and Strength of Materials	2 SWS	Lecture (V)	Fidlin
SS 2020	2162239	Introduction to Engineering Mechanics I: Statics and Strength of Materials (Tutorial)	1 SWS	Practice (Ü)	Fidlin, Altoé
Exams					
WS 19/20	76-T-MACH-102208-1	Introduction to Engineering Mechanics I: Statics (75min)		Prüfung (PR)	Fidlin
WS 19/20	76-T-MACH-102208-2	Introduction to Engineering Mechanics I: Statics and Strength of Materials (120min)		Prüfung (PR)	Fidlin
SS 2020	76-T-MACH-102208-1	Introduction to Engineering Mechanics I: Statics(75 Min)		Prüfung (PR)	Fidlin
SS 2020	76-T-MACH-102208-2	Introduction to Engineering Mechanics I: Statics and Strength of Materials (120 Min)		Prüfung (PR)	Fidlin

Competence Certificate
The assessment consists of a written examination (120 min) taking place in the recess period (according to Section 4(2), 1 of the examination regulation). The examination takes place in every semester. Re-examinations are offered at eyery ordinary examination date.

For students of economics the assessement consists of a written examination (Statics - 75 min.)

Permitted utilities: non-programmable calculator

Prerequisites
None

Below you will find excerpts from events related to this course:

V Introduction to Engineering Mechanics I: Statics and Strength of Materials — Lecture (V)
2162238, SS 2020, 2 SWS, Language: German, Open in study portal

Content
Statics: force · moment · general equilibrium condistions · center of mass · inner force in structure · plane frameworks · theory of adhesion

T 3.168 Course: Introduction to Industrial Production Economics [T-MACH-105388]

Responsible: Simone Dürrschnabel
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104852 - Major Field Production Technology

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Competence Certificate
oral exam (approx. 30 min)

The exam is offered in German only!

Prerequisites
none

T 3.169 Course: Introduction to Microsystem Technology I [T-MACH-105182]

Responsible: Dr. Vlad Badilita
Dr. Mazin Jouda
Prof. Dr. Jan Gerrit Korvink

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104851 - Major Field Product Development and Construction
M-MACH-104878 - Specification in Mechanical Engineering
M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	1

Events					
WS 19/20	2141861	Introduction to Microsystem Technology I	2 SWS	Lecture (V)	Korvink, Badilita
Exams					
WS 19/20	76-T-MACH-105182	Introduction to Microsystem Technology I		Prüfung (PR)	Korvink, Badilita

Competence Certificate
written examination (60 min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Introduction to Microsystem Technology I
2141861, WS 19/20, 2 SWS, Language: English, Open in study portal

Lecture (V)

Literature
Mikrosystemtechnik für Ingenieure, W. Menz und J. Mohr, VCH Verlagsgesellschaft, Weinheim 2005

M. Madou
Fundamentals of Microfabrication
Taylor & Francis Ltd.; Auflage: 3. Auflage. 2011

T 3.170 Course: Introduction to Microsystem Technology II [T-MACH-105183]

Responsible: Dr. Mazin Jouda
Prof. Dr. Jan Gerrit Korvink

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104851 - Major Field Product Development and Construction
M-MACH-104878 - Specification in Mechanical Engineering
M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	1

Events					
SS 2020	2142874	Introduction to Microsystem Technology II	2 SWS	Lecture (V)	Korvink, Badilita
Exams					
WS 19/20	76-T-MACH-105183	Introduction to Microsystem Technology II		Prüfung (PR)	Korvink, Badilita

Competence Certificate
written examination (60 min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Introduction to Microsystem Technology II

2142874, SS 2020, 2 SWS, Language: English, Open in study portal

Lecture (V)

Content
- Introduction in Nano- and Microtechnologies
- Lithography
- LIGA-technique
- Mechanical microfabrication
- Patterning with lasers
- Assembly and packaging
- Microsystems

Literature
Menz, W., Mohr, J., O. Paul: Mikrosystemtechnik für Ingenieure, VCH-Verlag, Weinheim, 2005

M. Madou
Fundamentals of Microfabrication
Taylor & Francis Ltd.; Auflage: 3. Auflage. 2011

T 3.171 Course: Introduction to Neutron Cross Section Theory and Nuclear Data Generation [T-MACH-105466]

Responsible: apl. Prof. Dr. Ron Dagan
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104878 - Specification in Mechanical Engineering
M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2190490	Introduction to Neutron Cross Section Theory and Nuclear Data Generation	2 SWS	Lecture (V)	Dagan
Exams					
WS 19/20	76-T-MACH-105466	Introduction to Neutron Cross Section Theory and Nuclear Data Generation		Prüfung (PR)	Dagan, Stieglitz
SS 2020	76-T-MACH-105466	Introduction to Neutron Cross Section Theory and Nuclear Data Generation		Prüfung (PR)	Dagan

Competence Certificate
oral exam of about 30 minutes

Prerequisites
none

Annotation
none

Below you will find excerpts from events related to this course:

V Introduction to Neutron Cross Section Theory and Nuclear Data Generation — Lecture (V)
2190490, SS 2020, 2 SWS, Language: English, Open in study portal

Content
Cross section characterization

Summary of basic cross section theory

Resonance cross section

Doppler broadening

Scattering kernels

Basic of slowing down theory

Unit cell based XS data generation

Cross sections Data libraries

Data Measurements

The students:

- Understand the special importance of cross sections in various domains of natural science (Reactor physics, Material research, Solar radiation etc.)
- Are familiar with the theoretical methods and experimental effort to generate cross sections data.

Regular attendance: 26 h

self study: 94 h

oral exam about 30 min.

Literature

Handbuch von Nuklearen Reaktoren Vol I . Y. Ronen CRC press 1986 (in English)

D. Emendorfer. K.H. Höcker Theorie der Kernreaktoren, Teil I, II BI- Hochschultaschenbücher 1969

P. Tippler, R. Llewellyn Modern Physics 2008 (in English)

T 3.172 Course: Introduction to Nonlinear Vibrations [T-MACH-105439]

Responsible: Prof. Dr.-Ing. Alexander Fidlin
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104853 - Major Field Theoretical Foundations of Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	7	Each winter term	1

Events					
WS 19/20	2162247	Introduction to Nonlinear Vibrations	2 SWS	Lecture (V)	Fidlin
WS 19/20	2162248	Introduction into the nonlinear vibrations (Tutorial)	2 SWS	Practice (Ü)	Fidlin, Schröders
Exams					
WS 19/20	76-T-MACH-105439	Introduction to Nonlinear Vibrations		Prüfung (PR)	Fidlin
SS 2020	76-T-MACH-105439	Introduction to Nonlinear Vibrations		Prüfung (PR)	Fidlin

Competence Certificate
oral exam, 30 min.

Prerequisites
none

Recommendation
Vibration theory, Mathematical Methods of Vibration Theory, Dynamic Stability

Below you will find excerpts from events related to this course:

V Introduction to Nonlinear Vibrations

2162247, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content

- dynamic systems
- basic ideas of asymptotic methods
- perturbation methods: Linstedt-Poincare, averaging, multiple scales
- limit cycles
- nonlinear resonance
- basics of the bifurcation analysis, bifurcation diagrams
- types of bifurcations
- discontinuous systems
- dynamic chaos

Literature

- Hagedorn P. Nichtlineare Schwingungen. Akademische Verlagsgesellschaft, 1978.
- Nayfeh A.H., Mook D.T. Nonlinear Oscillation. Wiley, 1979.
- Thomsen J.J. Vibration and Stability, Order and Chaos. McGraw-Hill, 1997.
- Fidlin A. Nonlinear Oscillations in Mechanical Engigeering. Springer, 2005.
- Bogoliubov N.N., Mitropolskii Y.A. Asymptotic Methods in the Theory of Nonlinear Oscillations. Gordon and Breach, 1961.
- Nayfeh A.H. Perturbation Methods. Wiley, 1973.
- Sanders J.A., Verhulst F. Averaging methods in nonlinear dynamical systems. Springer-Verlag, 1985.
- Blekhman I.I. Vibrational Mechanics. World Scientific, 2000.
- Moon F.C. Chaotic Vibrations – an Introduction for applied Scientists and Engineers. John Wiley & Sons, 1987.

V **Introduction into the nonlinear vibrations (Tutorial)** **Practice (Ü)**

2162248, WS 19/20, 2 SWS, Language: German, Open in study portal

Content

Exercises related to the lecture

T 3.173 Course: Introduction to Nuclear Energy [T-MACH-105525]

Responsible: Prof. Dr.-Ing. Xu Cheng
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2189903	Introduction to Nuclear Energy	2 SWS	Lecture (V)	Cheng
Exams					
WS 19/20	76-T-MACH-105525	Introduction to Nuclear Energy		Prüfung (PR)	Cheng

Competence Certificate
oral exam, 30 min

Prerequisites
none

Below you will find excerpts from events related to this course:

V Introduction to Nuclear Energy
2189903, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
This lecture is dedicated to students of mechanical engineering and other engineering Bachelor or Master degree courses. Goal of the lecture is the fundamental knowledge of nuclear energy and nuclear reactors. After the lecture the students understand the principle of the usage of nuclear energy, the structure and operation of nuclear power plants and nuclear safety measures. Furthermore, the students are capable of giving technical assessment of the usage of nuclear energy with respect to its safety and sustainability.

T 3.174 Course: Introduction to numerical mechanics [T-MACH-108718]

Responsible: Prof. Dr. Eckart Schnack
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104853 - Major Field Theoretical Foundations of Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Exams				
WS 19/20	76-T-MACH-108718	Introduction to numerical mechanics	Prüfung (PR)	
SS 2020	76-T-MACH-108718	Introduction to numerical mechanics	Prüfung (PR)	

Competence Certificate
Oral Exam, 20 minutes

Prerequisites
None

Annotation
The lecture notes are made available via ILIAS.

T 3.175 Course: Introduction to Operations Research I and II [T-WIWI-102758]

Responsible: Prof. Dr. Stefan Nickel
Prof. Dr. Steffen Rebennack
Prof. Dr. Oliver Stein

Organisation: KIT Department of Economics and Management

Part of: M-MACH-104884 - Courses of the Department of Economics and Management

Type	Credits	Recurrence	Version
Written examination	9	see Annotations	1

Events					
WS 19/20	2530043	Introduction to Operations Research II	2 SWS	Lecture (V)	Stein
WS 19/20	2530044		SWS	Tutorial (Tu)	Assistenten, Stein
SS 2020	2550040	Introduction to Operations Research I	2 SWS	Lecture (V)	Rebennack
Exams					
WS 19/20	7900001_WS1920_HK	Introduction to Operations Research I and II		Prüfung (PR)	Stein

Competence Certificate
The assessment of the module is carried out by a written examination (120 minutes) according to Section 4(2), 1 of the examination regulation.

In each term (usually in March and July), one examination is held for both courses.

The overall grade of the module is the grade of the written examination.

Prerequisites
None

Recommendation
Mathematics I und II. Programming knowledge for computing exercises.

It is strongly recommended to attend the course *Introduction to Operations Research I* [2550040] before attending the course*Introduction to Operations Research II* [2530043].

Below you will find excerpts from events related to this course:

V Introduction to Operations Research II

2530043, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Integer and Combinatorial Programming: Basic notions, cutting plane metehods, branch and bound methods, branch and cut methods, heuristics.

Nonlinear Programming: Basic notions, optimality conditions, solution methods for convex and nonconvex optimization problems.

Dynamic and stochastic models and methods: dynamical programming, Bellman method, lot sizing models, dyanical and stochastic inventory models, queuing theory.

Learning objectives:

The student

- names and describes basic notions of integer and combinatorial optimization, nonlinear programming, and dynamic programming,
- knows the indispensable methods and models for quantitative analysis,
- models and classifies optimization problems and chooses the appropriate solution methods to solve optimization problems independently,
- validates, illustrates and interprets the obtained solutions.

Literature

- Nickel, Stein, Waldmann: Operations Research, 2. Auflage, Springer, 2014
- Hillier, Lieberman: Introduction to Operations Research, 8th edition. McGraw-Hill, 2005
- Murty: Operations Research. Prentice-Hall, 1995
- Neumann, Morlock: Operations Research, 2. Auflage. Hanser, 2006
- Winston: Operations Research - Applications and Algorithms, 4th edition. PWS-Kent, 2004

V Introduction to Operations Research I

2550040, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Examples for typical OR problems.

Linear Programming: Basic notions, simplex method, duality, special versions of the simplex method (dual simplex method, three phase method), sensitivity analysis, parametric optimization, game theory.

Graphs and Networks: Basic notions of graph theory, shortest paths in networks, project scheduling, maximal and minimal cost flows in networks.

Learning objectives:

The student

- names and describes basic notions of linear programming as well as graphs and networks,
- knows the indispensable methods and models for quantitative analysis,
- models and classifies optimization problems and chooses the appropriate solution methods to solve optimization problems independently,
- validates, illustrates and interprets the obtained solutions.

Literature

- Nickel, Stein, Waldmann: Operations Research, 2. Auflage, Springer, 2014
- Hillier, Lieberman: Introduction to Operations Research, 8th edition. McGraw-Hill, 2005
- Murty: Operations Research. Prentice-Hall, 1995
- Neumann, Morlock: Operations Research, 2. Auflage. Hanser, 2006
- Winston: Operations Research - Applications and Algorithms, 4th edition. PWS-Kent, 2004

T 3.176 Course: Introduction to the Finite Element Method [T-MACH-105320]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Dr.-Ing. Tom-Alexander Langhoff

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	3

Events					
SS 2020	2162282	Introduction to the Finite Element Method	2 SWS	Lecture (V)	Langhoff, Böhlke

Competence Certificate
written exam (90 min)

Prerequisites
Passing the Tutorial "Introduction to the Finite element method" (T-MACH-110330) is a prerequisite for taking part in the exam.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-110330 - Tutorial Introduction to the Finite Element Method must have been passed.

Annotation
Knowledge of the contents of the courses "Continuum Mechanics of Solids and Fluids" and "Mathematical Methods of Continuum Mechanics" as well as the corresponding tutorials are expected

The assignment of the restricted places in the associated Lab Course is crucial to the institute.

Below you will find excerpts from events related to this course:

V Introduction to the Finite Element Method — Lecture (V)
2162282, SS 2020, 2 SWS, Language: German, Open in study portal

Content

- introduction and motivation, elements of tensor calculus
- Discrete FEM: systems of bars and springs
- Formulations of boundary value problems (1D)
- Approximations in FEM
- FEM for scalar and vector-valued field problems
- Solution methods for linear systems of equations

Literature

- Fish, J., Belytschko, T.: A First Course in Finite Elements, Wiley 2007
- Jung, M., Langer, U.: Methode der finiten Elemente für Ingenieure: Eine Einführung in die numerischen Grundlagen und Computersimulation, Teubner 2013
- Braess, D.: Finite Elemente -- Theorie, schnelle Löser und Anwendungen in der Elastizitätstheorie, Springer 2013
- Gustafsson, B.: Fundamentals of Scientific Computing, Springer 2011

T 3.177 Course: Introduction to Theory of Materials [T-MACH-105321]

Responsible: apl. Prof. Marc Kamlah
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Exams				
WS 19/20	76-T-MACH-105321	Introduction to Theory of Materials	Prüfung (PR)	Gruber
SS 2020	76-T-MACH-105321	Introduction to Theory of Materials	Prüfung (PR)	Kamlah

Competence Certificate
oral exam

T 3.178 Course: IoT Platform for Engineering [T-MACH-106743]

Responsible: Prof. Dr.-Ing. Jivka Ovtcharova
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104851 - Major Field Product Development and Construction

Type	Credits	Recurrence	Version
Examination of another type	4	Each term	1

Events					
WS 19/20	2123352	IoT platform for engineering	SWS		Ovtcharova, Maier
SS 2020	2123352	IoT platform for engineering	3 SWS	Project (PRO)	Ovtcharova, Maier
Exams					
WS 19/20	76T-MACH-106743	IoT platform for engineering		Prüfung (PR)	Ovtcharova

Competence Certificate
Assessment of another type (graded), procedure see webpage. Number of participants limited to 20 people. There is a participant selection process.

Below you will find excerpts from events related to this course:

V IoT platform for engineering
2123352, WS 19/20, SWS, Language: German, Open in study portal

Content
Industry 4.0, IT systems for fabrication and assembly, process modelling and execution, project work in teams, practice-relevant I4.0 problems, in automation, manufacturing industry and service.

Students can

- map and analyze processes in the context of Industry 4.0 with special methods of process modelling
- collaboratively grasp practical I4.0 issues using existing hardware and software and work out solutions for a continuous improvement process in a team
- prototypically implement the self-developed solution proposal with the given IT systems and the existing hardware equipment and finally present the results

Literature
Keine / None

V IoT platform for engineering
2123352, SS 2020, 3 SWS, Language: German, Open in study portal

Project (PRO)

Content
Industry 4.0, IT systems for fabrication and assembly, process modelling and execution, project work in teams, practice-relevant I4.0 problems, in automation, manufacturing industry and service.

Students can

- map and analyze processes in the context of Industry 4.0 with special methods of process modelling
- collaboratively grasp practical I4.0 issues using existing hardware and software and work out solutions for a continuous improvement process in a team
- prototypically implement the self-developed solution proposal with the given IT systems and the existing hardware equipment and finally present the results

Literature
Keine / None

3.179 Course: Lab Computer-Aided Methods for Measurement and Control [T-MACH-105341]

Responsible: Prof. Dr.-Ing. Christoph Stiller

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104850 - Major Field Mechatronics and Microsystem Technology

Type	Credits	Recurrence	Version
Completed coursework	4	Each winter term	1

Events					
WS 19/20	2137306	Lab Computer-aided methods for measurement and control	3 SWS	Practical course (P)	Stiller, Richter
Exams					
WS 19/20	76-T-MACH-105341	Lab Computer-Aided Methods for Measurement and Control		Prüfung (PR)	Stiller

Competence Certificate
Colloquia

Prerequisites
none

Below you will find excerpts from events related to this course:

Lab Computer-aided methods for measurement and control
2137306, WS 19/20, 3 SWS, Language: German, Open in study portal

Practical course (P)

Content
Lerninhalt (EN):

1. Digital technology
2. Digital storage oscilloscope and digital spectrum analyzer
3. Supersonic computer tomography
4. Lighting and image acquisition
5. Digital image processing
6. Image interpretation
7. Control synthesis and simulation
8. Robot: Sensors
9 Robot: Actuating elements and path planning
The lab comprises 9 experiments.

Voraussetzungen: Recommendations:

Basic studies and preliminary examination; basic lectures in automatic control

Arbeitsaufwand (EN): 120 hours

Lernziele (EN):

Powerful and cheap computation resources have led to major changes in the domain of measurement
and control. Engineers in various fields are nowadays confronted with the application of computer-aided methods. This lab tries to give an insight into the modern domain of measurement and control by means of practically oriented and flexible experiments. Based on experiments
on measurement instrumentation and digital signal processing, elementary knowledge in the domain of visual inspection and image processing will be taught. Thereby, commonly used software like MATLAB/Simulink will be used in both simulation and realization of control loops. The lab closes with selected applications, like control of a robot or supersonic computer
tomography.

Nachweis (EN):

Colloquia

Literature

Übungsanleitungen sind auf der Institutshomepage erhältlich.

Instructions to the experiments are available on the institute's website

T 3.180 Course: Laboratory Exercise in Energy Technology [T-MACH-105331]

Responsible: Prof. Dr.-Ing. Hans-Jörg Bauer
Prof. Dr. Ulrich Maas
Heiner Wirbser

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Completed coursework	4	Each term	1

Events					
WS 19/20	2171487	Laboratory Exercise in Energy Technology	3 SWS	Practical course (P)	Bauer, Maas, Bykov
SS 2020	2171487	Laboratory Exercise in Energy Technology	3 SWS	Practical course (P)	Bauer, Maas, Bykov
Exams					
WS 19/20	76-T-MACH-105331	Laboratory Exercise in Energy Technology		Prüfung (PR)	Bauer, Maas, Wirbser
SS 2020	76-T-MACH-105331	Laboratory Exercise in Energy Technology		Prüfung (PR)	Bauer, Maas, Wirbser

Competence Certificate
1 report, approx. 12 pages

Discussion of the documented results with the assistents

Prerequisites
none

Below you will find excerpts from events related to this course:

V Laboratory Exercise in Energy Technology

2171487, WS 19/20, 3 SWS, Language: German, Open in study portal

Practical course (P)

Content
Online registration within the first two weeks of the lecture periode at: http://www.its.kit.edu

- Micro gas turbine
- Several test rigs for the investigation of heat transfer at thermally high loaded components
- Optimization of components of the internal air and oil system
- Characterization of spray nozzles
- Investigation of pollutant and noise emission as well as reliability and material deterioration
- Exhaust gas treatment
- Exhaust gas turbocharger
- Cooling Tower
- Heatpump
- Plant oil stove
- Heat capacity
- Wood combustion

regular attendance: 42h
self-study: 78h

Attending this course enables the students to:

- accomplish experimental and design related as well as theoretical tasks in a scientific background
- perform a correct evaluation of the obtained results
- adequately document and present their results in a scientific framework

1 report, approx. 12 pages

Discussion of the documented results with the assistents

Duration: 30 minutes

no tools or reference materials may be used

V **Laboratory Exercise in Energy Technology**
2171487, SS 2020, 3 SWS, Language: German, Open in study portal **Practical course (P)**

Content
Online registration within the first two weeks of the lecture periode at: http://www.its.kit.edu

- Micro gas turbine
- Several test rigs for the investigation of heat transfer at thermally high loaded components
- Optimization of components of the internal air and oil system
- Characterization of spray nozzles
- Investigation of pollutant and noise emission as well as reliability and material deterioration
- Exhaust gas treatment
- Exhaust gas turbocharger
- Cooling Tower
- Heatpump
- Plant oil stove
- Heat capacity
- Wood combustion

regular attendance: 42h
self-study: 78h

Attending this course enables the students to:

- accomplish experimental and design related as well as theoretical tasks in a scientific background
- perform a correct evaluation of the obtained results
- adequately document and present their results in a scientific framework

1 report, approx. 12 pages

Discussion of the documented results with the assistents

Duration: 30 minutes

no tools or reference materials may be used

T 3.181 Course: Laboratory Laser Materials Processing [T-MACH-102154]

Responsible: Dr.-Ing. Johannes Schneider
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Completed coursework	4	Each term	2

Events					
WS 19/20	2183640	Laboratory "Laser Materials Processing"	3 SWS	Practical course (P)	Schneider, Pfleging
SS 2020	2183640	Laboratory "Laser Materials Processing"	3 SWS	Practical course (P)	Schneider, Pfleging
Exams					
WS 19/20	76-T-MACH-102154	Laboratory Laser Materials Processing		Prüfung (PR)	Schneider
SS 2020	76-T-MACH-102154	Laboratory Laser Materials Processing		Prüfung (PR)	Schneider

Competence Certificate
The assessment consists of a colloquium for every single experiment and an overall final colloquium incl. an oral presentation of 20 min.

Prerequisites
None

Recommendation
Basic knowledge of physics, chemistry and material science is assumed.

Below you will find excerpts from events related to this course:

V Laboratory "Laser Materials Processing"

2183640, WS 19/20, 3 SWS, Language: German, Open in study portal

Practical course (P)

Content
The laboratory compromises 8 half-day experiments, which address the following laser processing topics of metals, ceramics and polymers:

• safety aspects

• surface hardening and remelting

• melt and reactive cutting

• surface modification by dispersing or alloying

• welding

• surface texturing

• metrology

There are used CO2-, excimer-, Nd:YAG- and high power diode-laser sources within the laboratory.

The student

- can describe the influence of laser, material and process parameters and can choose suitable parameters for the most important methods of laser-based processing in automotive engineering.
- can explain the requirements for safe handling of laser radiation and for the design of safe laser systems.

Basic knowledge of physics, chemistry and material science is assumed.

The attendance to one of the courses Physical Basics of Laser Technology (2181612) or Laser Application in Automotive Engineering (2182642) is strongly recommended.

regular attendance: 34 hours
self-study: 86 hours

The assessment consists of a colloquium for every single experiment and an overall final colloquium incl. an oral presentation of 20 min.

Literature
F. K. Kneubühl, M. W. Sigrist: Laser, 2008, Vieweg+Teubner

T. Graf: Laser - Grundlagen der Laserstrahlquellen, 2009, Vieweg-Teubner Verlag

R. Poprawe: Lasertechnik für die Fertigung, 2005, Springer

H. Hügel, T. Graf: Laser in der Fertigung, 2009, Vieweg+Teubner

J. Eichler, H.-J. Eichler: Laser - Bauformen, Strahlführung, Anwendungen, 2006, Springer

V **Laboratory "Laser Materials Processing"** **Practical course (P)**
2183640, SS 2020, 3 SWS, Language: German, Open in study portal

Content
The laboratory compromises 8 half-day experiments, which address the following laser processing topics of metals, ceramics and polymers:

• safety aspects

• surface hardening and remelting

• melt and reactive cutting

• surface modification by dispersing or alloying

• welding

• surface texturing

• metrology

There are used CO2-, excimer-, Nd:YAG- and high power diode-laser sources within the laboratory.

The student

- can describe the influence of laser, material and process parameters and can choose suitable parameters for the most important methods of laser-based processing in automotive engineering.
- can explain the requirements for safe handling of laser radiation and for the design of safe laser systems.

Basic knowledge of physics, chemistry and material science is assumed.

The attendance to one of the courses Physical Basics of Laser Technology (2181612) or Laser Application in Automotive Engineering (2182642) is strongly recommended.

regular attendance: 34 hours
self-study: 86 hours

The assessment consists of a colloquium for every single experiment and an overall final colloquium incl. an oral presentation of 20 min.

Literature
F. K. Kneubühl, M. W. Sigrist: Laser, 2008, Vieweg+Teubner

T. Graf: Laser - Grundlagen der Laserstrahlquellen, 2009, Vieweg-Teubner Verlag

R. Poprawe: Lasertechnik für die Fertigung, 2005, Springer

H. Hügel, T. Graf: Laser in der Fertigung, 2009, Vieweg+Teubner

J. Eichler, H.-J. Eichler: Laser - Bauformen, Strahlführung, Anwendungen, 2006, Springer

W.T. Silfvast: Laser Fundamentals, 2008, Cambrigde University Press

W.M. Steen: Laser Materials Processing, 2010, Springer

T 3.182 Course: Laboratory Mechatronics [T-MACH-105370]

Responsible: Prof. Dr. Veit Hagenmeyer
Prof. Dr.-Ing. Wolfgang Seemann
Prof. Dr.-Ing. Christoph Stiller

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104850 - Major Field Mechatronics and Microsystem Technology

Type	Credits	Recurrence	Version
Completed coursework	4	Each winter term	4

Events					
WS 19/20	2105014	Laboratory mechatronics	3 SWS	Practical course (P)	Seemann, Stiller, Lorch, Böhland, Burgert, Bitner

Competence Certificate
certificate of successful attendance

Prerequisites
None

Below you will find excerpts from events related to this course:

V Laboratory mechatronics

2105014, WS 19/20, 3 SWS, Language: German, Open in study portal

Practical course (P)

Content
Part I
Control, programming and simulation of robots
CAN-Bus communication
Image processing / machine vision
Dynamic simulation of robots in ADAMS

Part II
Solution of a complex problem in team work

Learning objectives:

The student is able to ...

- use his knowledge about mechatronics and microsystems technology to solve a practical problem. The laboratory course comprises simulation, bus communication, measurement instrumentation, control engineering and programming.
- integrate the different subsystems from a manipulator to a working compound system in teamwork.

Nachweis (EN): certificate of successful attendance

Voraussetzung (EN): none

Arbeitsaufwand (EN):

regular attendance: 33.5 h

self-study: 88.5 h

Literature
Materialien zum Mechatronik-Praktikum

Manuals for the laboratory course on Mechatronics

T 3.183 Course: Laser in Automotive Engineering [T-MACH-105164]

Responsible: Dr.-Ing. Johannes Schneider
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	2

Events					
SS 2020	2182642	Laser in automotive engineering	2 SWS	Lecture (V)	Schneider
Exams					
WS 19/20	76-T-MACH-105164	Laser in Automotive Engineering		Prüfung (PR)	Schneider
SS 2020	76-T-MACH-105164	Laser in Automotive Engineering		Prüfung (PR)	Schneider

Competence Certificate
oral examination (30 min)

no tools or reference materials

Prerequisites
It is not possible, to combine this brick with brick Physical Basics of Laser Technology [T-MACH-109084] and brick Physical Basics of Laser Technology [T-MACH-102102]

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-102102 - Physical Basics of Laser Technology must not have been started.

Recommendation
preliminary knowlegde in mathematics, physics and materials science

Below you will find excerpts from events related to this course:

V Laser in automotive engineering

2182642, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content

Based on a short description of the physical basics of laser technology the lecture reviews the most important high power lasers and their various applications in automotive engineering. Furthermore the application of laser light in metrology and safety aspects will be addressed.

- physical basics of laser technology
- laser beam sources (Nd:YAG-, CO2-, high power diode-laser)
- beam properties, guiding and shaping
- basics of materials processing with lasers
- laser applications in automotive engineering
- economical aspects
- savety aspects

The student

- can explain the principles of light generation, the conditions for light amplification as well as the basic structure and function of Nd:YAG-, CO2- and high power diode-laser sources.
- can describe the most important methods of laser-based processing in automotive engineering and illustrate the influence of laser, material and process parameters
- can analyse manufacturing problems and is able to choose a suitable laser source and process parameters.
- can explain the requirements for safe handling of laser radiation and for the design of safe laser systems.

Basic knowledge of physics, chemistry and material science is assumed.

It is not possible, to combine this lecture with the lecture *Physical basics of laser technology* [2181612].

regular attendance: 22,5 hours
self-study: 97,5 hours

oral examination (ca. 30 min)

no tools or reference materials

Literature

F. K. Kneubühl, M. W. Sigrist: Laser, 2008, Vieweg+Teubner

H. Hügel, T. Graf: Laser in der Fertigung, 2009, Vieweg+Teubner

T. Graf: Laser - Grundlagen der Laserstrahlquellen, 2009, Vieweg-Teubner Verlag

R. Poprawe: Lasertechnik für die Fertigung, 2005, Springer

J. Eichler, H.-J. Eichler: Laser - Bauformen, Strahlführung, Anwendungen, 2006, Springer

T 3.184 Course: Leadership and Conflict Management [T-MACH-105440]

Responsible: Hans Hatzl
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104851 - Major Field Product Development and Construction

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2110017	Leadership and Conflict Management (in German)	2 SWS	Lecture (V)	Hatzl
Exams					
SS 2020	76-T-MACH-105440	Leadership and Conflict Management		Prüfung (PR)	Deml, Hatzl

Competence Certificate
oral exam (approx. 30 min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Leadership and Conflict Management (in German)

2110017, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
In this compact event, management and leadership techniques are taught which are among the key qualifications for management tasks. Furthermore, you will be prepared for management and leadership tasks.

The course consists of the following course contents:

1. Introduction to the topic
   Goal setting and goal achievement
   Management techniques in planning
   Communication and information
   Decision Theory
   Leadership and cooperation
   Self Management
   Conflict management and strategy
   Case studies

It passes:

- Obligatory attendance

recommendations:

- Knowledge of work and economic science is advantageous

Literature
Das Skript und Literaturhinweise stehen auf ILIAS zum Download zur Verfügung.

T 3.185 Course: Leadership and Management Development [T-MACH-105231]

Responsible: Prof. Dr.-Ing. Albert Albers
Prof. Dr.-Ing. Sven Matthiesen
Andreas Ploch

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104851 - Major Field Product Development and Construction

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2145184	Leadership and Product Development	2 SWS	Lecture (V)	Ploch
Exams					
WS 19/20	76-T-MACH-105231	Leadership and Management Development		Prüfung (PR)	Ploch, Albers

Competence Certificate
oral exam (20 min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Leadership and Product Development

2145184, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Overview of leadership theories and their application

Selected management instruments and their use in organizations

Communication and leadership

change management

Management development and MD programmes

Assessment centres and management audits

Teamwork, team development and team roles

Coaching as an instrument of modern leadership

Intercultural competence and cross-cultural leadership

Management and ethics, corporate governance

Practical exercises and examples to deepen selected contents

Literature
Vorlesungsumdruck

T 3.186 Course: Lightweight Engineering Design [T-MACH-105221]

Responsible: Prof. Dr.-Ing. Albert Albers
Prof. Dr.-Ing. Norbert Burkardt

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104851 - Major Field Product Development and Construction

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	2

Events					
SS 2020	2146190	Lightweight Engineering Design	2 SWS	Lecture (V)	Albers, Burkardt
Exams					
WS 19/20	76-T-MACH-105221	Lightweight Engineering Design		Prüfung (PR)	Albers, Burkardt

Competence Certificate
Written examination (90 min)

Prerequisites
None

Below you will find excerpts from events related to this course:

V Lightweight Engineering Design

2146190, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
General aspects of leightweight design, lightweight strategies, construction methods, design principles, lightweight construction, stiffening techniques, lightweight materials, virtual product engineering, bionics, joining techniques, validation, recycling

Additionally, guest speakers from industry will present lightweight design from an practical point of view.

The students are able to ...

- evaluate the potential of central lightweight strategies and their application in design processes.
- apply different stiffing methods qualitatively and to evaluate their effectiveness.
- evaluate the potential of computer-aided engineering as well as the related limits and influences on manufacturing.
- reflect the basics of lightweight construction from a system view in the context of the product engineering process.

Literature
Klein, B.: Leichtbau-Konstruktion. Vieweg & Sohn Verlag, 2007

Wiedemann, J.: Leichtbau: Elemente und Konstruktion, Springer Verlag, 2006

Harzheim, L.: Strukturoptimierung. Grundlagen und Anwendungen. Verlag Harri Deutsch, 2008

T 3.187 Course: Localization of Mobile Agents [T-INFO-101377]

Responsible: Prof. Dr.-Ing. Uwe Hanebeck
Organisation: KIT Department of Informatics
Part of: M-MACH-104883 - Courses of the Department of Informatics

Type	Credits	Recurrence	Version
Oral examination	6	Each summer term	1

Events					
SS 2020	24613	Localization of Mobile Agents	3 SWS	Lecture (V)	Noack, Li
Exams					
WS 19/20	7500020	Localization of Mobile Agents		Prüfung (PR)	Noack, Hanebeck
SS 2020	7500004	Localization of Mobile Agents		Prüfung (PR)	Hanebeck, Noack

Below you will find excerpts from events related to this course:

V Localization of Mobile Agents

24613, SS 2020, 3 SWS, Language: German, Open in study portal

Lecture (V)

Content
This module provides a systematic introduction into the topic of localization methods. In order to facilitate understanding, the module is divided into four main topics. Dead reckoning treats the instantaneous determination of a vehicle's position based on dynamic parameters like velocity or steering angle. Localization with the help of measurements of known landmarks is part of static localization. In addition to the closed-form solutions for particular measurements (distances and angles), the least squares method for fusion arbitrary measurements is also introduced. Dynamic localization treats the combination of dead reckoning and static localization. The central part of the lecture is the derivation of the Kalman filter, which has been successfully applied in several practical applications. Finally, simultaneous localization and mapping (SLAM) is introduced, which allows localization in case of (partly) unknown landmark positions.

Literature
Grundlegende Kenntnisse der linearen Algebra und Stochastik sind hilfreich.

T 3.188 Course: Logistics and Supply Chain Management [T-WIWI-102870]

Responsible: Prof. Dr. Frank Schultmann
Dr. Marcus Wiens
Organisation: KIT Department of Economics and Management
Part of: M-MACH-104884 - Courses of the Department of Economics and Management

Type	Credits	Recurrence	Version
Written examination	3,5	Each summer term	1

Events					
SS 2020	2581996	Logistics and Supply Chain Management	2 SWS	Lecture (V)	Wiens, Schultmann
SS 2020	2581997	Übung zu Logistics and Supply Chain Management	1 SWS	Practice (Ü)	Diehlmann, Lüttenberg
Exams					
WS 19/20	7981996	Logistics and Supply Chain Management		Prüfung (PR)	Schultmann

Competence Certificate
The assessment consists of an oral (30 minutes) or a written (60 minutes) exam (following §4(2), 1 of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Prerequisites
None

Below you will find excerpts from events related to this course:

V Logistics and Supply Chain Management

Lecture (V)

2581996, SS 2020, 2 SWS, Language: English, Open in study portal

Content
Students are introduced to the methods and tools of logistics and supply chain management. They students learn the key terms and components of supply chains together with key economic trade-offs. In detail, students gain knowledge of decisions in supply chain management, such as facility location, supply chain planning, inventory management, pricing and supply chain cooperation. In this manner, students will gain knowledge in analyzing, designing and steering of decisions in the domain of logistics and supply chain management.

- Introduction: Basic terms and concepts
- Facility location and network optimization
- Supply chain planning I: flexibility
- Supply chain planning II: forecasting
- Inventory management & pricing
- Supply chain coordination I: the Bullwhip-effect
- Supply chain coordination II: double marginalization
- Supply chain risk management

Literature
Wird in der Veranstaltung bekannt gegeben.

T 3.189 Course: Machine Dynamics [T-MACH-105210]

Responsible: Prof. Dr.-Ing. Carsten Proppe
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104878 - Specification in Mechanical Engineering

Type	Credits	Recurrence	Version
Written examination	5	Each summer term	1

Events					
SS 2020	2161224	Machine Dynamics	2 SWS	Lecture (V)	Proppe
SS 2020	2161225	Machine Dynamics (Tutorial)	1 SWS	Practice (Ü)	Proppe, Fischer
Exams					
WS 19/20	76-T-MACH-105210	Machine Dynamics		Prüfung (PR)	Proppe
SS 2020	76-T-MACH-105210	Machine Dynamics		Prüfung (PR)	Proppe

Competence Certificate
written exam, 180 min.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Machine Dynamics

2161224, SS 2020, 2 SWS, Language: English, Open in study portal

Lecture (V)

Content
1. Introduction

2. Machine as mechatronic system
3. Rigid rotors: equations of motion, transient and stationary motion, balancing
4. Flexible rotors: Laval rotor (equations of motion, transient and stationary behavior, critical speed, secondary effects), refined models)
5. Slider-crank mechanisms: kinematics, equations of motion, mass and power balancing

Literature
Biezeno, Grammel: Technische Dynamik, 2. Aufl., 1953

Holzweißig, Dresig: Lehrbuch der Maschinendynamik, 1979

Dresig, Vulfson: Dynamik der Mechanismen, 1989

V Machine Dynamics (Tutorial)

2161225, SS 2020, 1 SWS, Language: English, Open in study portal

Practice (Ü)

Content
Exercises related to the lecture

T 3.190 Course: Machine Dynamics II [T-MACH-105224]

Responsible: Prof. Dr.-Ing. Carsten Proppe
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104878 - Specification in Mechanical Engineering
M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2162220	Machine Dynamics II	2 SWS	Lecture (V)	Proppe
Exams					
WS 19/20	76-T-MACH-105224	Machine Dynamics II		Prüfung (PR)	Proppe
SS 2020	76-T-MACH-105224	Machine Dynamics II		Prüfung (PR)	Proppe

Competence Certificate
oral exam, 30 min.

Prerequisites
none

Recommendation
Machine Dynamics

Below you will find excerpts from events related to this course:

V Machine Dynamics II

Lecture (V)

2162220, WS 19/20, 2 SWS, Language: English, Open in study portal

Content
hydrodynamic bearings

- rotating shafts in hydrodynamic bearings
- belt drives
- virbation of turbine blades

Literature
R. Gasch, R. Nordmann, H. Pfützner: Rotordynamik, Springer, 2006

T 3.191 Course: Machine Tools and Industrial Handling [T-MACH-109055]

Responsible: Prof. Dr.-Ing. Jürgen Fleischer
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104852 - Major Field Production Technology

Type	Credits	Recurrence	Version
Oral examination	8	Each winter term	1

Events					
WS 19/20	2149902	Machine Tools and Industrial Handling	6 SWS	Lecture / Practice (VÜ)	Fleischer
Exams					
WS 19/20	76-T-MACH-109055	Machine Tools and Industrial Handling		Prüfung (PR)	Fleischer
SS 2020	76-T-MACH-109055	Machine Tools and Industrial Handling		Prüfung (PR)	Fleischer

Competence Certificate
Oral exam (40 minutes)

Prerequisites
"T-MACH-102158 - Werkzeugmaschinen und Handhabungstechnik" must not be commenced.

Below you will find excerpts from events related to this course:

V Machine Tools and Industrial Handling

Lecture / Practice (VÜ)

2149902, WS 19/20, 6 SWS, Language: German, Open in study portal

Content
The lecture gives an overview of the construction, use and application of machine tools and industrial handling equipment. In the course of the lecture a well-founded and practice-oriented knowledge for the selection, design and evaluation of machine tools is conveyed. First, the main components of the machine tools are systematically explained and their design principles as well as the integral machine tool design are discussed. Subsequently, the use and application of machine tools will be demonstrated using typical machine examples. Based on examples from current research and industrial applications, the latest developments are discussed, especially concerning the implementation of Industry 4.0.

The individual topics are:

- Frames and frame components
- Feed axes
- Spindles
- Peripheral equipment
- Control unit
- Metrological evaluation and machine testing
- Process monitoring
- Maintenance of machine tools
- Safety assessment of machine tools
- Machine examples

Learning Outcomes:

The students …

- are able to assess the use and application of machine tools and handling equipment and to differentiate between them in terms of their characteristics and design.
- can describe and discuss the essential elements of the machine tool (frame, main spindle, feed axes, peripheral equipment, control unit).
- are able to select and dimension the essential components of a machine tool.
- are capable of selecting and evaluating machine tools according to technical and economic criteria.

Workload:

MACH:
regular attendance: 63 hours
self-study: 177 hours
WING:
regular attendance: 63 hours
self-study: 207 hours

Literature
Medien:
Skript zur Veranstaltung wird über Ilias (https://ilias.studium.kit.edu/) bereitgestellt.

Media:
Lecture notes will be provided in Ilias (https://ilias.studium.kit.edu/).

T 3.192 Course: Machine Vision [T-MACH-105223]

Responsible: Dr. Martin Lauer
Prof. Dr.-Ing. Christoph Stiller

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104878 - Specification in Mechanical Engineering
M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Written examination	8	Each winter term	2

Events					
WS 19/20	2137308	Machine Vision	4 SWS	Lecture / Practice (VÜ)	Lauer, Quehl
Exams					
WS 19/20	76-T-MACH-105223	Machine Vision		Prüfung (PR)	Stiller, Lauer
SS 2020	76-T-MACH-105223	Machine Vision		Prüfung (PR)	Stiller, Lauer

Competence Certificate
Type of Examination: written exam

Duration of Examination: 60 minutes

Prerequisites
None

Below you will find excerpts from events related to this course:

V Machine Vision

2137308, WS 19/20, 4 SWS, Language: English, Open in study portal

Lecture / Practice (VÜ)

Content
Lernziele (EN):

Machine vision (or *computer vision*) describes all kind of techniques that can be used to extract information from camera images in an automated way. Considerable improvements of machine vision techniques throughout recent years, e.g. by the advent of deep learning, have caused growing interest in these techniques and enabled applications in various domains, e.g. robotics, autonomous driving, gaming, production control, visual inspection, medicine, surveillance systems, and augmented reality.

The participants should gain an overview over the basic techniques in machine vision and obtain hands-on experience.

Nachweis: written exam, 60 min.

Arbeitsaufwand: 240 hours

Voraussetzungen: none

Literature
Foliensatz zur Veranstaltung wird als kostenlose pdf-Datei bereitgestellt.Weitere Empfehlungen
werden in der Vorlesung bekannt gegeben.

T 3.193 Course: Machines and Processes [T-MACH-105208]

Responsible: Prof. Dr.-Ing. Hans-Jörg Bauer
Dr.-Ing. Heiko Kubach
Prof. Dr. Ulrich Maas
Dr. Balazs Pritz

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104847 - Major Field Fundamentals of Engineering

Type	Credits	Recurrence	Version
Written examination	7	Each term	2

Events					
WS 19/20	2185000	Machines and Processes	4 SWS	Lecture / Practice (VÜ)	Bauer, Kubach, Maas, Pritz
SS 2020	3134140	Machines and Processes	4 SWS	Lecture / Practice (VÜ)	Bauer, Maas, Kubach, Pritz
Exams					
WS 19/20	76-T-MACH-105208	Machines and Processes		Prüfung (PR)	Kubach, Maas, Bauer
WS 19/20	76-T-MACH-105208e	Machines and Processes		Prüfung (PR)	Kubach, Maas, Bauer
SS 2020	76-T-MACH-105208	Machines and Processes		Prüfung (PR)	Kubach, Bauer, Maas, Pritz
SS 2020	76-T-MACH-105208e	Machines and Processes		Prüfung (PR)	Kubach, Bauer, Maas, Pritz

Competence Certificate
written exam (duration: 120 min)

Prerequisites
Taking part at the exam is possible only when lab course has been successfully completed

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105232 - Machines and Processes, Prerequisite must have been passed.

Below you will find excerpts from events related to this course:

V Machines and Processes

2185000, WS 19/20, 4 SWS, Open in study portal

Lecture / Practice (VÜ)

Content

basics of thermodynamics

thermal fluid machines

- steam turbunes
- gas turbines
- combined-cycle plants
- turbines and compressors
- aircraft engines

hydraulic fluid machines

- oerating performance
- characterization
- control
- cavitation
- wind turbines, propellers

internal combustion engines

- characteristic parameters
- engine parts
- kinematics
- engine processes
- emissions

T 3.194 Course: Machines and Processes, Prerequisite [T-MACH-105232]

Responsible: Prof. Dr.-Ing. Hans-Jörg Bauer
Dr.-Ing. Heiko Kubach
Prof. Dr. Ulrich Maas
Dr. Balazs Pritz

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104847 - Major Field Fundamentals of Engineering

Type	Credits	Recurrence	Version
Completed coursework	0	Each term	1

Events					
WS 19/20	2187000	Machines and Processes	1 SWS	Practical course (P)	Bauer, Kubach, Maas, Pritz, Schmidt
SS 2020	2187000	Machinery and Processes	1 SWS	Practical course (P)	Bauer, Kubach, Maas, Pritz
Exams					
WS 19/20	76-T-MACH-105232	Machines and Processes, Prerequisite		Prüfung (PR)	Kubach, Maas, Bauer, Gabi
SS 2020	76-T-MACH-105232	Machines and Processes, Prerequisite		Prüfung (PR)	Kubach, Bauer, Maas, Pritz

Competence Certificate
successful completed training course

Prerequisites
none

Below you will find excerpts from events related to this course:

V Machines and Processes
2187000, WS 19/20, 1 SWS, Open in study portal

Practical course (P)

Content
Lab Course Experiment

V Machinery and Processes
2187000, SS 2020, 1 SWS, Open in study portal

Practical course (P)

Content
successful lab course and written exam (2 h)

Taking part at the exam is possible only when lab course has been successfully completed

Lab course and lecture take place in summer and winter semester.

In the SS the lecture is held in English. The lab course is always bilingual.

Media:

slides to download

Documentation of the labcourse

basics of thermodynamics

thermal fluid machines

- steam turbunes
- gas turbines
- combined-cycle plants
- turbines and compressors
- aircraft engines

hydraulic fluid machines

- oerating performance
- characterization
- control
- cavitation
- wind turbines, propellers

internal combustion engines

- characteristic parameters
- engine parts
- kinematics
- engine processes
- emissions

regular attendance: 48 h, self-study: 160 h

The students can name and describe basic energy conversion processes and energy converting machines. They can explain the application of these energy conversion processes in various machines. They can analyze and evaluate the processes and machines in terms of functionality and efficiency and they are able to solve basic technical problems in terms of operating the machines.

T 3.195 Course: Magnet Technology of Fusion Reactors [T-MACH-105434]

Responsible: Dr. Walter Fietz
Dr. Klaus-Peter Weiss

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering
M-MACH-104878 - Specification in Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2190496	Magnet Technology of Fusion Reactors	2 SWS	Lecture (V)	Fietz, Weiss
Exams					
WS 19/20	76-T-MACH-105434	Magnet Technology of Fusion Reactors		Prüfung (PR)	Fietz, Weiss
SS 2020	76-T-MACH-105434	Magnet Technology of Fusion Reactors		Prüfung (PR)	Fietz, Weiss

Competence Certificate
Oral examination of about 30 minutes

Prerequisites
none

Annotation
none

Below you will find excerpts from events related to this course:

V Magnet Technology of Fusion Reactors

Lecture (V)

2190496, SS 2020, 2 SWS, Language: German/English, Open in study portal

Content

In Greifswald/Germany the fusion experiment Wendelstein 7-X is now in operation to demonstrate the performance of Stellerator-type fusion machines. In south of France the fusion reactor ITER is under construction which will demonstrate the production of energy by fusion. In both machines the plasma inclusion will be ensured by magnets and to produce high magnetic fields in an efficient way, these magnets have to be superconducting. Design, construction and operation of such magnets is a technologic challenge because low temperature (4.5 K) and high currents (typ. 68 kA) are necessary.

The lecture will show basic principles for design and construction of such magnets and includes:

- Introduction with examples to nuclear fusion and to magnetic plasma confinement
- Basics of low temperature and high temperature properties and cryotechnique
- Material testing and critical material properties at low temperatures
- Principles of magnet design, construction and safe magnet operation
- Present status and magnet examples from fusion projects ITER, W7-X and JT-60SA
- Application of high temperature superconductors on fusion and power engineering

The goal of the lecture is to impart the fundamentals of construction of superconducting magnets. Magnet technology is inherently of multidisciplinary character e.g. material properties at low temperature, high voltage and high current technique. The use of superconductors is mandatory to reach highest magnetic fields with comparable small losses. Examples of magnets from power application, basic research and fusion reactor construction are discussed.

Lecture Content:

- Basics of nuclear fusion and design aspects of fusion magnets
- Superconductors - basics and stability
- Low temperature cryogenic aspects
- Low temperature and high temperature superconductors
- Cryogenic material testing and properties of fusion materials at low temperatures
- Quench and high voltage aspects for magnets
- Status and magnets of fusion machines ITER, W7-X, JT-60SA & future DEMO
- Impact of high temperature superconductors on fusion and power engineering

Educational objective: The students know:

- Magnetic plasma confinement principles in connection with fusion machine
- Examples and basic properties of different superconductors
- Basics of formation of superconducting cables and magnet construction
- Generation of low temperature, cryostat construction
- Basics of magnet design and magnet safety
- Material testing and material properties at low temperatures
- High-temperature superconductor use in magnet construction and power application

Recommendations:

Knowledge in energy technology, power plants, material testing is welcomed

- Time of attendance: 2 SWS, Other: excursion, etc. 5 hours
- Self-study: preparation and postprocessing LV (course): 1 hour / week
- Preparation for the examination: 80 hours per semester

Oral examination of about 30 minutes

T 3.196 Course: Magnetohydrodynamics [T-MACH-105426]

Responsible: Prof. Dr. Leo Bühler
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2153429	Magnetohydrodynamics	2 SWS	Lecture (V)	Bühler
Exams					
WS 19/20	76-T-MACH-105426	Magnetohydrodynamics		Prüfung (PR)	Bühler

Competence Certificate
oral

Duration: 30 minutes

No auxiliary means

Prerequisites
The partial performance number T-MACH-108845 "Magnetohydrodynamics" (Nat/Inf/Etit) must not be startet or completed.

The partial services T-MACH-108845 "Magnetohydrodynamics" (Nat/Inf/Etit) and T-MACH-105426 "Magnetohydrodynamics" are mutually exclusive.

Recommendation
Fluid Mechanics (T-MACH-105207)

Mathematical Methods in Fluid Mechanics (T-MACH-105295)

Below you will find excerpts from events related to this course:

V Magnetohydrodynamics

2153429, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content

- Introduction
- Basics of electro and fluid dynamics
- Exact solutions, Hartmann flow, pump, generator, channel flows
- Inductionless approximation
- Developing flows, change of cross-section, variable magnetic fields
- Alfven waves
- Stability, transition to turbulence
- Liquid dynamos

Educational objective: The students can describe the fundamentals of magnetohydrodynamics. They are qualified to explain the interrelations of electro and fluid dynamics so as to analyze magnetohydrodynamic flows in engineering applications or for phenomena in geo and astrophysics.

Literature
U. Müller, L. Bühler,2001,Magnetofluiddynamics in Channels and Containers, ISBN 3-540-41253-0, Springer Verlag

R. Moreau, 1990, Magnetohydrodynamics, Kluwer Academic Publisher

P. A. Davidson, 2001, An Introduction to Magnetohydrodynamics, Cambridge University Press

J. A. Shercliff, 1965, A Textbook of Magnetohydrodynamics, Pergamon Press

T 3.197 Course: Management Accounting 1 [T-WIWI-102800]

Responsible: Prof. Dr. Marcus Wouters
Organisation: KIT Department of Economics and Management
Part of: M-MACH-104884 - Courses of the Department of Economics and Management

Type	Credits	Recurrence	Version
Written examination	4,5	Each summer term	2

Events					
SS 2020	2579900	Management Accounting 1	2 SWS	Lecture (V)	Wouters
SS 2020	2579901	Übung zu Management Accounting 1 (Bachelor)	2 SWS	Practice (Ü)	Riar
SS 2020	2579902		2 SWS	Practice (Ü)	Riar
Exams					
WS 19/20	79-2579900-B	Management Accounting 1 (Bachelor)		Prüfung (PR)	Wouters
WS 19/20	79-2579900-M	Management Accounting 1 (Mastervorzug und Master)		Prüfung (PR)	Wouters

Competence Certificate
The assessment consists of a written exam (120 minutes) (following §4(2), 1 of the examination regulation) at the end of each semester.

Prerequisites
None

Annotation
Students in the Bachelor' program can only take the related tutorial and examination. Students in the Master's program (and Bachelor's students who are already completing examinations for their Master's program) can only take the related tuturial and examination.

Below you will find excerpts from events related to this course:

V Management Accounting 1 — Lecture (V)
2579900, SS 2020, 2 SWS, Language: English, Open in study portal

Content
The course covers topics in management accounting in a decision-making framework. Some of these topics in the course MA1 are: short-term planning, investment decisions, budgeting and activity-based costing.

We will use international material written in English.

We will approach these topics primarily from the perspective of the users of financial information (not so much from the controller who prepares the information).

The course builds on an introductory level of understanding of accounting concepts from Business Administration courses in the core program. The course is intended for students in Industrial Engineering.

Learning objectives:

- Students have an understanding of theory and applications of management accounting topics.
- They can use financial information for various purposes in organizations.

Examination:

- The assessment consists of a written exam (120 minutes) at the end of each semester (following § 4 (2) No. 1 of the examination regulation).

Workload:

- The total workload for this course is approximately 135.0 hours. For further information see German version.

Literature

- Marc Wouters, Frank H. Selto, Ronald W. Hilton, Michael W. Maher: Cost Management – Strategies for Business Decisions, 2012, Publisher: McGraw-Hill Higher Education (ISBN-13 9780077132392 / ISBN-10 0077132394)
- In addition, several papers that will be available on ILIAS.

V **Übung zu Management Accounting 1 (Bachelor)** **Practice (Ü)**
2579901, SS 2020, 2 SWS, Language: English, Open in study portal

Content
see Module Handbook

V **Practice (Ü)**
2579902, SS 2020, 2 SWS, Language: English, Open in study portal

Content
see Module Handbook

T 3.198 Course: Management and Strategy [T-WIWI-102629]

Responsible: Prof. Dr. Hagen Lindstädt
Organisation: KIT Department of Economics and Management
Part of: M-MACH-104884 - Courses of the Department of Economics and Management

Type	Credits	Recurrence	Version
Written examination	3,5	Each summer term	1

Events					
SS 2020	2577900	Management and Strategy	2 SWS	Lecture (V)	Lindstädt
Exams					
WS 19/20	7900199	Management and Strategy		Prüfung (PR)	Lindstädt

Competence Certificate
The assessment consists of a written exam (60 min) taking place at the beginn of the recess period (according to §4 (2), 1 of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Prerequisites
None

Below you will find excerpts from events related to this course:

V Management and Strategy — **Lecture (V)**
2577900, SS 2020, 2 SWS, Language: German, Open in study portal

Content

The participants learn about central concepts of strategic management along the ideal-typical strategy process: internal and external strategic analysis, concept and sources of competitive advantages, their importance when establishing competitive and corporate strategies as well as strategy assessment and implementation. This aims in particular to provide a summary of the basic concepts and models of strategic management, i.e. to provide in particular an action-oriented integration. Thereby a focus is on imparting knowledge about how price developments in oligopolistic markets can be understood, modeled and forecasted based on game theory.

Content in brief:

- Corporate management principles
- Strategic management principles
- Strategic analysis
- Competitive strategy: modelling and selection on a divisional level
- Strategies for oligopolies and networks: anticipation of dependencies
- Corporate strategy: modelling and evaluation on a corporate level
- Strategy implementation

Learning Objectives:

After passing this course students are able to

- prepare strategic decisions along the ideal-typical strategy process in practice ("strategic analysis").
- assess strategic options.
- explain the portfolio management (Parental advantage and best owner of business entities).
- discuss price and capacity decisions in oligopolies and explain them in examples.

Recommendations:

None.

Workload:

The total workload for this course is approximately 105.0 hours. For further information see German version.

Assessment:

The assessment will consist of a written exam (60 min) taking place at the beginning of the recess period (according to Section 4 (2), 2 of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Literature

- Pidun, U.: *Corporate Strategy: Theory and Practice*. Springer-Gabler, Wiesbaden 2019.
- Lindstädt, H.; Hauser, R.: *Strategische Wirkungsbereiche des Unternehmens*. Gabler, Wiesbaden 2004.
- Grant, R.M.: *Strategisches Management*. Pearson Studium, 5., aktualisierte Aufl., München 2006.

Die relevanten Auszüge und zusätzliche Quellen werden in der Veranstaltung bekannt gegeben.

T 3.199 Course: Manufacturing Technology [T-MACH-102105]

Responsible: Prof. Dr.-Ing. Volker Schulze
Dr.-Ing. Frederik Zanger

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104852 - Major Field Production Technology

Type	Credits	Recurrence	Version
Written examination	8	Each winter term	3

Events					
WS 19/20	2149657	Manufacturing Technology	6 SWS	Lecture / Practice (VÜ)	Schulze, Zanger
Exams					
WS 19/20	76-T-MACH-102105	Manufacturing Technology		Prüfung (PR)	Schulze
SS 2020	76-T-MACH-102105	Manufacturing Technology		Prüfung (PR)	Schulze

Competence Certificate
Written Exam (180 min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Manufacturing Technology

2149657, WS 19/20, 6 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Content
The objective of the lecture is to look at manufacturing technology within the wider context of production engineering, to provide an overview of the different manufacturing processes and to impart detailed process knowledge of the common processes. The lecture covers the basic principles of manufacturing technology and deals with the manufacturing processes according to their classification into main groups regarding technical and economic aspects. The lecture is completed with topics such as process chains in manufacturing.

The following topics will be covered:

- Quality control
- Primary processing (casting, plastics engineering, sintering, additive manufacturing processes)
- Forming (sheet-metal forming, massive forming, plastics engineering)
- Cutting (machining with geometrically defined and geometrically undefined cutting edges, separating, abrading)
- Joining
- Coating
- Heat treatment and surface treatment
- Process chains in manufacturing

This lucture provides an excursion to an industry company.

Learning Outcomes:

The students ...

- are capable to specify the different manufacturing processes and to explain their functions.
- are able to classify the manufacturing processes by their general structure and functionality according to the specific main groups.
- have the ability to perform a process selection based on their specific characteristics.
- are enabled to identify correlations between different processes and to select a process regarding possible applications.
- are qualified to evaluate different processes regarding specific applications based on technical and economic aspects.
- are experienced to classify manufacturing processes in a process chain and to evaluate their specific influence on surface integrity of workpieces regarding the entire process chain.

Workload:

regular attendance: 63 hours
self-study: 177 hours

Literature
Medien:
Skript zur Veranstaltung wird über ilias (https://ilias.studium.kit.edu/) bereitgestellt.

Media:
Lecture notes will be provided in ilias (https://ilias.studium.kit.edu/).

T 3.200 Course: Material Flow in Logistic Systems [T-MACH-102151]

Responsible: Prof. Dr.-Ing. Kai Furmans
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104852 - Major Field Production Technology

Type	Credits	Recurrence	Version
Examination of another type	9	Each winter term	3

Events					
WS 19/20	2117051	Material flow in logistic systems	6 SWS	Others (sonst.)	Furmans
Exams					
WS 19/20	76-T-MACH-102151	Material Flow in Logistic Systems		Prüfung (PR)	Furmans

Competence Certificate
The assessment (Prüfungsleistung anderer Art) consists of the following assignments:

- 40% assessment of the final case study as individual performance,
- 60% semester evaluation which includes working on 5 case studies and defending those (For both assessment types, the best 4 of 5 tries count for the final grade.):
    - 40% assessment of the result of the case studies as group work,
    - 20% assessment of the oral examination during the case study colloquiums as individual performance.

A detailed description of the learning control can be found under Annotations.

Prerequisites
none

Recommendation
Recommended elective subject: Probability Theory and Statistics

Annotation
Students are divided into groups for this course. Five case studies are carried out in these groups. The results of the group work during the lecture period are presented and evaluated in writing. In the oral examination during the case study colloquiums, the understanding of the result of the group work and the models dealt with in the course is tested. The participation in the oral defenses is compulsory and will be controlled. For the written submission the group receives a common grade, in the oral defense each group member is evaluated individually.

After the lecture period, there is the final case study. This case study contains the curriculum of the whole semester. The students work individually on this case study which takes place at a predefined place and time (duration: 4h).

Below you will find excerpts from events related to this course:

V Material flow in logistic systems

Others (sonst.)

2117051, WS 19/20, 6 SWS, Language: German, Open in study portal

Content
Learning Content:

- Elements of material flow systems (conveyor elements, fork, join elements)
- Models of material flow networks using graph theory and matrices
- Queueing theory, calculation of waiting time, utilization
- Warehouseing and order-picking
- Shuttle systems
- Sorting systems
- Simulation
- Calculation of availability and reliability
- Value stream analysis

After successful completion of the course, you are able (alone and in a team) to:

- Accurately describe a material handling system in a conversation with an expert.
- Model and parameterize the system load and the typical design elements of a material handling system.
- Design a material handling system for a task.
- Assess the performance of a material handling system in terms of the requirements.
- Change the main lever for influencing the performance.
- Expand the boundaries of today's methods and system components conceptually if necessary.

Literature:

Arnold, Dieter; Furmans, Kai: Materialfluss in Logistiksystemen; Springer-Verlag Berlin Heidelberg, 2009

Description:

Students are divided into groups for this course. Five case studies are carried out in these groups. The results of the group work during the lecture period are presented and evaluated in writing. During the colloquiums, the result of the case study is presented and the understanding of the group work and the models dealt with in the course are tested in an oral defense. The participation in the colloquiums is compulsory and will be controlled. For the written submission and the presentation the group receives a common grade, in the oral defense each group member is evaluated individually.

After the lecture period, there is the final case study. This case study contains the curriculum of the whole semester. The students work individually on this case study which takes place at a predefined place and time (duration: 4h).

We strongly recommend to attend the introductory session at 16.10.2019. In this session, the teaching concept of "Materialfluss in Logistiksysteme" is explained and outstanding issues are clarified.

Workload:

- Regular attendance: 35 h
- Self-study: 135 h
- Group work: 100 h

Competence Certificate:

The assessment (Prüfungsleistung anderer Art) consists of the following assignments:

- 40% assessment of the final case study as individual performance,
- 60% semester evaluation which includes working on 5 case studies and defending those (For both assessment types, the best 4 of 5 tries count for the final grade.):
    - 40% assessment of the result and the presentation of the case studies as group work,
    - 20% assessment of the oral examination during the colloquiums as individual performance.

T 3.201 Course: Materials Characterization [T-MACH-107684]

Responsible: Dr.-Ing. Jens Gibmeier
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	3

Events					
WS 19/20	2174586	materials characterization	2 SWS	Lecture (V)	Schneider, Gibmeier
Exams					
WS 19/20	76-T-MACH-107684	Materials Characterization		Prüfung (PR)	Heilmaier, Gibmeier
SS 2020	76-T-MACH-107684	Materials Characterization		Prüfung (PR)	Heilmaier, Gibmeier

Competence Certificate
Oral exam, about 25 minutes

Prerequisites
Successful participation in Exercises for Materials Characterization is the condition for the admittance to the oral exam in Materials Characterization.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-107685 - Exercises for Materials Characterization must have been passed.

Below you will find excerpts from events related to this course:

V materials characterization

Lecture (V)

2174586, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
The following methods will be introduced within this lecture:

- microscopic methods: optical microscopy, electron microscopy (SEM/TEM), atomic force microscopy
- material and microstructure analyses by means of X-ray, neutron and electron beams
- analysis methods at SEM/TEM (e.g. EELS)
- spectroscopic methods (e.g. EDS / WDS)

learning objectives:
The students have fundamental knowledge about methods of material analysis. They have a basic understanding to transfer this fundamental knowledge on problems in engineering science. Furthermore, the students have the ability to describe technical material by its microscopic and submicroscopic structure.
requirements:
none
workload:

The workload for the module “Materials Characterization” is 180 h per semester and consists of the presence during the lectures (21 h) and tutorials (12 h) as well as self-study for the lecture (99 h) and for the tutorials (48 h).

Literature
Vorlesungsskript (wird zu Beginn der Veranstaltung ausgegeben).

Literatur wird zu Beginn der Veranstaltung bekanntgegeben.

T 3.202 Course: Materials Modelling: Dislocation Based Plasticy [T-MACH-105369]

Responsible: Dr. Daniel Weygand
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	2

Events					
SS 2020	2182740	Materials modelling: dislocation based plasticy	2 SWS	Lecture (V)	Weygand
Exams					
WS 19/20	76-T-MACH-105369	Materials Modelling: Dislocation Based Plasticity		Prüfung (PR)	Weygand
SS 2020	76-T-MACH-105369	Materials Modelling: Dislocation Based Plasticy		Prüfung (PR)	Weygand

Competence Certificate
oral exam ca. 30 minutes

Prerequisites
none

Recommendation
preliminary knowlegde in mathematics, physics and materials science

Below you will find excerpts from events related to this course:

V Materials modelling: dislocation based plasticy — Lecture (V)
2182740, SS 2020, 2 SWS, Language: German, Open in study portal

Content
1. Introduction
2. elastic fields of dislocations
3. slip, crystallography
4. equations of motion of dislocations
a) fcc
b) bcc
5. interaction between dislocations
6. molecular dynamics
7. discrete dislocation dynamics
8. continuum description of dislocations

The student

- has the basic understanding of the physical basics to describe dislocations and their interaction with point, line and area defects.
- can apply modelling approaches for dislocation based plasticity.
- can explain discrete methods for modelling of microstructural evolution processes.

preliminary knowlegde in mathematics, physics and materials science recommended

regular attendance: 22,5 hours
self-study: 97,5 hours

oral exam ca. 30 minutes

Literature

1. D. Hull and D.J. Bacon, Introduction to Dislocations, Oxford Pergamon 1994
2. W. Cai and W. Nix, Imperfections in Crystalline Solids, Cambridge University Press, 2016
3. J.P. Hirth and J. Lothe: Theory of dislocations, New York Wiley 1982. (oder 1968)
4. J. Friedel, Dislocations, Pergamon Oxford 1964.
5. V. Bulatov, W. Cai, Computer Simulations of Dislocations, Oxford University Press 2006
6. A.S. Argon, Strengthening mechanisms in crystal plasticity, Oxford materials.

T 3.203 Course: Materials of Lightweight Construction [T-MACH-105211]

Responsible: Prof. Dr.-Ing. Peter Elsner
Dr.-Ing. Wilfried Liebig

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2174574	Materials for Lightweight Construction	2 SWS	Lecture (V)	Liebig, Elsner
Exams					
WS 19/20	76-T-MACH-105211	Materials of Lightweight Construction		Prüfung (PR)	Liebig, Weidenmann
SS 2020	76-T-MACH-105211	Materials of Lightweight Construction		Prüfung (PR)	Liebig

Competence Certificate
Oral exam, about 25 minutes

Prerequisites
none

Recommendation
Materials Science I/II

Below you will find excerpts from events related to this course:

V Materials for Lightweight Construction

2174574, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content

Introduction

Constructive, production-orientied and material aspects of lightweight construction

Aluminium-based alloys

Aluminium wrought alloys

Aluminium cast alloys

Magnesium-based alloys

Magnesium wrought alloys

Magnesium cast alloys

Titanium-based alloys

Titanium wrought alloys

Titanium cast alloys

High-strength steels

High-strength structural steels,

Heat-treatable steels, press-hardening and hardenable steels

Composites - mainly PMC

Matrices

Reinforcements

Basic mechanical principles of composites

Hybrid composites

Special materials for lightweight design

Beryllium alloys

Metallic Glasses

Applications

learning objectives:

The students are capable to name different lightweight materials and can describe their composition, properties and fields of application. They can describe the hardening mechanisms of lightweight materials and can transfer this knowledge to applied problems.

The students can apply basic mechanical models of composites and can depict differences in the mechanical properties depending on composition and structure. The students can describe the basic principle of hybrid material concepts and can judge their advantages in comparison to bulk materials. The students can name special materials for lightweight design and depict differences to conventional materials. The students have the ability to present applications for different lightweight materials and can balance reasons for their use.

requirements:

Werkstoffkunde I/II (recommended)

workload:

The workload for the lecture “Materials for Lightweight Construction” is 120 h per semester and consists of the presence during the lectures (24 h), preparation and rework time at home (48 h) and preparation time for the oral exam (48 h).

Literature

Literaturhinweise, Unterlagen und Teilmanuskript in der Vorlesung

T 3.204 Course: Materials Physics and Metals [T-MACH-100285]

Responsible: Prof. Dr.-Ing. Martin Heilmaier
Prof. Dr. Astrid Pundt

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Oral examination	13	Each winter term	2

Events					
WS 19/20	2177010	Materials Physics	3 SWS	Lecture (V)	Gruber
SS 2020	2174598	Metals	4 SWS	Lecture (V)	Pundt, Kauffmann, Lang
SS 2020	2174599	Übungen zur Vorlesung "Metalle"	1 SWS	Practice (Ü)	Pundt, Heilmaier, Kauffmann
Exams					
WS 19/20	76-T-MACH-100285	Materials Physics and Metals		Prüfung (PR)	Heilmaier, Gruber
WS 19/20	76-T-MACH-100285-W	Materials Physics and Metals		Prüfung (PR)	Heilmaier, Gruber, Pundt
SS 2020	76-T-MACH-100285	Materials Physics and Metals		Prüfung (PR)	Heilmaier, Gruber, Pundt

Competence Certificate
Oral exam, about 45 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Metals

2174598, SS 2020, 4 SWS, Language: German, Open in study portal

Lecture (V)

Content
Properties of pure elements; thermodynamic foundations of single-component and of binary systems, as well as multiphase systems; nucleation and growth; diffusion processes in crystalline materials; phase diagrams; effects of alloying; nonequilibrium microstructures; heat treatment technology

learning objectives:
The students are familiar with the thermodynamic foundations of phase transformations, the kinetics of phase transformations in the solid state, the mechanisms of microstructure formation and microstructure-property relationships and can apply them to metallic materials. They can assess the effects of heat treatments and of alloying on the microstructure and the mechanicla and physical properties of metallic materials. This competence is in particular deepened for iron- and aluminum-based alloys.
requirements:
Materials physics
workload:

Regular attendance: 42 h

Self-study: 138 h

Literature

D.A. Porter, K. Easterling, Phase Transformation in Metals and Alloys, 2nd edition, Chapman & Hall, London 1997,

G. Gottstein. Physikalische Grundlagen der Materialkunde, Springer 2007

E. Hornbogen, H. Warlimont, Metalle (Struktur und Eigenschaften von Metallen und Legierungen), Springer-Verlag, Berlin 2001

H.-J. Bargel, G. Schulze, Werkstoffkunde, Springer-Verlag Berlin 2005

J. Rösler, H. Harders, M. Bäker, Mechanisches Verhalten der Werkstoffe, Vieweg+Teubner Wiesbaden, 2008

J. Freudenberger: http://www.ifw-dresden.de/institutes/imw/lectures/lectures/pwe

V **Übungen zur Vorlesung "Metalle"** **Practice (Ü)**

2174599, SS 2020, 1 SWS, Language: German, Open in study portal

Content

Properties of pure elements; thermodynamic foundations of single-component and of binary systems, as well as multiphase systems; nucleation and growth; diffusion processes in crystalline materials; phase diagrams; effects of alloying; nonequilibrium microstructures; heat treatment technology

learning objectives:

The Students have hands-on experience in the application of thermodynamic foundations of phase transformations, the kinetics of phase transformations in the solid state, the mechanisms of microstructure formation and microstructure-property relationships. They can assess the effects of heat treatments and of alloying on the microstructure and the mechanicla and physical properties of metallic materials. This competence is in particular practiced for iron- and aluminum-based alloys.

requirements:

Materials physics

workload:

Regular attendance: 14 h

Self-study: 16 h

Literature

G. Gottstein: „Materialwissenschaft und Werkstofftechnik: Physikalische Grundlagen“, Springer (2014)
http://dx.doi.org/10.1007/978-3-642-36603-1 (frei über die KIT-Lizenz abrufbar)
J. Freudenberger: „Skript zur Vorlesung Physikalische Werkstoffeigenschaften“, IFW Dresden (2004)
http://www.ifw-dresden.de/institutes/imw/lectures/pwe
P. Haasen: „Physikalische Metallkunde“, Cambridge University Press (2003)
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC309606810
R.W. Cahn, P. Haasen (Editoren): „Physical Metallurgy“, Serie, North Holland (1996)
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC052463656
D. A. Porter, K. Easterling: „Phase Transformation in Metals and Alloys“, Chapman & Hall (2009)
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC27759961X
E. Hornbogen, H. Warlimont: „Metalle: Struktur und Eigenschaften von Metallen und Legierungen“, Springer (2016)
http://dx.doi.org/10.1007/978-3-662-47952-0 (frei über die KIT-Lizenz abrufbar)
E. Hornbogen, G. Eggeler, E. Werner: „Werkstoffe: Aufbau und Eigenschaften von Keramik-, Metall-, Polymer- und Verbundwerkstoffen“, Springer (2012)
http://dx.doi.org/10.1007/978-3-642-22561-1 (frei über die KIT-Lizenz abrufbar)
H.-J. Bargel, G. Schulze: „Werkstoffkunde“, Springer (2012)
http://dx.doi.org/10.1007/978-3-642-17717-0 (frei über die KIT-Lizenz abrufbar)
J. Rösler, H. Harders, M. Bäker: „Mechanisches Verhalten der Werkstoffe“, Springer Vieweg (2016)
http://dx.doi.org/10.1007/978-3-658-13795-3 (frei über die KIT-Lizenz abrufbar)

T 3.205 Course: Materials Processing Technology [T-MACH-100295]

Responsible: Dr. Joachim Binder
Dr.-Ing. Wilfried Liebig

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Oral examination	6	Each winter term	2

Events					
WS 19/20	2173540	Materials Processing Technology	3 SWS	Lecture / Practice (VÜ)	Liebig, Binder
Exams					
WS 19/20	76-T-MACH-100295	Materials Processing Technology		Prüfung (PR)	Liebig, Gruber
SS 2020	76-T-MACH-100295	Materials Processing Technology		Prüfung (PR)	Liebig

Competence Certificate
Oral exam (lecture + lab course), approx. 25 min, lab course "Materials Processing" has to be finished successfully.

Prerequisites
Lab course "Materials Processing" has to be passed successfully in advance.

Annotation
Lecture: lecture notes, slides + beamer, blackboard

lab course: experimental equipment, paper, pencil, lab course notes, calculator

Below you will find excerpts from events related to this course:

V Materials Processing Technology

2173540, WS 19/20, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Content
Introduction

Polymers:

Raw materials, materials laws and models, rheology, moulding, forming, joining

Ceramics:

raw materials, powder synthesis, additives, moulding and forming of glass, moulding, abrasive techniques, changing properties, final processing

metals:

raw materials, materials processing, moulding, forming, cutting, joining

semiconductors:

raw materials, moulding, changing properties

Summary

objectives:

The students are able to name the different materials processing techniques and can the describe their basic principles and allocate them to the different classes of metarials processing methods.

They can chose specific processing techniques based on given problems and consider constraints derived from their basic knowledge in materials science.

The students are able to carry out simple experiments with lab scale equipment. They can correlate the processing parameters with resulting material properties by analyzing the materials using adequate testing methods which have to be chosen, evaluated and documented suitable to the problems given.

requirements:

none, **Recommendations:** Module "Basics in Materials Science" should be passed

workload:

The workload for the lecture “materials processing technology” is 180 h per semester and consists of the presence during the lectures (36 h) including tutorials, presence during the lab course (12 h), preparation and rework time at home (72 h) and preparation time for the oral exam (60 h).

Literature
Literaturhinweise, Unterlagen und Teilmanuskript in der Vorlesung

Presentation slides and additional lecture notes are handed out during the lecture, additional literature recommendations given

T 3.206 Course: Materials Science and Engineering III [T-MACH-105301]

Responsible: Prof. Dr.-Ing. Martin Heilmaier
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Oral examination	8	Each winter term	2

Events					
WS 19/20	2173553	Materials Science and Engineering III	4 SWS	Lecture (V)	Heilmaier, Lang
WS 19/20	2173554	Übungen zu Werkstoffkunde III	1 SWS	Practice (Ü)	Heilmaier, Kauffmann
Exams					
WS 19/20	76-T-MACH-105301	Materials Science III		Prüfung (PR)	Heilmaier, Lang
SS 2020	76-T-MACH-105301	Materials Science III		Prüfung (PR)	Heilmaier, Lang

Competence Certificate
Oral exam, about 35 minutes

Prerequisites
T-MACH-110818 - Plasticity of Metals and Intermetallics has not been started

Below you will find excerpts from events related to this course:

V Materials Science and Engineering III

2173553, WS 19/20, 4 SWS, Language: German, Open in study portal

Lecture (V)

Content
Properties of pure iron; thermodynamic foundations of single-component and of binary systems; nucleation and growth; diffusion processes in crystalline iron; the phase diagram Fe-Fe3C; effects of alloying on Fe-C-alloys; nonequilibrium microstructures; multicomponent iron-based alloys; heat treatment technology; hardenability and hardenability tests.

learning objectives:
The students are familiar with the thermodynamic foundations of phase transformations, the kinetics of phase transformations in the solid states (nucleation and growth phenomena), the mechanisms of microstructure formation and microstructure-property relationships and can apply them to metallic materials. They can assess the effects of heat treatmens and of alloying on the microstructure and the properties of iron-based materials (steels in particular). The can select steels for structural applications in mechanical engineering and subject them to appropriate heat treatmens.

requirements:
Basic knowledge in materials science and engineering (Werkstoffkunde I/II)

workload:

regular attendance: 53 hours
self-study: 187 hours

Literature
Vorlesungsskript; Übungsaufgaben; Bhadeshia, H.K.D.H. & Honeycombe, R.W.K.
Steels – Microstructure and Properties
CIMA Publishing, 3. Auflage, 2006

T 3.207 Course: Mathematical Methods in Dynamics [T-MACH-105293]

Responsible: Prof. Dr.-Ing. Carsten Proppe
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104847 - Major Field Fundamentals of Engineering

Type	Credits	Recurrence	Version
Written examination	6	Each winter term	2

Events					
WS 19/20	2161206	Mathematical Methods in Dynamics	2 SWS	Lecture (V)	Proppe
WS 19/20	2161207	Übungen zu Mathematische Methoden der Dynamik	1 SWS	Practice (Ü)	Proppe, Oestringer
Exams					
WS 19/20	76-T-MACH-105293	Mathematical Methods in Dynamics		Prüfung (PR)	Proppe
SS 2020	76-T-MACH-105293	Mathematical Methods in Dynamics		Prüfung (PR)	Proppe

Competence Certificate
written examination, 180 min.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Mathematical Methods in Dynamics — Lecture (V)
2161206, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
Dynamics of continua:
Concept of continuum, geometry of continua, kinematics and kinetics of continua

Dynamics of rigid bodies:
Kinematics and kinetics of rigid bodies

Variational principles:
Priniciple of virtual work, variational calculations, Principle of Hamilto

Approximate solution methods:
Methods of weighted residuals, method of Ritz

Applications

Literature
Vorlesungsskript (erhältlich im Internet)

J.E. Marsden, T.J.R. Hughes: Mathematical foundations of elasticity, New York, Dover, 1994

P. Haupt: Continuum mechanics and theory of materials, Berlin, Heidelberg, 2000

M. Riemer: Technische Kontinuumsmechanik, Mannheim, 1993

K. Willner: Kontinuums- und Kontaktmechanik : synthetische und analytische Darstellung, Berlin, Heidelberg, 2003

J.N. Reddy: Energy Principles and Variational Methods in applied mechanics, New York, 2002

A. Boresi, K.P. Chong, S. Saigal: Approximate solution methods in engineering mechanics, New York, 2003

V

Übungen zu Mathematische Methoden der Dynamik

2161207, WS 19/20, 1 SWS, Language: German, Open in study portal

Practice (Ü)

Content

Excercises related to the lecture

T 3.208 Course: Mathematical Methods in Fluid Mechanics [T-MACH-105295]

Responsible: Prof. Dr.-Ing. Bettina Frohnapfel
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104847 - Major Field Fundamentals of Engineering

Type	Credits	Recurrence	Version
Written examination	6	Each summer term	1

Events					
SS 2020	2154432	Mathematical Methods in Fluid Mechanics	2 SWS	Lecture (V)	Frohnapfel, Gatti
SS 2020	2154433	Tutorial in Mathematical Methods of Fluid Mechanics	1 SWS	Practice (Ü)	Frohnapfel, Gatti, Magagnato
SS 2020	2154540	Mathematical Methods in Fluid Mechanics	SWS	Lecture (V)	Magagnato
Exams					
WS 19/20	76-T-MACH-105295	Mathematical Methods in Fluid Mechanics		Prüfung (PR)	Frohnapfel
SS 2020	76-T-MACH-105295	Mathematical Methods in Fluid Mechanics		Prüfung (PR)	Frohnapfel, Gatti

Competence Certificate
written examination - 3 hours

Prerequisites
none

Recommendation
Basic Knowledge about Fluid Mechanics

Below you will find excerpts from events related to this course:

V Mathematical Methods in Fluid Mechanics

2154432, SS 2020, 2 SWS, Language: German/English, Open in study portal

Lecture (V)

Content
The students can to simplify the Navier-Stokes equations for specific flow problems. They are able to employ mathematical method in fluid mechanics effectively in order to solve the resulting conservation equations analytically, if possible, or to enable simpler numerical access to the problem. They can describe the limits of applicability of the assumptions made to model the flow behavior.

The lecture will cover a selection of the following topics:

- Potential flow theory
- Creeping flows
- Lubrication theory
- Boundary-layer theory
- Laminar-turbulent transition (linear stability theory)
- Turbulent flows
- Numerical solution of the governing equation (finite difference methods)

The students can to simplify the Navier-Stokes equations for specific flow problems. They are able to employ mathematical method in fluid mechanics effectively in order to solve the resulting conservation equations analytically, if possible, or to enable simpler numerical access to the problem. They can describe the limits of applicability of the assumptions made to model the flow behavior.

Literature

Kundu, P.K., Cohen, K.M.: Fluid Mechanics, Elsevier, 4th Edition, 2008

Kuhlmann, H.: Strömungsmechanik, Pearson, 2007

Spurk, J. H.: Strömungslehre, Springer, 2006

Zierep, J., Bühler, K.: Strömungsmechanik, Springer, 1991

Schlichting H., Gersten K., Grenzschichttheorie, Springer, 2006

Kundu, P.K., Cohen, K.M.: Fluid Mechanics, Elsevier, 4th Edition, 2008

Batchelor, G.K.: An Introduction to Fluid Dynamics, Cambridge Mathematical Library, 2000

Pope, S. B.: Turbulent Flows, Cambridge University Press, 2000

Ferziger, H., Peric, M.: Computational Methods for Fluid Dynamics, Springer, 2008

V Tutorial in Mathematical Methods of Fluid Mechanics

Practice (Ü)

2154433, SS 2020, 1 SWS, Language: German, Open in study portal

Content

The exercises will practise the lecture topics:

- Curvilinear coordinates and tensor calculus
- Potential flow theory
- Boundary-layer theory
- Laminar-turbulent transition (linear stability theory)
- Turbulent flows
- Numerical solution of the governing equation (finite difference methods)

Literature

Kuhlmann, H.: Strömungsmechanik, Pearson, 2007

Spurk, J. H.: Strömungslehre, Springer, 2006

Zierep, J., Bühler, K.: Strömungsmechanik, Springer, 1991

Schlichting H., Gersten K., Grenzschichttheorie, Springer, 2006

Oertel,H., Laurien, E.: Numerische Strömungsmechanik, Vieweg Verlag 2003

V Mathematical Methods in Fluid Mechanics

Lecture (V)

2154540, SS 2020, SWS, Language: English, Open in study portal

Content

The students can to simplify the Navier-Stokes equations for specific flow problems. They are able to employ mathematical method in fluid mechanics effectively in order to solve the resulting conservation equations analytically, if possible, or to enable simpler numerical access to the problem. They can describe the limits of applicability of the assumptions made to model the flow behavior.

The lecture will cover a selection of the following topics:

- Potential flow theory
- Creeping flows
- Lubrication theory
- Boundary-layer theory
- Laminar-turbulent transition (linear stability theory)
- Turbulent flows
- Numerical solution of the governing equation (finite difference methods)

The students can to simplify the Navier-Stokes equations for specific flow problems. They are able to employ mathematical method in fluid mechanics effectively in order to solve the resulting conservation equations analytically, if possible, or to enable simpler numerical access to the problem. They can describe the limits of applicability of the assumptions made to model the flow behavior.

T 3.209 Course: Mathematical Methods in Structural Mechanics [T-MACH-105298]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104847 - Major Field Fundamentals of Engineering

Type	Credits	Recurrence	Version
Written examination	5	Each summer term	2

Events					
SS 2020	2162204	Consultation hour Mathematical Methods in Micromechanics	2 SWS	Consultation-hour (Sprechst.)	Karl, Krause

Competence Certificate
written exam (180 min). Additives as announced.

Prerequisites
Passing the tutorial to Mathematical Methods in Structural Mechanics T-MACH-106831

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-106831 - Tutorial Mathematical Methods in Structural Mechanics must have been passed.

Recommendation
This course is geared to MSc students. The contents of the lecture "Mathematical methods in Strength of Materials" are assumed to be known.

T 3.210 Course: Mathematical Methods of Vibration Theory [T-MACH-105294]

Responsible: Prof. Dr.-Ing. Wolfgang Seemann
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104847 - Major Field Fundamentals of Engineering

Type	Credits	Recurrence	Version
Written examination	6	Each summer term	2

Events					
SS 2020	2162241	Mathematical methods of vibration theory	2 SWS	Lecture (V)	Seemann
SS 2020	2162242	Mathematical methods of vibration theory (Tutorial)	2 SWS	Practice (Ü)	Seemann, Burgert
Exams					
WS 19/20	76-T-MACH-105294	Mathematical Methods of Vibration Theory		Prüfung (PR)	Seemann
SS 2020	76-T-MACH-105294	Mathematical Methods of Vibration Theory		Prüfung (PR)	Seemann

Competence Certificate
written examination, 180 min.

Prerequisites
none

Recommendation
Engineering Mechanics III/IV

Below you will find excerpts from events related to this course:

V Mathematical methods of vibration theory

2162241, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Linear, time-invariant, ordinary single differential equations: homogeneous solution; harmonic, periodic and non-periodic excitations; Duhamel's integral; Fourier and Laplace transform; introduction into the theory of distributions; Systems of ordinary differential equations: matrix notation, eigenvalue theory, fundamental matrix, forced vibrations via modal expansion and transition matrix; Introduction into the dynamic stability theory; Partial differential equations: solution in product form, eigenvalue theory, modal expansion using Ritz series; Variational methods, Hamilton's principle, boundary value problems representing vibrating continua; Perturbation methods

Literature
Riemer, Wedig, Wauer: Mathematische Methoden der Technischen Mechanik

V Mathematical methods of vibration theory (Tutorial)

2162242, SS 2020, 2 SWS, Language: German, Open in study portal

Practice (Ü)

Content
Seven tutorials with examples of the contents of the course

Literature
Riemer, Wedig, Wauer: Mathematische Methoden der Technischen Mechanik

T 3.211 Course: Mathematical Models and Methods for Production Systems [T-MACH-105189]

Responsible: Dr.-Ing. Marion Baumann
Prof. Dr.-Ing. Kai Furmans

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104847 - Major Field Fundamentals of Engineering
M-MACH-104878 - Specification in Mechanical Engineering
M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	6	Each winter term	1

Events					
WS 19/20	2117059	Mathematical models and methods for Production Systems	4 SWS	Lecture (V)	Baumann, Furmans
Exams					
WS 19/20	76-T-MACH-105189	Mathematical models and methods for Production Systems		Prüfung (PR)	Furmans

Competence Certificate
The assessment consists of an oral exam (20 min.) taking place in the recess period according to § 4 paragraph 2 Nr. 2 of the examination regulation.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Mathematical models and methods for Production Systems — Lecture (V)
2117059, WS 19/20, 4 SWS, Language: English, Open in study portal

Content
Media:

black board, lecture notes, presentations

Learning Content:

- single server systems: M/M/1, M/G/1: priority rules, model of failures
- networks: open and closed approximations, exact solutions and approximations
- application to flexible manufacturing systems, AGV (automated guided vehicles) - systems
- modeling of control approaches like constant work in process (ConWIP) or kanban
- discrete-time modeling of queuing systems

Learning Goals:

Students are able to:

- Describe queueing systems with analytical solvable stochastic models,
- Derive approches for modeling and controlling material flow and production systems based on models of queueing theory,
- Use simulation and exakt methods.

Recommendations:

- Basic knowledge of statistic
- recommended compusory optional subject: Stochastics
- recommended lecture: Materials flow in logistic systems (also parallel)

Workload:

regular attendance: 42 hours
self-study: 198 hours

Literature
Wolff: Stochastic Modeling and the Theory of Queues, Prentice Hall, 1989
Shanthikumar, Buzacott: Stochastic Models of Manufacturing Systems

T 3.212 Course: Mathematical Models and Methods in Combustion Theory [T-MACH-105419]

Responsible: Dr. Viatcheslav Bykov
Prof. Dr. Ulrich Maas

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2165525	Mathematical models and methods in combustion theory	2 SWS	Lecture (V)	Bykov

Competence Certificate
oral exam (20 min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Mathematical models and methods in combustion theory

Lecture (V)

2165525, WS 19/20, 2 SWS, Language: German, Open in study portal

Literature
Combustion Theory, F A Williams, (2nd Edition), 1985, Benjamin Cummins.

Combustion - Physical and Chemical Fundamentals, Modeling and Simulation, Experiments, Pollutant Formation, J. Warnatz, U. Mass and R. W. Dibble, (3nd Edition), Springer-Verlag, Heidelberg, 2003.

The Mathematical Theory of Combustion and Explosions, Ya.B. Zeldovich, G.I. Barenblatt, V.B. Librovich, G.M. Makhviladze, Springer, New York and London, 1985.

T 3.213 Course: Measurement II [T-MACH-105335]

Responsible: Prof. Dr.-Ing. Christoph Stiller
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104850 - Major Field Mechatronics and Microsystem Technology

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	1

Events					
SS 2020	2138326	Measurement II	2 SWS	Lecture (V)	Stiller, Wirth
Exams					
WS 19/20	76-T-MACH-105335	Measurement II		Prüfung (PR)	Stiller
SS 2020	76-T-MACH-105335	Measurement II		Prüfung (PR)	Stiller

Competence Certificate
written exam

60 min.

2 DIN A4 Self-created formular sheets allowed

Prerequisites
none

Below you will find excerpts from events related to this course:

V Measurement II
2138326, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Lerninhalt (EN)

1. Amplifiers
2. Digital technology
3. Stochastic modeling for measurement applications
4. Estimation
5. Kalman Filter
6. Environmental perception

Lernziele (EN):

The capabilities of modern sensor technology pave the way for novel applications in engineering. Especially digital measurement techniques may be used even in very complex environments and thus have strong impact on technological progress. Stochastic models of measurement processes form the basis for meaningful information processing and provide a valuable tool for engineering. This interdisciplinary lecture addresses students in mechanical engineering and related subjects. The lecture gives an overview of digital technology and stochastics. These areas form the basics of estimation methods that can be embedded elegantly in the theory of state observers. Applications in signal processing for modern environmental perception (video, Lidar, Radar) illustrate the discussed subjects.

Nachweis:

Written exam

60 minutes

Individual sheet of formulas

Arbeitsaufwand:

120 hours

Literature
Skript und Foliensatz zur Veranstaltung werden als kostenlose pdf-Dateien bereitgestellt. Weitere Empfehlungen werden in der Vorlesung bekannt gegeben.

Idealerweise haben Sie zuvor 'Grundlagen der Mess- und Regelungstechnik' gehört oder verfügen aus einer Vorlesung anderer Fakultäten über grundlegende Kenntnisse der Mess- und Regelungstechnik und der Systemtheorie.

T 3.214 Course: Measurement Instrumentation Lab [T-MACH-105300]

Responsible: Sven Richter
Prof. Dr.-Ing. Christoph Stiller

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104850 - Major Field Mechatronics and Microsystem Technology

Type	Credits	Recurrence	Version
Completed coursework	4	Each summer term	1

Events					
SS 2020	2138328	Measurement Instrumentation Lab	2 SWS	Practical course (P)	Stiller, Wang
Exams					
SS 2020	76-T-MACH-105300	Measurement Instrumentation Lab		Prüfung (PR)	Stiller

Competence Certificate
Non graded colloquia

Prerequisites
none

Below you will find excerpts from events related to this course:

V Measurement Instrumentation Lab
2138328, SS 2020, 2 SWS, Language: German, Open in study portal

Practical course (P)

Content
Please consider the bulletin on our website!

A Signal recording

- measurement of temperature
- measurement of lengths

B Signal pre-precessing

- bridge circuits and principles of measurement
- analog/digital transducers

C Signal processing

- measuring stochastic signals

D Complete systems

- system identification
- inverse pendulum
- mobile robot platform

Recommendations:

Basic studies and preliminary examination; basic lectures in automatic control

Arbeitsaufwand: 90 hours

Lernziele (EN):

The laboratory complements the course "Introduction to Measurement and Control". While the course is organized into principles and subsystems, the laboratory presents complete measurement systems and methods for the most relevant industrial measurands.

Literature
Anleitungen auf der Homepage des Instituts erhältlich.

Instructions to the eyperiments are available on the institute's website

T 3.215 Course: Mechanics and Strength of Polymers [T-MACH-105333]

Responsible: Prof. Dr.-Ing. Bernd-Steffen von Bernstorff
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	2

Events					
WS 19/20	2173580	Mechanics and Strengths of Polymers	2 SWS	Lecture (V)	von Bernstorff
Exams					
WS 19/20	76-T-MACH-105333	Mechanics and Strengths of Polymers		Prüfung (PR)	von Bernstorff

Competence Certificate
Oral exam, about 25 minutes

Prerequisites
none

Recommendation
Basic knowledge in materials science (e.g. lecture materials science I and II)

Below you will find excerpts from events related to this course:

V Mechanics and Strengths of Polymers — Lecture (V)

2173580, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
Molecular structure and morphology of polymers, temperature- and time dependency of mechanical behavior, viscoelasticity, time/temperature- superposition principle, yielding, crazing and fracture of polymers, failure criterions, impact and dynamic loading, corresponding principle, tough/brittle-transition, introduction to the principles of fiber reinforcement and multiple cracking in composites

learning objectives:

The students are prepared to

- repeat the calculus on strength and design of engineering parts exposed to complex loadings,
- estimate the influence of time and temperature on the strength of polymeric materials,
- relate the strength of materials to their molecular structure, morphology and processing parameters and
- derive failure mechanisms for homogenuous polymers and composite materials therefrom.

requirements:
basic knowledge in materials science (e.g. lecture materials science I and II)

workload:

The workload for the lecture Mechanics and Strengths of Polymers is 120 h per semester and consists of the presence during the lecture (28 h) as well as preparation and rework time at home (92 h).

Literature
Literaturliste, spezielle Unterlagen und ein Teilmanuskript werden in der Vorlesung ausgegeben

T 3.216 Course: Mechanics in Microtechnology [T-MACH-105334]

Responsible: Dr. Christian Greiner
Dr. Patric Gruber

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104850 - Major Field Mechatronics and Microsystem Technology

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2181710	Mechanics in Microtechnology	2 SWS	Lecture (V)	Gruber, Greiner
Exams					
WS 19/20	76-T-MACH-105334	Mechanics in Microtechnology		Prüfung (PR)	Gruber
WS 19/20	76-T-MACH-105334-W	Mechanics in Microtechnology		Prüfung (PR)	Gruber
SS 2020	76-T-MACH-105334	Mechanics in Microtechnology		Prüfung (PR)	Gruber

Competence Certificate
Oral examination, ca. 30 min

Prerequisites
none

Below you will find excerpts from events related to this course:

V Mechanics in Microtechnology

2181710, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
1. Introduction: Application and Processing of Microsystems
2. Scaling Effects
3. Fundamentals: Stress and Strain, (anisotropic) Hooke's Law
4. Fundamentals: Mechanics of Beams and Membranes
5. Thin Film Mechanics: Origin and Role of Mechanical Stresses
6. Characterization of Mechanical Properties of Thin Films and Small Structures: Measurement of Stresses and Mechnical Parameters such as Young'sModulus and YieldDtrength; Thin Film Adhesion and Stiction
7. Transduction: Piezo-resistivity, Piezo-electric Effect, Elektrostatics,...
8. Aktuation: Inverse Piezo-electric Effect, Shape Memory, Elektromagnetic Actuation,…

The students know and understand size and scaling effects in micro- and nanosystems. They understand the impact of mechanical phenomena in small dimensions. Based on this they can judge how they determine material processing as well as working principles and design of microsensors and microactuators.

regular attendance: 22,5 hours
self-study: 97,5 hours

oral exam ca. 30 minutes

Literature
Folien,
1. M. Ohring: "The Materials Science of Thin Films", Academic Press, 1992
2. L.B. Freund and S. Suresh: "Thin Film Materials"
3. M. Madou: Fundamentals of Microfabrication", CRC Press 1997
4. M. Elwenspoek and R. Wiegerink: "Mechanical Microsensors" Springer Verlag 2000
5. Chang Liu: Foundations of MEMS, Illinois ECE Series, 2006

T 3.217 Course: Mechatronical Systems and Products [T-MACH-105574]

Responsible:	Prof. Dr.-Ing. Sören Hohmann Prof. Dr.-Ing. Sven Matthiesen
Organisation:	KIT Department of Mechanical Engineering
Part of:	M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Written examination	3	Each winter term	3

Events					
WS 19/20	2303003	Tutorial for 2303161 Mechatronical Systems and Products	1 SWS	Practice (Ü)	Schwartz, Hölz
WS 19/20	2303161	Mechatronical Systems and Products	2 SWS	Lecture (V)	Matthiesen, Hohmann
Exams					
WS 19/20	76-T-MACH-105574	Mechatronical Systems and Products		Prüfung (PR)	Matthiesen

Competence Certificate
written examination (duration: 60min)

Prerequisites
Successful participation in the workshop Mechatronic Systems and Products is mandatory for admission to the examination.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-108680 - Workshop Mechatronical Systems and Products must have been passed.

Annotation
All relevant content (scripts, exercise sheets, etc.) for the course can be obtained via the eLearning platform ILIAS. To participate in the course, please complete the survey " Anmeldung und Gruppeneinteilung " in ILIAS before the start of the semester.

T 3.218 Course: Medical Imaging Techniques I [T-ETIT-101930]

Responsible: Prof. Dr. Olaf Dössel
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the Department of Electrical Engineering and Information Technology

Type	Credits	Recurrence	Version
Written examination	3	Each winter term	1

Events					
WS 19/20	2305261	Medical Imaging Techniques I	2 SWS	Lecture (V)	Dössel
Exams					
WS 19/20	7305261	Medical Imaging Techniques I		Prüfung (PR)	Dössel

Competence Certificate
Success control is carried out in the form of a written test of 120 minutes.

Prerequisites
none

T 3.219 Course: Medical Imaging Techniques II [T-ETIT-101931]

Responsible: Prof. Dr. Olaf Dössel
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the Department of Electrical Engineering and Information Technology

Type	Credits	Recurrence	Version
Written examination	3	Each summer term	1

Events					
SS 2020	2305262	Medical Imaging Techniques II	2 SWS	Lecture (V)	Dössel
Exams					
SS 2020	7305262	Medical Imaging Techniques II		Prüfung (PR)	Dössel

Competence Certificate
Success control is carried out in the form of a written test of 120 minutes.

Prerequisites
none

Recommendation
The contents of the M-ETIT-100384 module are required.

T 3.220 Course: Medical Robotics [T-INFO-101357]

Responsible: Prof. Dr.-Ing. Torsten Kröger
Jun.-Prof. Dr. Franziska Mathis-Ullrich

Organisation: KIT Department of Informatics

Part of: M-MACH-104883 - Courses of the Department of Informatics

Type	Credits	Recurrence	Version
Written examination	3	Each summer term	1

Events					
SS 2020	24681	Medical Robotics	2 SWS	Lecture (V)	Mathis-Ullrich
Exams					
WS 19/20	7500129	Medical Robotics		Prüfung (PR)	Mathis-Ullrich

T 3.221 Course: Metal Forming [T-MACH-105177]

Responsible: Dr. Thomas Herlan
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104852 - Major Field Production Technology

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2150681	Metal Forming	2 SWS	Lecture (V)	Herlan
Exams					
WS 19/20	76-T-MACH-105177	Metal Forming		Prüfung (PR)	Herlan
WS 19/20	76-T-MACH-105177-Wdh	Metal Forming - re-examination		Prüfung (PR)	Herlan
SS 2020	76-T-MACH-105177	Metal Forming		Prüfung (PR)	Schulze

Competence Certificate
Oral Exam (20 min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Metal Forming

Lecture (V)

2150681, SS 2020, 2 SWS, Language: German, Open in study portal

Content

At the beginning of the lecture the basics of metal forming are briefly introduced. The focus of the lecture is on massive forming (forging, extrusion, rolling) and sheet forming (car body forming, deep drawing, stretch drawing). This includes the systematic treatment of the appropriate metal forming Machines and the corresponding tool technology. Aspects of tribology, as well as basics in material science and aspects of production planning are also discussed briefly. The plastic theory is presented to the extent necessary in order to present the numerical simulation method and the FEM computation of forming processes or tool design. The lecture will be completed by product samples from the forming technology.

The topics are as follows:

- Introduction and basics
- Hot forming
- Metal forming machines
- Tools
- Metallographic fundamentals
- Plastic theory
- Tribology
- Sheet forming
- Extrusion
- Numerical simulation

Learning Outcomes:

The students …

- are able to reflect the basics, forming processes, tools, Machines and equipment of metal forming in an integrated and systematic way.
- are capable to illustrate the differences between the forming processes, tools, machines and equipment with concrete examples and are qualified to analyze and assess them in terms of their suitability for the particular application.
- are also able to transfer and apply the acquired knowledge to other metal forming problems.

Workload:

regular attendance: 21 hours
self-study: 99 hours

Literature
Medien:
Skript zur Veranstaltung wird über (https://ilias.studium.kit.edu/) bereitgestellt.

Media:
Lecture notes will be provided in Ilias (https://ilias.studium.kit.edu/)

T 3.222 Course: Metallographic Lab Class [T-MACH-105447]

Responsible: Prof. Dr.-Ing. Martin Heilmaier
Fabian Mühl

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Completed coursework	4	Each term	2

Events					
WS 19/20	2175590	Metallographic Lab Class	3 SWS	Practical course (P)	Mühl
SS 2020	2175590	Metallographic Lab Class	3 SWS	Practical course (P)	Mühl
Exams					
WS 19/20	76-T-MACH-105447	Metallographic Lab Class		Prüfung (PR)	Heilmaier

Competence Certificate
Colloquium for every experiment, about 60 minutes, protocol

Prerequisites
none

Below you will find excerpts from events related to this course:

V Metallographic Lab Class

2175590, WS 19/20, 3 SWS, Language: German, Open in study portal

Practical course (P)

Content
Light microscope in metallography

metallographic sections of metallic materials

Investigation of the microstructure of unalloyed steels and cast iron

Microstructure development of steels with accelerated cooling from the austenite area

Investigation of microstructures of alloyed steels

Investigation of failures quantitative microstructural analysis

Microstructural investigation of technically relevant non-ferrous metals

Application of Scanning electron microscope

learning objectives:
The students in this lab class gain are able to perform standard metallographic preparations and are able to apply standard software for quantitative microstructural analyses. Based on this the student can interpret unetched as well as etched microstructures with respect to relevant microstructural features. They can draw concluding correlations between heat treatments, ensuing microstructures and the resulting mechanical as well as physical properties of the investigated materials.

requirements:
Material Science I/II

workload:

The workload for the Metallographic Lab Class is 120 h per semester and consists of the presence during the lab course (25 h) as well as preparation and rework time at home (95 h).

Literature
Macherauch, E.: Praktikum in Werkstoffkunde, 10. Aufl., 1992

Schumann, H.: Metallographie, 13. Aufl., Deutscher Verlag für Grundstoffindustrie, 1991

Literaturliste wird zu jedem Versuch ausgegeben

V Metallographic Lab Class

2175590, SS 2020, 3 SWS, Language: German, Open in study portal

Practical course (P)

Content

learning objectives:

requirements:

workload:

Literature
Macherauch, E.: Praktikum in Werkstoffkunde, 10. Aufl., 1992

Schumann, H.: Metallographie, 13. Aufl., Deutscher Verlag für Grundstoffindustrie, 1991

Literaturliste wird zu jedem Versuch ausgegeben

T 3.223 Course: Metals [T-MACH-105468]

Responsible: Prof. Dr.-Ing. Martin Heilmaier
Prof. Dr. Astrid Pundt

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Oral examination	6	Each summer term	1

Events					
SS 2020	2174598	Metals	4 SWS	Lecture (V)	Pundt, Kauffmann, Lang
SS 2020	2174599	Übungen zur Vorlesung "Metalle"	1 SWS	Practice (Ü)	Pundt, Heilmaier, Kauffmann
Exams					
WS 19/20	76-T-MACH-105468	Metals		Prüfung (PR)	Heilmaier, Pundt
SS 2020	76-T-MACH-105468	Metals		Prüfung (PR)	Heilmaier

Competence Certificate
Oral exam, about 20 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Metals

2174598, SS 2020, 4 SWS, Language: German, Open in study portal

Lecture (V)

Content
Properties of pure elements; thermodynamic foundations of single-component and of binary systems, as well as multiphase systems; nucleation and growth; diffusion processes in crystalline materials; phase diagrams; effects of alloying; nonequilibrium microstructures; heat treatment technology

learning objectives:
The students are familiar with the thermodynamic foundations of phase transformations, the kinetics of phase transformations in the solid state, the mechanisms of microstructure formation and microstructure-property relationships and can apply them to metallic materials. They can assess the effects of heat treatments and of alloying on the microstructure and the mechanicla and physical properties of metallic materials. This competence is in particular deepened for iron- and aluminum-based alloys.
requirements:
Materials physics
workload:

Regular attendance: 42 h

Self-study: 138 h

Literature

D.A. Porter, K. Easterling, Phase Transformation in Metals and Alloys, 2nd edition, Chapman & Hall, London 1997,

G. Gottstein. Physikalische Grundlagen der Materialkunde, Springer 2007

E. Hornbogen, H. Warlimont, Metalle (Struktur und Eigenschaften von Metallen und Legierungen), Springer-Verlag, Berlin 2001

H.-J. Bargel, G. Schulze, Werkstoffkunde, Springer-Verlag Berlin 2005

J. Rösler, H. Harders, M. Bäker, Mechanisches Verhalten der Werkstoffe, Vieweg+Teubner Wiesbaden, 2008

J. Freudenberger: http://www.ifw-dresden.de/institutes/imw/lectures/lectures/pwe

V **Übungen zur Vorlesung "Metalle"** **Practice (Ü)**
2174599, SS 2020, 1 SWS, Language: German, Open in study portal

Content
Properties of pure elements; thermodynamic foundations of single-component and of binary systems, as well as multiphase systems; nucleation and growth; diffusion processes in crystalline materials; phase diagrams; effects of alloying; nonequilibrium microstructures; heat treatment technology

learning objectives:
The Students have hands-on experience in the application of thermodynamic foundations of phase transformations, the kinetics of phase transformations in the solid state, the mechanisms of microstructure formation and microstructure-property relationships. They can assess the effects of heat treatments and of alloying on the microstructure and the mechanicla and physical properties of metallic materials. This competence is in particular practiced for iron- and aluminum-based alloys.
requirements:
Materials physics
workload:

Regular attendance: 14 h

Self-study: 16 h

Literature
G. Gottstein: „Materialwissenschaft und Werkstofftechnik: Physikalische Grundlagen“, Springer (2014)
http://dx.doi.org/10.1007/978-3-642-36603-1 (frei über die KIT-Lizenz abrufbar)
J. Freudenberger: „Skript zur Vorlesung Physikalische Werkstoffeigenschaften“, IFW Dresden (2004)
http://www.ifw-dresden.de/institutes/imw/lectures/pwe
P. Haasen: „Physikalische Metallkunde“, Cambridge University Press (2003)
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC309606810
R.W. Cahn, P. Haasen (Editoren): „Physical Metallurgy“, Serie, North Holland (1996)
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC052463656
D. A. Porter, K. Easterling: „Phase Transformation in Metals and Alloys“, Chapman & Hall (2009)
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC27759961X
E. Hornbogen, H. Warlimont: „Metalle: Struktur und Eigenschaften von Metallen und Legierungen“, Springer (2016)
http://dx.doi.org/10.1007/978-3-662-47952-0 (frei über die KIT-Lizenz abrufbar)
E. Hornbogen, G. Eggeler, E. Werner: „Werkstoffe: Aufbau und Eigenschaften von Keramik-, Metall-, Polymer- und Verbundwerkstoffen“, Springer (2012)
http://dx.doi.org/10.1007/978-3-642-22561-1 (frei über die KIT-Lizenz abrufbar)
H.-J. Bargel, G. Schulze: „Werkstoffkunde“, Springer (2012)
http://dx.doi.org/10.1007/978-3-642-17717-0 (frei über die KIT-Lizenz abrufbar)
J. Rösler, H. Harders, M. Bäker: „Mechanisches Verhalten der Werkstoffe“, Springer Vieweg (2016)
http://dx.doi.org/10.1007/978-3-658-13795-3 (frei über die KIT-Lizenz abrufbar)

T 3.224 Course: Methods and Processes of PGE - Product Generation Development [T-MACH-109192]

Responsible: Prof. Dr.-Ing. Albert Albers
Prof. Dr.-Ing. Norbert Burkardt
Prof. Dr.-Ing. Sven Matthiesen

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104847 - Major Field Fundamentals of Engineering

Type	Credits	Recurrence	Version
Written examination	6	Each summer term	1

Events					
SS 2020	2146176	Methods and processes of PGE - Product Generation Development	4 SWS	Lecture (V)	Albers
Exams					
WS 19/20	76-T-MACH-105382	Methods and Processes of PGE - Product Generation Engineering		Prüfung (PR)	Albers, Burkardt
WS 19/20	76-T-MACH-105382-en	Methods and Processes of PGE - Product Generation Engineering		Prüfung (PR)	Albers

Competence Certificate
Written exam (processing time: 120 min + 10 min reading time)

Auxiliaries:

- Calculator
- German dictionary (books only)

Prerequisites
None

Annotation
This lecture is the basis for the main subject Integrated Product Development, which is offered as a specialisation.

Below you will find excerpts from events related to this course:

V Methods and processes of PGE - Product Generation Development

Lecture (V)

2146176, SS 2020, 4 SWS, Language: German, Open in study portal

Content
Note:

This lecture is the basis for the main subject Integrated Product Development, which is offered as a specialisation.

Recommendations:

none

Workload:

regular attendance: 39 h

self-study: 141 h

Examination:

Written exam

Duration: 120 minutes (+10 minutes reading time)

Auxiliaries:

- Calculator
- German dictionary (books only)

Course content:

Basics of Product Development: Basic Terms, Classification of the Product
Development into the industrial environment, generation of costs / responsibility for costs
Concept Development: List of demands / Abstraction of the Problem Definition / Creativity Techniques / Evaluation and selection of solutions
Drafting : Prevailing basic rules of Design / Design Principles as a
problem oriented accessory
Rationalization within the Product Development: Basics of Development
Management/ Simultaneous Engineering and Integrated Product Development/Development of Product
Lines and Modular Construction Systems
Quality Assurance in early Development Phases : Methods of Quality Assurance
in an overview/QFD/FMEA

Learning objectives:

The students are able to ...

- classify product development in companies and differentiate between different types of product development.
- name the relevant influencing factors of a market for product development.
- name, compare and use the central methods and process models of product development within moderate complex technical systems.
- explain problem solving techniques and associated development methods.
- explain product profiles and to differentiate and choose suitable creative techniques of solution/idea generation finding on this basis.
- use design guidelines to create simple technical systems and to explain these guidelines.
- name and compare quality assurance methods; to choose and use suitable methods for particular applications.
- explain the differents methods of design of experiment.
- explain the costs in development process.

Literature

Vorlesungsunterlagen
Pahl, Beitz: Konstruktionslehre, Springer-Verlag 1997
Hering, Triemel, Blank: Qualitätssicherung für Ingenieure; VDI-Verlag,1993

T 3.225 Course: Methods of Signal Processing [T-ETIT-100694]

Responsible: Prof. Dr.-Ing. Fernando Puente Leon
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the Department of Electrical Engineering and Information Technology

Type	Credits	Recurrence	Version
Written examination	6	Each winter term	1

Events					
WS 19/20	2302113	Methods of Signal Processing	2 SWS	Lecture (V)	Puente Leon
WS 19/20	2302115	Methods of Signal Processing (Tutorial to 2302113)	1+1 SWS	Practice (Ü)	Puente Leon, Schwär
Exams					
WS 19/20	7302113	Methods of Signal Processing		Prüfung (PR)	Puente Leon

Prerequisites
none

T 3.226 Course: Micro- and Nanosystem Integration for Medical, Fluidic and Optical Applications [T-MACH-108809]

Responsible: Dr. Ulrich Gengenbach
Dr. Liane Koker
PD Dr.-Ing. Ingo Sieber

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2105032	Micro- and nanosystem integration for medical, fluidic and optical applications	2 SWS	Lecture (V)	Koker, Gengenbach, Sieber
Exams					
WS 19/20	76-T-MACH-108809	Micro- and nanosystem integration for medical, fluidic and optical applications		Prüfung (PR)	Gengenbach, Koker

Competence Certificate
Oral exam (Duration: 30min)

Prerequisites
T-MACH-105695 "Selected topics of system integration for micro- and nanotechnology" must not be started.

Below you will find excerpts from events related to this course:

V Micro- and nanosystem integration for medical, fluidic and optical applications

Lecture (V)

2105032, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
Content:

- Introduction to the role of system integration in the product development process
- Simplistic modeling and use of analogies in system design
- Introduction to modeling and simulation in system design
- Mechanics simulation
- Optics simulation
- Fluidics simulation
- Coupling of simulation tools
- Requirements for system integration of active implants
- Design of active implants
- Approaches to system integration of active implants
- Test methods (hermeticity, accelerated aging etc.)
- Micro-optical subsystems
- Micro-fluidic subsystems
- Self-assembly as integration process at micro and nano scale

Learning objectives:

The students …:

- have a fundamental understanding of modeling using analogies
- know the basics of modeling and simulation in design of mechanical, optical, and fluidic subsystems
- can assess the need for inter-domain simulations
- understand the challenges in the design of active implants
- have an overview of different active implants and their applications
- know approaches to system integration and packaging of active implants
- are familiar with different methods of testing with the focus on hermeticity
- have an overview of processes for the integration of micro-optical and micro-fluidic subsystems
- gain insight into technical applications of self-assembly processes

T 3.227 Course: Micro Magnetic Resonannce [T-MACH-105782]

Responsible: Prof. Dr. Jan Gerrit Korvink
Dr. Neil MacKinnon

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104878 - Specification in Mechanical Engineering
M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Completed coursework	4	Each winter term	1

Events					
WS 19/20	2141501	Micro Magnetic Resonance	2 SWS	Seminar (S)	MacKinnon, Badilita, Jouda, Korvink
Exams					
WS 19/20	76-T-MACH-105782	Micro Magnetic Resonannce		Prüfung (PR)	Korvink, MacKinnon

Competence Certificate
Own Presentation, participation at the course discussions, result is passed or failed.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Micro Magnetic Resonance

Seminar (S)

2141501, WS 19/20, 2 SWS, Language: English, Open in study portal

T 3.228 Course: Microactuators [T-MACH-101910]

Responsible: Prof. Dr. Manfred Kohl
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104850 - Major Field Mechatronics and Microsystem Technology

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	2

Events					
SS 2020	2142881	Microactuators	2 SWS	Lecture (V)	Kohl
Exams					
WS 19/20	76-T-MACH-101910	Microactuators		Prüfung (PR)	Kohl

Competence Certificate
written exam, 60 min.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Microactuators
2142881, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
- Basic knowledge in the material science of the actuation principles
- Layout and design optimization
- Fabrication technologies
- Selected developments
- Applications

The lecture includes amongst others the following topics:

- Microelectromechnical systems: linear actuators, microrelais, micromotors
- Medical technology and life sciences: Microvalves, micropumps, microfluidic systems
- Microrobotics: Microgrippers, polymer actuators (smart muscle)
- Information technology: Optical switches, mirror systems, read/write heads

Literature
- Folienskript "Mikroaktorik"
- D. Jendritza, Technischer Einsatz Neuer Aktoren: Grundlagen, Werkstoffe, Designregeln und Anwendungsbeispiele, Expert-Verlag, 3. Auflage, 2008
- M. Kohl, Shape Memory Microactuators, M. Kohl, Springer-Verlag Berlin, 2004
- N.TR. Nguyen, S.T. Wereley, Fundamentals and applications of Microfluidics, Artech House, Inc. 2002
- H. Zappe, Fundamentals of Micro-Optics, Cambride University Press 2010

T 3.229 Course: Microenergy Technologies [T-MACH-105557]

Responsible: Prof. Dr. Manfred Kohl
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104878 - Specification in Mechanical Engineering
M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2142897	Microenergy Technologies	2 SWS	Lecture (V)	Kohl
Exams					
WS 19/20	76-T-MACH-105557	Microenergy Technologies		Prüfung (PR)	Kohl

Competence Certificate
Oral examination (30 Min.)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Microenergy Technologies
2142897, SS 2020, 2 SWS, Language: English, Open in study portal

Lecture (V)

Content
- Basic physical principles of energy conversion
- Layout and design optimization
- Technologies
- Selected devices
- Applications

The lecture includes amongst others the following topics:

Micro energy harvesting of vibrations

Thermal micro energy harvesting

Microtechnical applications of energy harvesting

Heat pumps in micro technology

Micro cooling

Literature
- Folienskript "Micro Energy Technologies"
- Stephen Beeby, Neil White, Energy Harvesting for Autonomous Systems, Artech House, 2010
- Shashank Priya, Daniel J. Inman, Energy Harvesting Technologies, Springer, 2009

T 3.230 Course: Microsystem Simulation [T-MACH-108383]

Responsible: Prof. Dr. Jan Gerrit Korvink
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	1

Events					
SS 2020	2142875	Microsystem Simulation	3 SWS	Lecture / Practice (VÜ)	Korvink

Competence Certificate
written exam

Prerequisites
none

Below you will find excerpts from events related to this course:

V Microsystem Simulation

Lecture / Practice (VÜ)

2142875, SS 2020, 3 SWS, Language: English, Open in study portal

Content
Microsystems are multiphysical devices. For example, in order to measure infrared radiation, a microsystem might use the Seebeck (thermoelectric) effect, which couples heat to electrical currents – thus radiation, heat flow, and charge transport are coupled in a multiphysical manner.

Because microsystemcomponents are very small (in the micrometre range), often the operational modalities will be described better bystatistical mechanics or evenquantum mechanics, so that we have to take caution to use the right models.

In many cases, commercial tools are unavailable, so that engineers are forcedbuild their own simulation programs to be able to make intelligent designs.

In this lecture you will learn the fundamentals needed to build such a computer program. Because we want to be very efficient in learning, and not re-invent all the wheels or confront computer science issues such as compilation and libraries, you will learn to build your program in the higher level programming environment Mathematica ®.

This lecture consists of the following 12 topics, one presented each week of semester:

1. The Act of Modelling
2. Mathematica Introduction
3. Equation Types
4. Approximation and Integration
5. Differentiation and Finite Differences
6. Geometry and Meshing
7. Weighted Residual Methods
8. Finite Element Method
9. Numerical Solving
10. Computational Post-processing
11. Program Structure
12. Commercial Programs

Attendees will first learn how to approach the modelling process. Afterwards, they will learn the fundamental numerical mathematics techniques with which to form numerical simulation models, which in turn will lead to computational programs. The lecture offers one hour of exercises where students can consult the lecturers on the topics of the lecture. Students are offered numerous learning goals per chapter, to simplify the attendence of lectures.

Students are expected to work with the program Mathematica ® to complete their exercises. It provides a symbolical and numerical environment, and offers high level graphics for ease of programming. All programming exercises will be in Mathematica ®, so as to speed up the learning process.

The written examination questions draw from the examples provided during the lecture (recorded on the slides and on the black board during class) as well as from the exercises.

Literature
The following references are usedby the lecturers to prepare the lecture.Students are not required to access most of these, but of course it does not hurt! Hints for efficient further reading, depending on interest, will be provided during the lecture.

- E. Buckingham, On physically similar systems: illustrations on the use of dimensional equations, Phys. Rev. 4, 345–376 (1914)
- E. Buckingham, Model Experiments and the Forms of Empirical Equations, ASME 263–296 (1915)
- K. Eriksson, D. Estep, P. Hansbo, C. Johnson, Computational Differential Equations, Cambridge University Press, Cambridge (1996)
- Bengt Fornberg, Calculation of Weights in Finite Difference Formulas, SIAM Rev. 40(3) 1998
- Gene H. Golub, Charles F. van Loan, Matrix Computations, John Hopkins University Press 1996
- H. Hanche-Olsen, Buckingham's pi-theorem, Internet (2004)
- Arieh Iserles, A First Course in the Numerical Analysis of Differential Equations, Cambridge University Press, Cambridge (1996)
- Mathematica Help Documentation
- N. Metropolis, A.W. Rosenbluth, M.N. Rosenbluth. A.H. Teller and E. Teller, "Equation of State Calculations by Fast Computing Machines, J. Chem. Phys. 21 (1953) 1087-1092.
- Rick Beatson and Leslie Greengard, A short course on fast multipole methods

T 3.231 Course: Mobile Machines [T-MACH-105168]

Responsible: Prof. Dr.-Ing. Marcus Geimer
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Oral examination	8	Each summer term	1

Events					
SS 2020	2114073	Mobile Machines	4 SWS	Lecture (V)	Geimer, Lehr
Exams					
WS 19/20	76T-MACH-105168	Mobile Machines		Prüfung (PR)	Geimer
WS 19/20	76-T-MACH-105168	Mobile Machines		Prüfung (PR)	Geimer
SS 2020	76T-MACH-105168	Mobile Machines		Prüfung (PR)	Geimer
SS 2020	76-T-MACH-105168	Mobile Machines		Prüfung (PR)	Geimer

Competence Certificate
The assessment consists of an oral exam (45 min) taking place in the recess period. The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Prerequisites
none

Recommendation
Knowledge in Fluid Power Systems is required. It is recommended to attend the course *Fluid Power Systems* [2114093] beforehand.

Annotation
After completion of the course the students have knowledge of:

- a wide range of mobile machines
- operation modes and working cycles of importmant mobile machines
- selected subsystems and components

Content:

- Introduction of the required components and machines
- Basics and structure of mobile machines
- Practical insight in the development techniques

Below you will find excerpts from events related to this course:

V Mobile Machines

Lecture (V)

2114073, SS 2020, 4 SWS, Language: German, Open in study portal

Content

- Introduction of the required components and machines
- Basics of the structure of the whole system
- Practical insight in the development techniques

Knowledge in Fluid Power is required.

Recommendations:

It is recommended to attend the course *Fluid Power Systems* [2114093] beforehand.

- regular attendance: 42 hours
- self-study: 184 hours

T 3.232 Course: Modeling and Simulation [T-MACH-105297]

Responsible: Prof. Dr.-Ing. Kai Furmans
Prof. Dr.-Ing. Marcus Geimer
Dr. Balazs Pritz
Prof. Dr.-Ing. Carsten Proppe

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104847 - Major Field Fundamentals of Engineering

Type	Credits	Recurrence	Version
Written examination	7	Each winter term	1

Events					
WS 19/20	2185227	Modelling and Simulation	2 SWS	Lecture (V)	Proppe, Furmans, Pritz, Geimer
WS 19/20	2185228	Übungen zu Modellbildung und Simulation	2 SWS	Practice (Ü)	Proppe, Bykov, Pritz, Völker, Furmans, Bolender, Fischer
Exams					
WS 19/20	76-T-MACH-105297	Modeling and Simulation		Prüfung (PR)	Furmans, Geimer, Proppe

Competence Certificate
The assessment consists of a 180 minutes written examination.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Modelling and Simulation

2185227, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Introduction: Overview, concept formation, simulation studies, time/event-discrete models, event-oriented/process orientated/ transaction-oriented view, typical model classes (operation/maintenance, storekeeping, loss-susceptible systems)

Time-continuous models with concentrated parameters, model characteristics and model analysis Numerical treatment of ordinary differential equations and differential-algebraic sets of equations coupled simulations with concentrated parameters

Time-continuous models with distributed parameters, description of systems by means of partial differential equations, model reduction, numerical solution procedures for partial differential equations

Literature
Keine.

3.233 Course: Modeling of Thermodynamical Processes [T-MACH-105396]

Responsible: Prof. Dr. Ulrich Maas
Dr.-Ing. Robert Schießl

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104853 - Major Field Theoretical Foundations of Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	6	Each term	1

Events					
WS 19/20	2167523	Modeling of Thermodynamical Processes	3 SWS	Lecture (V)	Schießl, Maas
SS 2020	2167523	Modeling of Thermodynamical Processes	3 SWS	Lecture (V)	Maas, Schießl
Exams					
WS 19/20	76-T-MACH-105396	Modeling of Thermodynamical Processes		Prüfung (PR)	Maas
SS 2020	76-T-MACH-105396	Modeling of Thermodynamical Processes		Prüfung (PR)	Maas

Competence Certificate
Oral exam (30 min)

Prerequisites
none

Below you will find excerpts from events related to this course:

Modeling of Thermodynamical Processes
2167523, WS 19/20, 3 SWS, Language: German, Open in study portal

Lecture (V)

Literature
Vorlesungsskript

Numerical Recipes C, FORTRAN; Cambridge University Press
R.W. Hamming; Numerical Methods for scientists and engineers; Dover Books On Engineering; 2nd edition; 1973

J. Kopitz, W. Polifke; Wärmeübertragung; Pearson Studium; 1. Auflage

Modeling of Thermodynamical Processes
2167523, SS 2020, 3 SWS, Language: German, Open in study portal

Lecture (V)

Content
Thermodynamic basics
Numerical solver strategies for algebraic equations
Optimization issues
Ordinary and partial differential equations
Application to various problems in thermodynamics (engine processes, determination of equilibrium states, unsteady processes in inhomogeneous systems)

Literature
Vorlesungsskript

Numerical Recipes C, FORTRAN; Cambridge University Press
R.W. Hamming; Numerical Methods for scientists and engineers; Dover Books On Engineering; 2nd edition; 1973

J. Kopitz, W. Polifke; Wärmeübertragung; Pearson Studium; 1. Auflage

T 3.234 Course: Modeling of Turbulent Flows - RANS and LES [T-BGU-110842]

Responsible: Prof. Dr.-Ing. Markus Uhlmann
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-MACH-105405 - Courses of the Department of Civil Engineering, Geo and Environmental Sciences

Type	Credits	Recurrence	Expansion	Version
Oral examination	6	Each term	1 terms	1

Competence Certificate
oral exam, appr. 45 min.

Prerequisites
none

Recommendation
none

Annotation
none

T 3.235 Course: Modelling and Simulation [T-MACH-100300]

Responsible: Prof. Dr. Peter Gumbsch
Prof. Dr. Britta Nestler

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Written examination	5	Each term	2

Events					
WS 19/20	2183703	Numerical methods and simulation techniques	3 SWS	Lecture / Practice (VÜ)	Nestler
SS 2020	2183703	Modelling and Simulation	2+1 SWS	Lecture / Practice (VÜ)	Nestler
Exams					
WS 19/20	76-T-MACH-100300	Modelling and Simulation		Prüfung (PR)	Nestler

Competence Certificate
Written exam, 90 min

Prerequisites
none

Recommendation
preliminary knowlegde in mathematics, physics and materials science

Below you will find excerpts from events related to this course:

V Numerical methods and simulation techniques

2183703, WS 19/20, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Content
The course gives an introduction to modelling and simulation techniques.
The following topics are included:
- splines, interpolation methods, Taylor series
- finite difference method
- dynamical systems
- numerics of partial differential equations
- mass and heat diffusion
- microstructure simulation
- parallel and adaptive algorithms
- high performance computing
- practical exercises

The student can

- explain the basic algorithms and numerical methods which are beside other applications relevant for materials simulations.
- describe and apply numerical solution methods for partial differential equations and dynamical systems
- apply numerical methods to solve heat and mass diffusion problems which can also be used to model microstructure formation processes
- has experiences in how to implement and program the introduced numerical methods from an integrated computer lab.

preliminary knowlegde in mathematics, physics and materials science recommended

regular attendance: 22,5 hours lecture, 11,5 hours exercises
self-study: 116 hours

We regularly hand out exercise sheets. In addition, the course will be accompanied by practical exercises at the computer.

written examination: 90 minutes

Literature

1. Scientific Computing, G. Golub and J.M. Ortega (B.G.Teubner Stuttgart 1996)

V **Modelling and Simulation** **Lecture / Practice (VÜ)**
2183703, SS 2020, 2+1 SWS, Language: German, Open in study portal

Content
The course gives an introduction to modelling and simulation techniques.
The following topics are included:
- splines, interpolation methods, Taylor series
- finite difference method
- dynamical systems
- numerics of partial differential equations
- mass and heat diffusion
- microstructure simulation
- parallel and adaptive algorithms
- high performance computing
- practical exercises

The student can

- explain the basic algorithms and numerical methods which are beside other applications relevant for materials simulations.
- describe and apply numerical solution methods for partial differential equations and dynamical systems
- apply numerical methods to solve heat and mass diffusion problems which can also be used to model microstructure formation processes
- has experiences in how to implement and program the introduced numerical methods from an integrated computer lab.

preliminary knowlegde in mathematics, physics and materials science recommended

regular attendance: 22,5 hours lecture, 11,5 hours exercises
self-study: 116 hours

We regularly hand out exercise sheets. In addition, the course will be accompanied by practical exercises at the computer.

written examination: 90 minutes

Literature

1. Scientific Computing, G. Golub and J.M. Ortega (B.G.Teubner Stuttgart 1996)

T 3.236 Course: Modelling of Microstructures [T-MACH-105303]

Responsible: Dr. Anastasia August
Prof. Dr. Britta Nestler

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Oral examination	5	Each winter term	2

Events					
WS 19/20	2183702	Modelling of Microstructures	3 SWS	Lecture / Practice (VÜ)	August, Nestler
Exams					
WS 19/20	76-T-MACH-105303	Modelling of Microstructures		Prüfung (PR)	August, Nestler, Weygand

Competence Certificate
oral exam 30 min

Prerequisites
none

Recommendation
materials science
fundamental mathematics

Below you will find excerpts from events related to this course:

V Modelling of Microstructures

2183702, WS 19/20, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Content

- Brief Introduction in thermodynamics
- Statistical interpretation of entropy
- Gibbs free energy and phase diagrams
- Free energy functional
- Phasefield equation
- Gibbs-Thomson-equation
- Driving forces
- Grand chemical potential functional and the evolution equations
- For compare: Free energy functional with driving forces

The student can

- explain the thermodynamic and statistical foundations for liquid-solid and solid-solid phase transition processes and apply them to construct phase diagrams.
- describe the specific characteristics of dendritic, eutectic and peritectic microstructures.
- explain the mechanisms of grain and phase boundary motion induced by external fields
- use the phase-field method for simulation of microstructure formation processes using modeling approaches and challenges of current research
- has experiences in computing and conduction simulations of microstructure formation from an integrated computer lab.

knowledge in materials science and in fundamental mathematics recommended

regular attendance: 22,5 hours lecture, 11,5 hours exercises
self-study: 116 hours

We regularly hand out exercise sheets. The individual solutions will be corrected.

oral exam ca. 30 min

Literature

1. Gottstein, G. (2007) Physikalische Grundlagen der Materialkunde. Springer Verlag Berlin Heidelberg
2. Kurz, W. and Fischer, D. (1998) Fundamentals of Solidification. Trans Tech Publications ltd, Switzerland Germany UK USA
3. Porter, D.A. Eastering, K.E. and Sherif, M.Y. (2009) Phase transformation in metals and alloys (third edition). CRC Press, Taylor & Francis Group, Boca Raton, London, New York
4. Gaskell, D.R., Introduction to the thermodynamics of materials
5. Übungsblätter

T 3.237 Course: Modern Control Concepts I [T-MACH-105539]

Responsible: apl. Prof. Dr. Lutz Groell
PD Dr.-Ing. Jörg Matthes

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104850 - Major Field Mechatronics and Microsystem Technology

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	1

Events					
SS 2020	2105024	Modern Control Concepts I	2 SWS	Lecture (V)	Matthes, Groell
Exams					
WS 19/20	76-T-MACH-105539	Modern Control Concepts I		Prüfung (PR)	Matthes

Competence Certificate
Written exam (Duration: 1 h)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Modern Control Concepts I

2105024, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Literature

- Aström, K.-J., Murray, R.M.: Feedback Systems, 2012
- Rugh, W.: Linear System Theory. Prentice Hall, 1996

T 3.238 Course: Motor Vehicle Labor [T-MACH-105222]

Responsible: Dr.-Ing. Michael Frey
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Written examination	4	Each term	3

Events					
WS 19/20	2115808	Motor Vehicle Laboratory	2 SWS	Practical course (P)	Frey, Knoch
SS 2020	2115808	Motor Vehicle Laboratory	2 SWS	Practical course (P)	Frey
Exams					
WS 19/20	76-T-MACH-105222	Motor Vehicle Laboratory		Prüfung (PR)	Frey, Unrau

Competence Certificate
Colloquium before each experiment

After completion of the experiments: written examination

Duration: 90 minutes

Auxiliary means: none

Prerequisites
none

Below you will find excerpts from events related to this course:

V Motor Vehicle Laboratory
2115808, WS 19/20, 2 SWS, Language: German, Open in study portal

Practical course (P)

Content
1. Determination of the driving resistances of a passenger vehicle on a roller dynamometer; measurement of the engine performance of the test vehicle

2. Investigation of a twin-tube and a single-tube shock absorber

3. Behavior of car tyres under longitudinal forces and lateral forces

4. Investigation of acoustic behaviour of vehicles

5. Rolling resistance, energy dissipation and high-speed strength of car tires

6. Investigation of the moment transient characteristic of a Visco clutch

Learning Objectives:

The students have deepened their knowledge on motor vehicles acquired in lectures and can apply it practically. They have an overview of the applied measuring technique and can execute and analyse measurements for the handling of given problem definitions. They are ready to analyze and to judge measurement results.

Literature
1. Matschinsky, W: Radführungen der Straßenfahrzeuge, Verlag TÜV Rheinland, 1998

2. Reimpell, J.: Fahrwerktechnik: Fahrzeugmechanik, Vogel Verlag, 1992

3. Gnadler, R.: Versuchsunterlagen zum Kraftfahrzeuglaboratorium

V

Motor Vehicle Laboratory

2115808, SS 2020, 2 SWS, Language: German, Open in study portal

Practical course (P)

Content

1. Determination of the driving resistances of a passenger vehicle on a roller dynamometer; measurement of the engine performance of the test vehicle

2. Investigation of a twin-tube and a single-tube shock absorber

3. Behavior of car tyres under longitudinal forces and lateral forces

4. Behavior of car tires on wet road surface

5. Rolling resistance, energy dissipation and high-speed strength of car tires

6. Investigation of the moment transient characteristic of a Visco clutch

Learning Objectives:

The students have deepened their knowledge on motor vehicles acquired in lectures and can apply it practically. They have an overview of the applied measuring technique and can execute and analyse measurements for the handling of given problem definitions. They are ready to analyze and to judge measurement results.

Literature

1. Matschinsky, W: Radführungen der Straßenfahrzeuge, Verlag TÜV Rheinland, 1998

2. Reimpell, J.: Fahrwerktechnik: Fahrzeugmechanik, Vogel Verlag, 1992

3. Gnadler, R.: Versuchsunterlagen zum Kraftfahrzeuglaboratorium

T 3.239 Course: Multi-Scale Plasticity [T-MACH-105516]

Responsible: Dr. Christian Greiner
Dr. Katrin Schulz

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Examination of another type	4	Each winter term	2

Events					
WS 19/20	2181750	Multi-scale Plasticity	2 SWS	Lecture (V)	Schulz, Greiner
Exams					
WS 19/20	76-T-MACH-105516	Multi-Scale Plasticity		Prüfung (PR)	Schulz, Greiner
SS 2020	76-T-MACH-105516	Multi-Scale Plasticity		Prüfung (PR)	Schulz

Competence Certificate
presentation (40%) und colloquium (30 min, 60%)

Prerequisites
none

Recommendation
preliminary knowlegde in mathematics, physics, mechanics and materials science

Annotation

- limited number of participants
- mandatory registration
- mandatory attendance

Below you will find excerpts from events related to this course:

V Multi-scale Plasticity

2181750, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
This module will attempt to provide an overview to complex subjects in the field of material mechanics. For this purpose important scientific papers will be presented and discussed.
This will be done by having students read and critique one paper each week in a short review. In addition, each week will include presentation from one of the participants which aim to advocate or criticise each piece of work using the short reviews. He will also be the discussion leader, while students discuss the content, ideas, evaluation and open research questions of the paper. Using a professional conference management system (HotCRP), the student assume the role of reviewers and gain insight into the work of researchers.

The student

- can explain the physical foundations of plasticity as well as results of latest research.
- can independently read and evaluate scientific research papers.
- can present specific, technical information in structured, precise, and readable manner.
- is able to argue for and/or against a particular approach or idea using the knowledge acquired within the lecture.

preliminary knowlegde in mathematics, physics, mechanics and materials science recommended

regular attendance: 22,5 hours
self-study: 97,5 hours

Exam: presentation (40%), oral examination (30 min, 60%)

The maximum number of students is 14 per semester.

T 3.240 Course: Nanotechnology for Engineers and Natural Scientists [T-MACH-105180]

Responsible: Prof. Dr. Martin Dienwiebel
PD Dr. Hendrik Hölscher
Stefan Walheim

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104850 - Major Field Mechatronics and Microsystem Technology

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	1

Events					
SS 2020	2142861	Nanotechnology for Engineers and Natural Scientists	2 SWS	Lecture (V)	Hölscher, Dienwiebel
Exams					
WS 19/20	76-T-MACH-105180	Nanotechnology for Engineers and Natural Scientists		Prüfung (PR)	Hölscher, Dienwiebel

Competence Certificate
written exam 90 min

Prerequisites
none

Below you will find excerpts from events related to this course:

V Nanotechnology for Engineers and Natural Scientists

Lecture (V)

2142861, SS 2020, 2 SWS, Language: German, Open in study portal

Content
1) Introduction into nanotechnology
2) History of scanning probe techniques
3) Scanning tunneling microscopy (STM)
4) Atomic force microscopy (AFM)
5) Dynamic Modes (DFM, ncAFM, MFM, KPFM, ...)
6) Friction force microscopy & nanotribology
7) Nanolithography
8) Other families of the SPM family

The student can

- explain the most common measurement principles of nanotechnology especialy scanning probe methods and is able to use them for the characterisation of chemical and physical properties of surfaces
- decribe interatomic forces and their influence on nanotechnology
- describe methods of micro- and nanofabrication and of –nanolithography
- explain simple models used in contact mechanics and nanotribology
- describe basic concepts used for nanoscale components

preliminary knowlegde in mathematics and physics

The successfull attandence of the lecture is controlled by a 30 minutes oral exam.

Literature
Alle Folien und Originalliteratur werden auf ILIAS zur Verfügung gestellt.

T 3.241 Course: Neurovascular Interventions (BioMEMS V) [T-MACH-106747]

Responsible: Dr.-Ing. Giorgio Cattaneo
Prof. Dr. Andreas Guber

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2141103	BioMEMS V - Microfuidic Chip Systems	2 SWS	Lecture (V)	Rajabi, Guber
Exams					
WS 19/20	76-T-MACH-106747	BioMEMS V - New Methods in Biomedical Diagnostics and Basic Research		Prüfung (PR)	Guber

Competence Certificate
oral exam (30 Min.)

Prerequisites
none

T 3.242 Course: Neutron Physics of Fusion Reactors [T-MACH-105435]

Responsible: Dr. Ulrich Fischer
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2189473	Neutron physics of fusion reactors	2 SWS	Lecture (V)	Fischer
Exams					
WS 19/20	76-T-MACH-105435	Neutron physics of fusion reactors		Prüfung (PR)	Stieglitz
SS 2020	76-T-MACH-105435	Neutron Physics of Fusion Reactors		Prüfung (PR)	Stieglitz, Fischer

Competence Certificate
oral exam of about 30 minutes

Prerequisites
none

Annotation
none

Below you will find excerpts from events related to this course:

V Neutron physics of fusion reactors

2189473, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Nuclear interaction processes and energy release
Chain reaction and criticality
Neutron transport, Boltzmann equation
Diffusion approximation, Monte Carlo method
Neutronic reactor design

The aim of this lecture is to provide the neutron physics principles required for analysis of nuclear fission and fusion reactors. First of all, the basic nuclear interaction processes are presented which are important for the physical behaviour of the reactors. Next the neutron transport phenomenon in matter is described by means of the Boltzmann transport equation. Suitable mathematical solution methods are presented such as the diffusion approximation for nuclear fission reactors and the Monte Carlo method for fusion reactors. The knowledge acquired will eventually be used to solve neutron physics problems related to the design and optimization of the reactors.

oral exam, duration: approximately 30 minutes, no tools or reference materials may be used during the exam

regular attendance: 21 h
self-study: 42 h

Admission to Campus North is required, please register to attend the lecture at: il-sekretariat@inr.kit.edu

Literature
K. H. Beckurts, K. Wirtz, Neutron Physics, Springer Verlag, Berlin, Germany (1964)

W. M. Stacey, Nuclear Reactor Physics, John Wiley & Sons, Wiley-VCH, Berlin(2007)

J. Raeder (Ed.), Kontrollierte Kernfusion. Grundlagen ihrer Nutzung zur Energieversorgung, Teubner, Stuttgart (1981)

T 3.243 Course: NMR micro probe hardware conception and construction [T-MACH-108407]

Responsible: Prof. Dr. Jan Gerrit Korvink
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Completed coursework	4	Each summer term	1

Events					
SS 2020	2142551	NMR micro probe hardware conception and construction	2 SWS	Practical course (P)	Korvink, Jouda

Competence Certificate
Successful participation.

Prerequisites
none

Below you will find excerpts from events related to this course:

V NMR micro probe hardware conception and construction

2142551, SS 2020, 2 SWS, Language: English, Open in study portal

Practical course (P)

Content
In order to prepare attendees, the following chapters will be offered, spread over the week as lecture units, and accompanying the practical work:

- Theory of magnetic resonance imaging

-The MRI probe and the principle of reciprocity

- RF resonators

- Coaxial cables and cable traps

- Tuning and matching the MRI probe

- Effects of material susceptibility

- The mechanical support of the MRI probe

- Introduction to ParaVision, the MRI imaging software.

T 3.244 Course: Nonlinear Continuum Mechanics [T-MACH-105532]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104878 - Specification in Mechanical Engineering
M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	5	Each summer term	2

Events					
SS 2020	2162344	Nonlinear Continuum Mechanics	2 SWS	Lecture (V)	Böhlke
Exams					
WS 19/20	76-T-MACH-105532	Nonlinear Continuum Mechanics		Prüfung (PR)	Böhlke

Competence Certificate
oral examination (approx. 25 min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Nonlinear Continuum Mechanics

2162344, SS 2020, 2 SWS, Language: English, Open in study portal

Lecture (V)

Content

- tensor calculus, kinematics, balance equations
- principles of material theory
- finite elasticity
- infinitesimal elasto(visco)plasticity
- exact solutions ov infinitesimal Platicity
- finite elasto(visco)plasticity
- infinitesimal and finite crystal(visco)plasticity
- hardening and failure
- strain localization

Literature

- Vorlesungsskript
- Bertram, A.: Elasticity and Plasticity of Large Deformations - an Introduction. Springer 2005.
- Liu, I-S.: Continuum Mechanics. Springer 2002.
- Schade, H.: Tensoranalysis.Walter de Gruyter 1997.
- Wriggers, P.: Nichtlineare Finite-Element-Methoden. Springer 2001.

T 3.245 Course: Novel Actuators and Sensors [T-MACH-102152]

Responsible: Prof. Dr. Manfred Kohl
Dr. Martin Sommer

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104850 - Major Field Mechatronics and Microsystem Technology

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	3

Events					
WS 19/20	2141865	Novel actuators and sensors	2 SWS	Lecture (V)	Kohl, Sommer
Exams					
WS 19/20	76-T-MACH-102152	Novel Actuators and Sensors		Prüfung (PR)	Kohl, Sommer

Competence Certificate
written exam, 60 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Novel actuators and sensors

2141865, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Literature

- Vorlesungsskript "Neue Aktoren" und Folienskript "Sensoren"
- Donald J. Leo, Engineering Analysis of Smart Material Systems, John Wiley & Sons, Inc., 2007
- "Sensors Update", Edited by H.Baltes, W. Göpel, J. Hesse, VCH, 1996, ISBN: 3-527-29432-5
- "Multivariate Datenanalyse – Methodik und Anwendungen in der Chemie", R. Henrion, G. Henrion, Springer 1994, ISBN 3-540-58188-X

T 3.246 Course: Nuclear Fusion Technology [T-MACH-110331]

Responsible: Dr. Aurelian Florin Badea
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Expansion	Version
Oral examination	4	1 terms	1

Events					
WS 19/20	2189920	Nuclear Fusion Technology	2 SWS	Lecture (V)	Badea
Exams					
WS 19/20	76-T-MACH-110331	Nuclear Fusion Technology		Prüfung (PR)	Badea

Competence Certificate
oral exam, approx. 20 min.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Nuclear Fusion Technology

Lecture (V)

2189920, WS 19/20, 2 SWS, Language: English, Open in study portal

Content
This lecture is dedicated to Master students of mechanical engineering and other engineering studies. Goal of the lecture is the understanding of the physics of fusion, the components of a fusion reactor and their functions. The technological requirements for using fusion technology for future commercial production of electricity and the related environmental impact are also addressed. The students are capable of giving technical assessment of the usage of the fusion energy with respect to its safety and sustainability. The students are qualified for further training in fusion energy field and for research-related professional activity.

- nuclear fission & fusion
- neutronics for fusion
- fuel cycles, cross sections
- gravitational, magnetic and inertial confinement
- fusion experimental devices
- energy balance for fusion systems; Lawson criterion and Q-factor
- materials for fusion reactors
- plasma physics, confinement
- plasma heating
- timeline of the fusion technology
- ITER, DEMO
- safety and waste management

T 3.247 Course: Nuclear Power and Reactor Technology [T-MACH-110332]

Responsible: Dr. Aurelian Florin Badea
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Expansion	Version
Oral examination	4	1 terms	1

Events					
WS 19/20	2189921	Nuclear Power and Reactor Technology	3 SWS	Lecture (V)	Badea
Exams					
WS 19/20	76-T-MACH-110332	Nuclear Power and Reactor Technology		Prüfung (PR)	Badea

Competence Certificate
oral exam, approx. 20 min.

Prerequisites
None

Below you will find excerpts from events related to this course:

V Nuclear Power and Reactor Technology — Lecture (V)

2189921, WS 19/20, 3 SWS, Language: English, Open in study portal

Content
This lecture is dedicated to Master students of mechanical engineering and other engineering studies. Goal of the lecture is the understanding of reactor technology and of the major physical processes in converting nuclear power into electrical energy. The students acquire comprehensive knowledge on the physics of nuclear fission reactors: neutron flux, cross sections, fission, breeding processes, chain reaction, critical size of a nuclear system, moderation, reactor dynamics, transport- and diffusion-equation for the neutron flux distribution, power density distributions in reactor, one-group, two-group and multi-group theories for the neutron spectrum. Students are able to analyze and understand the obtained results. The students are capable of understanding the advantages and disadvantages of different reactor technologies - LWR, heavy water reactors, nuclear power systems of generation IV -by using the delivered knowledge on reactor physics, thermal-hydraulics, reactor design, control, safety and requirements of the front-end and back-end of the fuel cycle. The students are qualified for further training in nuclear energy and safety field and for (also research-related) professional activity in the nuclear industry.

- nuclear fission & fusion,
- radioactive decay, neutron excess, fission, fast and thermal neutrons, fissile and fertile nuclei, enrichment, neutron flux, cross section, reaction rate, mean free path,
- chain reaction, critical size, moderation,
- reactor dynamics,
- transport- and diffusion-equation for the neutron flux distribution,
- power distributions in reactor,
- one-group and two-group theories,
- light-water reactors,
- reactor safety,
- design of nuclear reactors,
- breeding processes,
- nuclear power systems of generation IV

T 3.248 Course: Nuclear Power Plant Technology [T-MACH-105402]

Responsible: Dr. Aurelian Florin Badea
Prof. Dr.-Ing. Xu Cheng
Prof. Dr.-Ing. Thomas Schulenberg

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104878 - Specification in Mechanical Engineering
M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2170460	Nuclear Power Plant Technology	2 SWS	Lecture (V)	Cheng, Schulenberg

Competence Certificate
oral exam, Duration: approximately 30 minutes

no tools or reference materials may be used during the exam

Prerequisites
none

Below you will find excerpts from events related to this course:

V Nuclear Power Plant Technology

2170460, SS 2020, 2 SWS, Language: English, Open in study portal

Lecture (V)

Content
The training objective of the course is the qualification for a research-related professional activity in nuclear power plant engineering. The participants can describe the most important components of nuclear power plants and their function. You can design or modify nuclear power plants independently and creatively. They have acquired a broad knowledge of this power plant technology, including specific knowledge of core design, design of primary and secondary systems, and of nuclear safety technologies. Based on the acquired knowledge in thermodynamics and neutron physics, they can describe and analyze the specific behavior of the nuclear power plant components and assess risks. Participants of the lecture have a trained analytical thinking and judgment in the design of nuclear power plants.

Power plants with pressurized water reactors:

Design of the pressurized water reactor

- Fuel assemblies
- Control rods and drives
- Core instrumentation
- Reactor pressure vessel and its internals

Components of the primary system

- Primary coolant pumps
- Pressurizer
- Steam generator
- Water make-up system

Secondary system:

- Turbines
- Reheater
- Feedwater system
- Cooling systems

Containment

- Containment design
- Components of safety systems
- Components of residual heat removal systems

Control of a nuclear power plant with PWR

Power plants with boiling water reactors:

Design of the boiling water reactor

- Fuel assemblies
- Control elements and drives
- Reactor pressure vessel and its internals

Containment and components of safety systems

Control of a nuclear power plant with boiling water reactors

Literature
Vorlesungsmanuskript

T 3.249 Course: Numerical Fluid Mechanics [T-MACH-105338]

Responsible: Dr.-Ing. Franco Magagnato
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	2

Events					
WS 19/20	2153441	Numerical Fluid Mechanics	2 SWS	Lecture (V)	Magagnato
Exams					
WS 19/20	76T-Mach-105338	Numerical Fluid Mechanics		Prüfung (PR)	Frohnapfel, Magagnato

Competence Certificate
oral exam - 30 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Numerical Fluid Mechanics
2153441, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
The students can describe the modern numerical simulation methods for fluid flows and can explain their relevance for industrial projects. They can choose appropriate boundary and initial conditions as well as turbulence models. They are qualified to explain the meaning of suitable meshes for processed examples. Convergence acceleration techniques like multi grid, implicit methods etc. as well as the applicability of these methods to parallel and vector computing can be described by the students. They can identify problems that occur during application of these methods and can discuss strategies to avoid them. The students are qualified to apply commercial codes like Fluent, Star-CD, CFX etc. as well as the research code SPARC. They can describe the differences between conventional methods (RANS) and more advanced approaches like Large Eddy Simulation (LES) and Direct Numerical Simulation (DNS).

1. Governing Equations of Fluid Dynamics
2. Discretization
3. Boundary and Initial conditions
4. Turbulence Modelling
5. Mesh Generation
6. Numerical Methods
7. LES, DNS and Lattice Gas Methods
8. Pre- and Postprocessing
9. Examples of Numerical Methods for Industrial Applications

Literature
Ferziger, Peric: Computational Methods for Fluid Dynamics. Springer-Verlag, 1999.
Hirsch: Numerical Computation of Internal and External Flows. John Wiley & Sons Inc., 1997.
Versteg, Malalasekera: An introduction to computational fluid dynamics. The finite volume method. John Wiley & Sons Inc., 1995

T 3.250 Course: Numerical Fluid Mechanics with PYTHON [T-MACH-110838]

Responsible: Prof. Dr.-Ing. Bettina Frohnapfel
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Completed coursework	4	Each summer term	1

Events					
SS 2020	2154405	Numerical Fluid Mechanics with Python	2 SWS	Practical course (P)	Gatti, Frohnapfel
Exams					
SS 2020	76-T-MACH-110838	Numerical Fluid Mechanics with Python		Prüfung (PR)	Frohnapfel, Gatti

Competence Certificate
ungraded homework

Prerequisites
none

Below you will find excerpts from events related to this course:

V Numerical Fluid Mechanics with Python

2154405, SS 2020, 2 SWS, Language: German, Open in study portal

Practical course (P)

Content
Numerical Fluid Mechanics with Phyton

- Introduction to Numerics and Matlab
- Finite-Difference-Method
- Finite-Volume-Method
- boundary conditions and intial conditions
- explicit and implicite schemes
- pressure correction
- Solving the Navier-Stokes equation numerically for 2D flow problems

Literature
H. Ferziger, M. Peric, *Numerische Strömungsmechanik*, Springer-Verlag, ISBN: 978-3-540-68228-8, 2008

E. Laurien, H. Oertel jr, *Numerische Strömungsmechanik*, Vieweg+Teubner Verlag, ISBN: 973-3-8348-0533-1, 2009

T 3.251 Course: Numerical Mathematics for Students of Computer Science [T-MATH-102242]

Responsible: Prof. Dr. Andreas Rieder
Dr. Daniel Weiß
Prof. Dr. Christian Wieners

Organisation: KIT Department of Mathematics

Part of: M-MACH-104885 - Courses of the Department of Mathematics

Type	Credits	Recurrence	Version
Written examination	6	Each term	3

Events					
SS 2020	0187400	Numerische Mathematik für die Fachrichtungen Informatik und Ingenieurwesen	2 SWS	Lecture (V)	Weiß
SS 2020	0187500	Übungen zu 0187400	1 SWS	Practice (Ü)	Weiß
Exams					
WS 19/20	6700011	Numerical Mathematics for Students of Computer Science		Prüfung (PR)	Weiß

Prerequisites
None

T 3.252 Course: Numerical Mechanics for Industrial Applications [T-MACH-108720]

Responsible: Prof. Dr. Eckart Schnack
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104853 - Major Field Theoretical Foundations of Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2162298	Numerical mechanics for industrial applications	3 SWS	Lecture (V)	Schnack
Exams					
SS 2020	76-T-MACH-108720	Numerical Mechanics for Industrial Applications		Prüfung (PR)	

Competence Certificate
Oral exam, 20 minutes

Prerequisites
None

Below you will find excerpts from events related to this course:

V Numerical mechanics for industrial applications

2162298, SS 2020, 3 SWS, Language: German, Open in study portal

Lecture (V)

Content
Brief overview of finite element methods. Structure of boundary element methods (BEM). Explanation of hybrid tension methods. Higher-grade finite element processes. Non-linear FEM processes.

Literature
Brebbia, C.A.; Telles, J.C.F.; Wrobel, L.C.: Boundary element techniques - Theory and applications in engineering. Berlin, Springer, 1984.

Gaul, L.; Fiedler, C.: Methode der Randelemente in Statik und Dynamik. Braunschweig und Wiesbaden. Vieweg, 1997.

Reddy, J.N.: An introduction to the finite element method. New York (u.a.). McGraw-Hill, 1993.

T 3.253 Course: Numerical Simulation of Multi-Phase Flows [T-MACH-105420]

Responsible: Dr. Martin Wörner
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104853 - Major Field Theoretical Foundations of Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2130934	Numerical Modeling of Multiphase Flows	2 SWS	Lecture (V)	Wörner
Exams					
WS 19/20	76-T-MACH-105420	Numerical Simulation of Multi-Phase Flows		Prüfung (PR)	Frohnapfel
SS 2020	76-T-MACH-105420	Numerical Simulation of Multi-Phase Flows		Prüfung (PR)	Frohnapfel

Competence Certificate
oral exam 30 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Numerical Modeling of Multiphase Flows

2130934, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content

1. Introduction in the subject of multi-phase flows (terms and definitions, examples)
2. Physical fundamentals (dimensionless numbers, phenomenology of single bubbles, conditions at fluid interfaces, forces on a suspended particle)
3. Mathematical fundamentals (governing equations, averaging, closure problem)
4. Numerical fundamentals (discretization in space and time, truncation error and numerical diffusion)
5. Models for interpenetrating continua (homogeneous model, algebraic slip model, standard two-fluid model and its extensions)
6. Euler-Lagrange model (particle equation of motion, particle response time, one-/two-/four-way coupling)
7. Interface resolving methods (volume-of-fluid, level-set and front-capturing method)

Literature
Ein englischsprachiges Kurzskriptum kann unter http://bibliothek.fzk.de/zb/berichte/FZKA6932.pdf heruntergeladen werden.

Die Powerpoint-Folien werden nach jeder Vorlesung im ILIAS-System zum Herunterladen bereitgestellt.

Eine Liste mit Buchempfehlungen wird in der ersten Vorlesungsstunde ausgegeben.

T 3.254 Course: Numerical Simulation of Turbulent Flows [T-MACH-105397]

Responsible: Dr. Günther Grötzbach
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2153449	Numerical Simulation of Turbulent Flows	3 SWS	Lecture (V)	Grötzbach

Competence Certificate
oral

Duration: 30 minutes

no auxiliary means

Prerequisites
none

Recommendation
Basics in fluid mechanics

Below you will find excerpts from events related to this course:

V Numerical Simulation of Turbulent Flows

2153449, WS 19/20, 3 SWS, Language: German, Open in study portal

Lecture (V)

Content
The students are qualified to describe the fundamentals of direct numerical simulation (DNS) and large eddy simulation (LES) of turbulent flows. They understand the principle differences between these simulation methods and the respective properties of the conventional turbulence modelling approaches basing on Reynolds Averaged Navier-Stokes equations (RANS). They can describe subgrid scale models, peculiarities of wall and inlet/outlet modelling, suitable numerical solution schemes and evaluation methods. They have obtained the knowledge and understanding required to identify the best modelling approach (among the available methods) for the problem at hand, thus being able to solve given thermal and fluid dynamical problems appropriately.

The lecture series will introduce in following subjects of the turbulence simulation method:

- Appearance of turbulence and deduction of requirements and limits of the simulation method.
- Conservation equations for flows with heat transfer, filtering them in time or space.
- Some subgrid scale models for small scale turbulence and their physical justification.
- Peculiarities in applying boundary and initial conditions.
- Suitable numerical schemes for integration in space and time.
- Statistical and graphical methods to analyse the simulation results.
- Application examples for turbulence simulations in research and engineering

Literature
J. Piquet, *Turbulent Flows – Models and Physics,* Springer, Berlin (2001)

J. Fröhlich, *Large Eddy Simulation turbulenter Strömungen.* Lehrbuch Maschinenbau, B.G. Teubner Verlag, Wiesbaden (2006)

P. Sagaut, C. Meneveau, *Large-eddy simulation for incompressible flows: An introduction.* Springer Verlag (2010)

G. Grötzbach, *Revisiting the Resolution Requirements for Turbulence Simulations in Nuclear Heat Transfer.* Nuclear Engineering & Design Vol. 241 (2011) pp. 4379-4390

G. Grötzbach,Script in English

T 3.255 Course: Occupational Safety and Environmental Protection [T-MACH-105386]

Responsible: Rainer von Kiparski
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104852 - Major Field Production Technology

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2110037	Occupational Safety and Environmental Protection	2 SWS		von Kiparski
Exams					
SS 2020	76-T-MACH-105386	Occupational Safety and Environmental Protection		Prüfung (PR)	Deml, von Kiparski

Competence Certificate
oral exam (approx. 30 min)

The exam is offered in German only!

Prerequisites
none

Below you will find excerpts from events related to this course:

V Occupational Safety and Environmental Protection
2110037, SS 2020, 2 SWS, Language: German, Open in study portal

Content
The participants have to solve a specific case study within the field of occupational safety and environmental protection. Therefore, they work in a team. The course work covers the information research as well as the presentation of the results.

Content:

- Occupational Safety and Safety Engineering
- Environmental Protection within a Production Enterprise
- Health Management

Structure:

- Terminology
- Basics of Occupational Safety and Environmental Protection
- Case Study
- Moderated Processing of a Case Stuy within a Small Group

Literature
Das Skript und Literaturhinweise stehen auf ILIAS zum Download zur Verfügung.

T 3.256 Course: Organ Support Systems [T-MACH-105228]

Responsible: Prof. Dr. Christian Pylatiuk
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104850 - Major Field Mechatronics and Microsystem Technology

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	1

Events					
SS 2020	2106008	Organ support systems	2 SWS	Lecture (V)	Pylatiuk
Exams					
WS 19/20	76-T-MACH-105228	Organ Support Systems		Prüfung (PR)	Pylatiuk

Competence Certificate
Written examination (Duration: 45min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Organ support systems
2106008, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Content:

- Introduction: Definitions and classification of organ support and replacement.
- Special topics: acoustic and visual prostheses, exoskeletons, neuroprostheses, tissue-engineering, hemodialysis, heart-lung machine, artificial hearts, biomaterials.

Learning objectives:

Students have fundamental knowledge about functionality of organ support systems and its components. An analysis of historical developments can be done and limitations of current systems can be found. The limits and possibilities of transplantations can be elaborated.

Literature

- Jürgen Werner: Kooperative und autonome Systeme der Medizintechnik: Funktionswiederherstellung und Organersatz. Oldenbourg Verlag.
- Rüdiger Kramme: Medizintechnik: Verfahren - Systeme – Informationsverarbeitung. Springer Verlag.
- E. Wintermantel, Suk-Woo Ha: Medizintechnik. Springer Verlag.

T 3.257 Course: Patent Law [T-INFO-101310]

Responsible: Prof. Dr. Thomas Dreier
Organisation: KIT Department of Informatics
Part of: M-MACH-104883 - Courses of the Department of Informatics

Type	Credits	Recurrence	Version
Written examination	3	Each summer term	2

Events					
SS 2020	24656	Patent Law	2 SWS	Lecture (V)	Koch
Exams					
WS 19/20	7500001	Patent Law		Prüfung (PR)	Dreier, Matz
SS 2020	7500062	Patent Law		Prüfung (PR)	Dreier, Matz

T 3.258 Course: Photovoltaics [T-ETIT-101939]

Responsible: Prof. Dr.-Ing. Michael Powalla
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the Department of Electrical Engineering and Information Technology

Type	Credits	Recurrence	Version
Written examination	6	Each summer term	2

Events					
SS 2020	2313737	Photovoltaics	4 SWS	Lecture (V)	Powalla, Lemmer
Exams					
WS 19/20	7313737	Photovoltaics		Prüfung (PR)	Powalla, Lemmer

Prerequisites
"M-ETIT-100524 - Solar Energy" must not have started.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-ETIT-100774 - Solar Energy must not have been started.

T 3.259 Course: Physical and Chemical Principles of Nuclear Energy in View of Reactor Accidents and Back-End of Nuclear Fuel Cycle [T-MACH-105537]

Responsible: apl. Prof. Dr. Ron Dagan

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	3

Events					
WS 19/20	2189906	Physical and chemical principles of nuclear energy in view of reactor accidents and back-end of nuclear fuel cycle	1 SWS	Lecture (V)	Dagan
Exams					
WS 19/20	76-T-MACH-105537	Physical and Chemical Principles of Nuclear Energy in View of Reactor Accidents and Back-End of Nuclear Fuel Cycle		Prüfung (PR)	Dagan, Stieglitz
SS 2020	76-T-MACH-105537	Physical and Chemical Principles of Nuclear Energy in View of Reactor Accidents and Back-End of Nuclear Fuel Cycle		Prüfung (PR)	Dagan

Competence Certificate
oral exam, 30 min.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Physical and chemical principles of nuclear energy in view of reactor accidents and back-end of nuclear fuel cycle

Lecture (V)

2189906, WS 19/20, 1 SWS, Language: German, Open in study portal

Content

- Relevant physical terms of nuclear physics
- Decay heat removal- Borst-Wheeler equation
- The accidents in TMI- Three Mile Island, and Fukushima .
- Fission , chain reaction and reactor control systems
- Basics of nuclear cross sections
- Principles of reactor dynamics
- Reactor poisoning
- The Idaho and Chernobyl accidents
- Principles of the nuclear fuel cycle
- Reprocessing of irradiated fuel elements and vitrification of fission product solutions
- Interim storage of nuclear residues in surface facilities
- Multi barrier concepts for final disposal in deep geological formations
- The situation in the repositories Asse II, Konrad and Morsleben

The students

- understand the physical explanations of the known nuclear accidents
- can perform simplified calculations to demonstrate the accidents outcome.
- Define safety relevant properties of low/ intermediate / high level waste products
- Are able to evaluate principles and implications of reprocessing, storage and disposal options for nuclear waste.

Regular attendance: 14 h
self study 46 h
oral exam about 20 min.

Literature

AEA öffentliche Dokumentation zu den nukleare Ereignissen
K. Wirtz: Grundlagen der Reaktortechnik Teil I, II, Technische Hochschule Karlsruhe 1966
D. Emendorfer. K.H. Höcker: Theorie der Kernreaktoren, Teil I, II BI- Hochschultaschenbücher 1969
J. Duderstadt and L. Hamilton: Nuclear reactor Analysis, J. Wiley $ Sons , Inc. 1975 (in Englisch)
R.C. Ewing: The nuclear fuel cycle: a role for mineralogy and geochemistry. Elements vol. 2, p.331-339, 2006 (in Englisch)
J. Bruno, R.C. Ewing: Spent nuclear fuel. Elements vol. 2, p.343-349, 2006 (in Englisch)

T 3.260 Course: Physical Basics of Laser Technology [T-MACH-102102]

Responsible: Dr.-Ing. Johannes Schneider
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Oral examination	5	Each winter term	3

Events					
WS 19/20	2181612	Physical basics of laser technology	3 SWS	Lecture / Practice (VÜ)	Schneider
Exams					
WS 19/20	76-T-MACH-102102	Physical Basics of Laser Technology		Prüfung (PR)	Schneider
SS 2020	76-T-MACH-102102	Physical Basics of Laser Technology		Prüfung (PR)	Schneider

Competence Certificate
oral examination (30 min)

no tools or reference materials

Prerequisites
It is not possible, to combine this brick with brick Laser Application in Automotive Engineering [T-MACH-105164] and brick Physical Basics of Laser Technology [T-MACH-109084]

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105164 - Laser in Automotive Engineering must not have been started.

Recommendation
Basic knowledge of physics, chemistry and material science

Below you will find excerpts from events related to this course:

V Physical basics of laser technology
2181612, WS 19/20, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Content
Based on the description of the physical basics about the formation and the properties of laser light the lecture goes through the different types of laser beam sources used in industry these days. The lecture focuses on the usage of lasers especially in materials engineering. Other areas like measurement technology or medical applications are also mentioned. An excursion to the laser laboratory of the Institute for Applied Materials (IAM) will be offered.

- physical basics of laser technology
- laser beam sources (solid state, diode, gas, liquid and other lasers)
- beam properties, guiding and shaping
- lasers in materials processing
- lasers in measurement technology
- lasers for medical applications
- savety aspects

The lecture is complemented by a tutorial.

The student

- can explain the principles of light generation, the conditions for light amplification as well as the basic structure and function of different laser sources.
- can describe the influence of laser, material and process parameters for the most important methods of laser-based materials processing and choose laser sources suitable for specific applications.
- can illustrate the possible applications of laser sources in measurement and medicine technology
- can explain the requirements for safe handling of laser radiation and for the design of safe laser systems.

Basic knowledge of physics, chemistry and material science is assumed.

regular attendance: 33,5 hours
self-study: 116,5 hours

The assessment consists of an oral exam (ca. 30 min) taking place at the agreed date (according to Section 4(2), 2 of the examination regulation). The re-examination is offered upon agreement.

It is allowed to select only one of the lectures "Laser in automotive engineering" (2182642) or "Physical basics of laser technology" (2181612) during the Bachelor and Master studies.

Literature
F. K. Kneubühl, M. W. Sigrist: Laser, 2008, Vieweg+Teubner

T. Graf: Laser - Grundlagen der Laserstrahlquellen, 2009, Vieweg-Teubner Verlag

R. Poprawe: Lasertechnik für die Fertigung, 2005, Springer

H. Hügel, T. Graf: Laser in der Fertigung, 2009, Vieweg+Teubner

J. Eichler, H.-J. Eichler: Laser - Bauformen, Strahlführung, Anwendungen, 2006, Springer

W. T. Silfvast: Laser Fundamentals, 2008, Cambridge University Press

W. M. Steen: Laser Material Processing, 2010, Springer

T 3.261 Course: Polymer Engineering I [T-MACH-102137]

Responsible: Prof. Dr.-Ing. Peter Elsner
Dr.-Ing. Wilfried Liebig

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2173590	Polymer Engineering I	2 SWS	Lecture (V)	Elsner, Liebig
Exams					
WS 19/20	76-T-MACH-102137	Polymer Engineering I		Prüfung (PR)	Elsner
SS 2020	76-T-MACH-102137	Polymer Engineering I		Prüfung (PR)	Elsner, Liebig

Competence Certificate
Oral exam, about 25 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Polymer Engineering I

2173590, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
1. Economical aspects of polymers
2. Introductiom of mechanical,
chemical end electrical properties
3. Processing of polymers
(introduction)
4. Material science of polymers
5. Synthesis

learning objectives:

The field of Polymer Engineering includes synthesis, material science, processing, construction, design, tool engineering, production technology, surface engineering and recycling. The aim is, to equip the students with knowledge and technical skills, and to use the material "polymer" meeting its requirements in an economical and ecological way.

The students

- are able to describe and classify polymers
  based on the fundamental synthesis processing techniques
- can find practical applications for state-of-the-art polymers and manufacturing technologies
- are able to apply the processing techniques, the application of polymers and polymer composites regarding to the basic principles of material science
- can describe the special mechanical, chemical and elctrical prooperties of polymers and correlate these properties to the chemical bindings.
- can define application areas and the limitation in the use of polymers

requirements:
none

workload:

regular attendance: 21 hours
self-study: 99 hours

Literature
Literaturhinweise, Unterlagen und Teilmanuskript werden in der Vorlesung ausgegeben.

T 3.262 Course: Polymer Engineering II [T-MACH-102138]

Responsible: Prof. Dr.-Ing. Peter Elsner
Dr.-Ing. Wilfried Liebig

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2174596	Polymer Engineering II	2 SWS	Lecture (V)	Elsner, Liebig
Exams					
WS 19/20	76-T-MACH-102138	Polymerengineering II		Prüfung (PR)	Elsner
SS 2020	76-T-MACH-102138	Polymerengineering II		Prüfung (PR)	Elsner, Liebig

Competence Certificate
Oral exam, about 25 minutes

Prerequisites
none

Recommendation
Knowledge in Polymerengineering I

Below you will find excerpts from events related to this course:

V Polymer Engineering II

Lecture (V)

2174596, SS 2020, 2 SWS, Language: German, Open in study portal

Content
1. Processing of polymers
2. Properties of polymer components
Based on practical examples and components
2.1 Selection of material
2.2 Component design
2.3 Tool engineering
2.4 Production technology
2.5 Surface engineering
2.6 Sustainability, recycling

learning objectives:

The field of Polymer Engineering includes synthesis, material science, processing, construction, design, tool engineering, production technology, surface engineering and recycling. The aim is, that the students gather knowledge and technical skills to use the material "polymer" meeting its requirements in an economical and ecological way.

The students

- can describe and classify different processing techniques
  and can exemplify mould design principles based on technical parts.
- know about practical applications and processing of polymer parts
- are able to design polymer parts according to given restrictions
- can choose appropriate polymers based on the technical requirements
- can decide how to use polymers regarding the production, economical and ecological requirements

requirements:
Polymerengineering I
workload:

The workload for the lecture Polymerengineering II is 120 h per semester and consists of the presence during the lecture (21 h) as well as preparation and rework time at home (99 h).

Literature
Literaturhinweise, Unterlagen und Teilmanuskript werden in der Vorlesung ausgegeben.

Recommended literature and selected official lecture notes are provided in the lecture.

T 3.263 Course: Polymers in MEMS A: Chemistry, Synthesis and Applications [T-MACH-102192]

Responsible: Dr.-Ing. Bastian Rapp
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104850 - Major Field Mechatronics and Microsystem Technology
M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2141853	Polymers in MEMS A: Chemistry, Synthesis and Applications	2 SWS		Rapp
Exams					
WS 19/20	76-T-MACH-102192	Polymers in MEMS A: Chemistry, Synthesis and Applications		Prüfung (PR)	Rapp, Worgull

Competence Certificate
Oral examination

Prerequisites
none

Below you will find excerpts from events related to this course:

V Polymers in MEMS A: Chemistry, Synthesis and Applications
2141853, WS 19/20, 2 SWS, Language: German, Open in study portal

T 3.264 Course: Polymers in MEMS B: Physics, Microstructuring and Applications [T-MACH-102191]

Responsible: Dr.-Ing. Matthias Worgull
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104850 - Major Field Mechatronics and Microsystem Technology
M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2141854	Polymers in MEMS B: Physics, Microstructuring and Applications	2 SWS	Lecture (V)	Worgull
Exams					
WS 19/20	76-T-MACH-102191	Polymers in MEMS B: Physics, Microstructuring and Applications		Prüfung (PR)	Worgull

Competence Certificate
Oral examination

Prerequisites
none

Below you will find excerpts from events related to this course:

V Polymers in MEMS B: Physics, Microstructuring and Applications

Lecture (V)

2141854, WS 19/20, 2 SWS, Language: German, Open in study portal

T 3.265 Course: Polymers in MEMS C: Biopolymers and Bioplastics [T-MACH-102200]

Responsible: Dr.-Ing. Bastian Rapp
Dr.-Ing. Matthias Worgull

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104850 - Major Field Mechatronics and Microsystem Technology
M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2142855	Polymers in MEMS C - Biopolymers and Bioplastics	2 SWS		Worgull, Rapp
Exams					
WS 19/20	76-T-MACH-102200	Polymers in MEMS C: Biopolymers and Bioplastics		Prüfung (PR)	Worgull, Rapp

Competence Certificate
Oral examination

Prerequisites
none

Below you will find excerpts from events related to this course:

V Polymers in MEMS C - Biopolymers and Bioplastics
2142855, SS 2020, 2 SWS, Language: German, Open in study portal

Content

Polymers are ubiquitous in everyday life: from packaging materials all the way to specialty products in medicine and medical engineering. Today it is difficult to find a product which does not (at least in parts) consist of polymeric materials. The question of how these materials can be improved with respect to their disposal and consumption of (natural) resources during manufacturing is often raised. Today polymers must be fully recycled in Germany and many other countries due to the fact that they do not (or only very slowly) decompose in nature. Furthermore significant reductions of crude oil consumption during synthesis are of increasing importance in order to improve the sustainability of this class of materials. With respect to disposal polymers which do not have to be disposed by combustion but rather allow natural decomposition (composting) are of increasing interest. Polymers from renewable sources are also of interest for modern microelectromechanical systems (MEMS) especially if the systems designed are intended as single-use products.

This lecture will introduce the most important classes of these so-called biopolymers and bioplastics. It will also discuss and highlight polymers which are created from naturally created analogues (e.g. via fermentation) to petrochemical polymer precursors and describe their technical processing. Numerous examples from MEMS as well as everyday life will be given.

Some of the topics covered are:

- What are biopolyurethanes and how can you produce them from castor oil?
- What are "natural glues" and how are they different from chemical glues?
- How do you make tires from natural rubbers?
- What are the two most important polymers for life on earth?
- How can you make polymers from potatoes?
- Can wood be formed by injection molding?
- How do you make buttons from milk?
- Can you play music on biopolymers?
- Where and how do you use polymers for tissue engineering?
- How can you built LEGO with DNA?

The lecture will be given in German language unless non-German speaking students attend. In this case, the lecture will be given in English (with some German translations of technical vocabulary). The lecture slides are in English language and will be handed out for taking notes. Additional literature is not required.

For further details, please contact the lecturer, Dr. Ing. Bastian E. Rapp (bastian.rapp@kit.edu) and PD Dr.-Ing. Matthias Worgull (matthias.worgull@kit.edu). Preregistration is not necessary.

Literature

Zusätzliche vorlesungsbegleitende Literatur ist nicht notwendig.

T 3.266 Course: Powertrain Systems Technology B: Stationary Machinery [T-MACH-105216]

Responsible: Prof. Dr.-Ing. Albert Albers
Prof. Dr.-Ing. Sven Matthiesen
Sascha Ott

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104851 - Major Field Product Development and Construction

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	2

Events					
WS 19/20	2145150	Powertrain Systems Technology B: Stationary Machinery	2 SWS	Lecture (V)	Albers, Ott
Exams					
WS 19/20	76-T-MACH-105216	Powertrain Systems Technology B: Stationary Machinery		Prüfung (PR)	Albers, Ott

Competence Certificate
written examination: 60 min duration

Prerequisites
None

Below you will find excerpts from events related to this course:

V Powertrain Systems Technology B: Stationary Machinery

Lecture (V)

2145150, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
Content

Students acquire the basic skills needed to develop future energy-efficient and safe drive system solutions for use in industrial environments. The course considers holistic development methods and evaluations of drive systems. The focal points can be divided into the following chapters:

- Powertrain System
- Operator System
- Environment System
- System Components
- Development Process

Recommendations:

- Powertrain Systems Technology A: Automotive Systems

Literature
VDI-2241: "Schaltare fremdbetätigte Reibkupplungen und -bremsen", VDI Verlag GmbH, Düsseldorf

Geilker, U.: "Industriekupplungen - Funktion, Auslegung, Anwendung", Die Bibliothek der Technik, Band 178, verlag moderne industrie, 1999

T 3.267 Course: Practical Course Technical Ceramics [T-MACH-105178]

Responsible: Dr. Günter Schell
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Completed coursework	1	Each winter term	1

Events					
WS 19/20	2125751	Practical Course Technical Ceramics	2 SWS	Practical course (P)	Schell
Exams					
WS 19/20	76-T-MACH-105178	Practical Course Technical Ceramics		Prüfung (PR)	Schell

Competence Certificate
Colloquium and laboratory report for the respective experiments.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Practical Course Technical Ceramics

2125751, WS 19/20, 2 SWS, Language: German, Open in study portal

Practical course (P)

Literature
Salmang, H.: Keramik, 7. Aufl., Springer Berlin Heidelberg, 2007. - Online-Ressource

Richerson, D. R.: Modern Ceramic Engineering, CRC Taylor & Francis, 2006

T 3.268 Course: Practical Training in Basics of Microsystem Technology [T-MACH-102164]

Responsible: Dr. Arndt Last
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104850 - Major Field Mechatronics and Microsystem Technology

Type	Credits	Recurrence	Version
Examination of another type	4	Each term	1

Events					
WS 19/20	2143875	Introduction to Microsystem Technology - Practical Course	2 SWS	Practical course (P)	Last
WS 19/20	2143877	Introduction to Microsystem Technology - Practical Course	2 SWS	Practical course (P)	Last
SS 2020	2143875	Introduction to Microsystem Technology - Practical Course	2 SWS	Practical course (P)	Last
SS 2020	2143877	Introduction to Microsystem Technology - Practical Course	2 SWS	Practical course (P)	Last
Exams					
WS 19/20	76-T-MACH-102164	Practical Training in Basics of Microsystem Technology		Prüfung (PR)	Last
SS 2020	76-T-MACH-102164	Practical Training in Basics of Microsystem Technology		Prüfung (PR)	Last

Competence Certificate
The assessment consists of a written exam

Prerequisites
none

Below you will find excerpts from events related to this course:

V Introduction to Microsystem Technology - Practical Course
2143875, WS 19/20, 2 SWS, Language: German, Open in study portal

Practical course (P)

Literature
Menz, W., Mohr, J.: Mikrosystemtechnik für Ingenieure, VCH-Verlag, Weinheim, 1997
Unterlagen zum Praktikum zur Vorlesung ' Grundlagen der Mikrosystemtechnik'

V Introduction to Microsystem Technology - Practical Course
2143877, WS 19/20, 2 SWS, Language: German, Open in study portal

Practical course (P)

Literature
Menz, W., Mohr, J.: Mikrosystemtechnik für Ingenieure, VCH-Verlag, Weinheim, 1997
Unterlagen zum Praktikum zur Vorlesung ' Grundlagen der Mikrosystemtechnik'

V Introduction to Microsystem Technology - Practical Course
2143875, SS 2020, 2 SWS, Language: German, Open in study portal

Practical course (P)

Content
In the practical training includes nine experiments:
1. Hot embossing of plastics micro structures
2. Micro electroforming
3. Mikro optics: "LIGA-micro spectrometer"
4. UV-lithography
5. Optical waveguides
6. Capillary electrophoresis on a chip
7. SAW gas sensor
8. Metrology
9. Atomic force microscopy
Each student takes part in only five experiments.
The experiments are carried out at real workstations at the IMT and coached by IMT-staff.

Literature
Menz, W., Mohr, J.: Mikrosystemtechnik für Ingenieure, VCH-Verlag, Weinheim, 1997
Unterlagen zum Praktikum zur Vorlesung ' Grundlagen der Mikrosystemtechnik'

V Introduction to Microsystem Technology - Practical Course

2143877, SS 2020, 2 SWS, Language: German, Open in study portal

Practical course (P)

Content
In the practical training includes nine experiments:
1. Hot embossing of plastics micro structures
2. Micro electroforming
3. Mikro optics: "LIGA-micro spectrometer"
4. UV-lithography
5. Optical waveguides
6. Capillary electrophoresis on a chip
7. SAW gas sensor
8. Metrology
9. Atomic force microscopy
Each student takes part in only five experiments.
The experiments are carried out at real workstations at the IMT and coached by IMT-staff.

Literature
Menz, W., Mohr, J.: Mikrosystemtechnik für Ingenieure, VCH-Verlag, Weinheim, 1997
Unterlagen zum Praktikum zur Vorlesung ' Grundlagen der Mikrosystemtechnik'

T 3.269 Course: Practical Training in Measurement of Vibrations [T-MACH-105373]

Responsible: Prof. Dr.-Ing. Alexander Fidlin
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104853 - Major Field Theoretical Foundations of Mechanical Engineering

Type	Credits	Recurrence	Version
Completed coursework	4	Each summer term	1

Events					
SS 2020	2162208	Schwingungstechnisches Praktikum	SWS	Practical course (P)	Fidlin, Keller
Exams					
SS 2020	76-T-MACH-105373	Practical Training in Measurement of Vibrations		Prüfung (PR)	Fidlin

Competence Certificate
Colloquium to each session, 10 out of 10 colloquiums must be passed

Prerequisites
Can not be combined with Experimental Dynamics (T-MACH-105514).

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105514 - Experimental Dynamics must not have been started.

Recommendation
Vibration Theory, Mathematical Methods of Vibration Theory, Dynamic Stability, Nonlinear Vibrations

T 3.270 Course: Principles of Ceramic and Powder Metallurgy Processing [T-MACH-102111]

Responsible: Dr. Günter Schell
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2193010	Basic principles of powder metallurgical and ceramic processing	2 SWS	Lecture (V)	Schell
Exams					
WS 19/20	76-T-MACH-102111	Principles of Ceramic and Powder Metallurgy Processing		Prüfung (PR)	Schell

Competence Certificate
The assessment consists of an oral exam (20-30 min) taking place at the agreed date. The re-examination is offered upon agreement.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Basic principles of powder metallurgical and ceramic processing — Lecture (V)
2193010, WS 19/20, 2 SWS, Language: German, Open in study portal

Literature

- R.J. Brook: Processing of Ceramics I+II, VCH Weinheim, 1996
- M.N. Rahaman: Cermamic Processing and Sintering, 2nd Ed., Marcel Dekker, 2003
- W. Schatt ; K.-P. Wieters ; B. Kieback. ".Pulvermetallurgie: Technologien und Werkstoffe", Springer, 2007
- R.M. German. "Powder metallurgy and particulate materials processing. Metal Powder Industries Federation, 2005
- F. Thümmler, R. Oberacker. "Introduction to Powder Metallurgy", Institute of Materials, 1993

T 3.271 Course: Principles of Medicine for Engineers [T-MACH-105235]

Responsible: Prof. Dr. Christian Pylatiuk
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	1

Events					
WS 19/20	2105992	Principles of Medicine for Engineers	2 SWS	Lecture (V)	Pylatiuk
Exams					
WS 19/20	76-T-MACH-105235	Principles of Medicine for Engineers		Prüfung (PR)	Pylatiuk

Competence Certificate
Written examination (Duration: 45min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Principles of Medicine for Engineers
2105992, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Content:

- Introduction: Definitions of "health" and "disease". History of medicine and paradigm shift towards evidence based medicine and personalized medicine.
- Special topics: nervous system, saltatory conduction, musculoskeletal system, cardio-circulatory system, narcosis, pain, respiratory system, sensory organs, gynaecology, digestive organs, surgery, nephrology, orthopaedics, immune system, genetics.

Learning objectives:

Students have fundamental knowledge about functionality and anatomy of organs within different medical disciplines. The students further know about technical methods in diagnosis and therapy, common diseases, their relevance and costs. Finally the students are able to communicate with medical doctors in a way, in which they prevent misunderstandings and achieve a more realistic idea of each others expectations.

Literature

- Adolf Faller, Michael Schünke: Der Körper des Menschen. Thieme Verlag.
- Renate Huch, Klaus D. Jürgens: Mensch Körper Krankheit. Elsevier Verlag.

T 3.272 Course: Probability Theory and Statistics [T-MATH-109620]

Responsible: Prof. Dr. Daniel Hug
Organisation: KIT Department of Mathematics
Part of: M-MACH-104885 - Courses of the Department of Mathematics

Type	Credits	Recurrence	Version
Written examination	5	Each term	2

Exams				
WS 19/20	00014	Fundamentals of Probability and Statistics for Students of Computer Science	Prüfung (PR)	Lerch

Competence Certificate
Written exam (90 min.)

Prerequisites
None

T 3.273 Course: Process Simulation in Forming Operations [T-MACH-105348]

Responsible: Dr.-Ing. Dirk Helm
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104853 - Major Field Theoretical Foundations of Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2161501	Process Simulation in Forming Operations	2 SWS	Lecture (V)	Helm

Competence Certificate
oral exam, 20 min.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Process Simulation in Forming Operations
2161501, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Based on basics of continuum mechanics, material theory and numerics the lecture gives an introduction into the simulation of forming operations for metals

- plasticity for metallic materials: dislocations, twinning, phase transformations, aniostropy, hardening
- classification of forming operations and discussion of selected topics
- basics of tensor algebra and tensor analysis
- continuum mechanics: kinematics, finite deformations, balance laws, thermdydnamics
- material theory: basics, modelling concepts, plasticity and visco plasticity, yield functions (von Mises, Hill, ...), kinematic and isotropic hardening, damage
- thermomechanical coupling
- modelling of contact
- finite element method: explicit and implicite formulations, types of elements, numerical integration of material models
- process simulation of selected problems of sheet metal forming

T 3.274 Course: Product and Innovation Management [T-WIWI-109864]

Responsible: Prof. Dr. Martin Klarmann
Organisation: KIT Department of Economics and Management
Part of: M-MACH-104884 - Courses of the Department of Economics and Management

Type	Credits	Recurrence	Version
Written examination	3	Each summer term	1

Events					
SS 2020	2571154	Product and Innovation Management	2 SWS	Lecture (V)	Feurer

Competence Certificate
The assessment consists of a written exam (60 minutes) (following §4(2), 1 of the examination regulation).

Prerequisites
None

Annotation
For further information please contact Marketing & Sales Research Group (marketing.iism.kit.edu).

Below you will find excerpts from events related to this course:

V Product and Innovation Management
2571154, SS 2020, 2 SWS, Language: English, Open in study portal

Lecture (V)

Content
This course addresses topics around the management of new as well as existing products. After the foundations of product management, especially the product choice behavior of customers, students get to know in detail different steps of the innovation process. Another section regards the management of the existing product portfolio.

Students

- know the most important terms of the product and innovation concept

- understand the models of product choice behavior (e.g., the Markov model, the Luce model)

- are familiar with the basics of network theory (e.g. the Triadic Closure concept)

- know the central strategic concepts of innovation management (especially the market driving approach, pioneer and successor, Miles/Snow typology, blockbuster strategy)

- master the most important methods and sources of idea generation (e.g. open innovation, lead user method, crowdsourcing, creativity techniques, voice of the customer, innovation games, conjoint analysis, quality function deployment, online toolkits)

- are capable of defining and evaluating new product concepts and know the associated instruments like focus groups, product testing, speculative sales, test market simulation Assessor, electronic micro test market

- have advanced knowledge about market introduction (e.g. adoption and diffusion models Bass, Fourt/Woodlock, Mansfield)

- understand important connections of the innovation process (cluster formation, innovation culture, teams, stage-gate process)

The assessment consists of a written exam (60 minutes) (following §4(2), 1 of the examination regulation).

Total effort for 3 credit points: approx. 90 hours

Presence time: 30 hours

Preparation and wrap-up of LV: 45.0 hours

Exam and exam preparation: 15.0 hours

For further information please contact Marketing & Sales Research Group (marketing.iism.kit.edu).

Literature
Homburg, Christian (2016), Marketingmanagement, 6. Aufl., Wiesbaden.

T 3.275 Course: Product- and Production-Concepts for modern Automobiles [T-MACH-110318]

Responsible: Dr. Stefan Kienzle
Dr. Dieter Steegmüller

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2149670	Product- and Production-Concepts for modern Automobiles	2 SWS	Lecture (V)	Steegmüller, Kienzle
Exams					
WS 19/20	76-T-MACH-110318	Product- and Production-Concepts for modern Automobiles		Prüfung (PR)	Steegmüller, Kienzle

Competence Certificate
Oral Exam (20 min)

Prerequisites
T-MACH-105166 - Materials and Processes for Body Leightweight Construction in the Automotive Industry must not have been started.

Below you will find excerpts from events related to this course:

V Product- and Production-Concepts for modern Automobiles

Lecture (V)

2149670, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
The lecture illuminates the practical challenges of modern automotive engineering. As former leaders of the automotive industry, the lecturers refer to current aspects of automotive product development and production.

The aim is to provide students with an overview of technological trends in the automotive industry. In this context, the course also focuses on changes in requirements due to new vehicle concepts, which may be caused by increased demands for individualisation, digitisation and sustainability. The challenges that arise in this context will be examined from both a production technology and product development perspective and will be illustrated with practical examples thanks to the many years of industrial experience of both lecturers.

The topics covered are:

- General conditions for vehicle and body development
- Integration of new drive technologies
- Functional requirements (crash safety etc.), also for electric vehicles
- Development Process at the Interface Product & Production, CAE/Simulation
- Energy storage and supply infrastructure
- Aluminium and lightweight steel construction
- FRP and hybrid parts
- Battery, fuel cell and electric motor production
- Joining technology in modern car bodies
- Modern factories and production processes, Industry 4.0.

Learning Outcomes:

The students …

- are able to name the presented general conditions of vehicle development and are able to discuss their influences on the final product using practical examples.
- are able to name the various lightweight approaches and identify possible areas of application.
- are able to identify the different production processes for manufacturing lightweight structures and explain their functions.
- are able to perform a process selection based on the methods and their characteristics.

Workload:

regular attendance: 25 hours
self-study: 95 hours

Literature
Medien:
Skript zur Veranstaltung wird über (https://ilias.studium.kit.edu/) bereitgestellt.

Media:
Lecture notes will be provided in Ilias (https://ilias.studium.kit.edu/).

T 3.276 Course: Product Development - Dimensioning of Components [T-MACH-105383]

Responsible: Dr.-Ing. Stefan Dietrich
Prof. Dr.-Ing. Volker Schulze

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104847 - Major Field Fundamentals of Engineering

Type	Credits	Recurrence	Version
Written examination	7	Each summer term	1

Events					
SS 2020	2150511	Product Development - Component Dimensioning	3 / 1 SWS	Lecture / Practice (VÜ)	Schulze, Dietrich
Exams					
WS 19/20	76-T-MACH-105383	Product Development - Dimensioning of Components		Prüfung (PR)	Schulze

Competence Certificate
written exam (2 hours)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Product Development - Component Dimensioning

2150511, SS 2020, 3 / 1 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Content
The aim of the lecture is to present the topics of the dimensioning and the material science in their connection and to learn how to deal with corresponding methods and the combination thereof.

For the prospective engineer the most important educational objective is to understand the interaction of these topics while the interplay of the individual material stresses in the component are clarified.

The topics in detail are

Structural dimensioning: basic stresses, superimposed stresses, notch influence, fatigue limit, fatigue strength, assessment of cracked components, operational strength, residual stresses, high temperature stress and corrosion

Material selection: Basics, material indices, material selection diagrams, Ashby procedure, multiple boundary conditions, target conflicts, shape and efficiency.

Learning target: The students…

are capable to design and dimension components according to their load.

can include mechanical material properties from the mechanical material test in the dimensioning process.

can identify superimposed total loads and critical loads on simple components and to compute them.

acquire the skill to select materials based on the application area of the components and respective loads.

Examination: written exam (2 hours)

Literature
Vorlesungsskript

T 3.277 Course: Product, Process and Resource Integration in the Automotive Industry [T-MACH-102155]

Responsible: Prof. Dr.-Ing. Sama Mbang
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	2

Events					
SS 2020	2123364	Product, Process and Resource Integration in the Automotive Industry	2 SWS	Lecture (V)	Mbang

Competence Certificate
Oral examination 20 min.

Prerequisites
None

Annotation
Limited number of participants.

Below you will find excerpts from events related to this course:

V Product, Process and Resource Integration in the Automotive Industry

2123364, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content

- Overview of product development in the automotive sector (process- and work cycle, IT-Systems)
- Integrated product models in the automotive industry (product, process and resource)
- New CAx modeling methods (intelligent feature technology, templates & functional modeling)
- Automation and knowledge-based mechanism for product design and production planning
- Product development in accordance with defined process and requirement (3D-master principle, tolerance models)
- Concurrent Engineering, shared working
- Enhanced concepts: the digital and virtual factory (application of virtual technologies and methods in the product development)

Literature
Vorlesungsfolien

T 3.278 Course: Production and Logistics Controlling [T-WIWI-103091]

Responsible: Alexander Rausch
Organisation: KIT Department of Economics and Management
Part of: M-MACH-104884 - Courses of the Department of Economics and Management

Type	Credits	Recurrence	Version
Written examination	3	Each winter term	1

Exams				
WS 19/20	79-T-WIWI-103091	Production and Logistics Controlling	Prüfung (PR)	Furmans

Competence Certificate
The assessment consists of a written exam (60 minutes) following §4(2), 1 of the examination regulation.
The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Prerequisites
None

T 3.279 Course: Production Planning and Control [T-MACH-105470]

Responsible: Dr.-Ing. Andreas Rinn
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104852 - Major Field Production Technology

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	1

Events					
WS 19/20	2110032	Production Planning and Control	2 SWS		Rinn
Exams					
WS 19/20	76-T-MACH-105470	Production Planning and Control		Prüfung (PR)	Deml, Rinn

Competence Certificate
written exam 60 minutes (if the number of participants is low, the examination is oral, 20 minutes)

Prerequisites
Timely pre-registration in ILIAS, since participation is limited.

Below you will find excerpts from events related to this course:

V Production Planning and Control
2110032, WS 19/20, 2 SWS, Language: German, Open in study portal

Content

1. Goals and recommanditions for production planning and control
2. Strategies for work control
3. Case study: Manufacturing of bicycles
4. FASI-Plus: Simulation of a bicycle factory for the production planning and control
5. Simulation of the order processing
6. Decision making about order control and procurement of purchased parts
7. Evaluation of the simulation protocols
8. Realisation of production planning and control

Requirements:

- Compact course
- Limited number of participants; seats are assigned according the date of registration
- Registration via ILIAS is required
- Compulsory attendance during the whole lecture

Recommendations:

- Knowledge in Production Management/Industrial Engineering is required
- Knowledge of Work Science and Economics is helpful
- Knowledge of Informatics is not required, but helpful

Learning targets:

- Lerninhalte zum Thema "Produktionsmanagement" vertiefen
- Kenntnisse über die Produktionsplanung und -steuerung erweitern
- Grundlegende Techniken der Modellierung und Simulation von Produktionssystemen verstehen

Literature
Das Skript und Literaturhinweise stehen auf ILIAS zum Download zur Verfügung.

T 3.280 Course: Production Techniques Laboratory [T-MACH-105346]

Responsible: Prof. Dr.-Ing. Barbara Deml
Prof. Dr.-Ing. Jürgen Fleischer
Prof. Dr.-Ing. Kai Furmans
Prof. Dr.-Ing. Jivka Ovtcharova

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104852 - Major Field Production Technology

Type	Credits	Recurrence	Version
Completed coursework	4	Each summer term	3

Events					
SS 2020	2110678	Production Techniques Laboratory	4 SWS	Practical course (P)	Deml, Fleischer, Furmans, Ovtcharova
Exams					
SS 2020	76-T-MACH-105346	Production Techniques Laboratory		Prüfung (PR)	Deml, Furmans, Ovtcharova, Schulze

Competence Certificate
Advanced Internship: Participate in practicle exercise courses and complete the colloquia successfully.

Elective Subject: Participate in practicle exercise courses and complete the colloquia successfully and presentation of a specific topic.

Prerequisites
None

Below you will find excerpts from events related to this course:

V Production Techniques Laboratory

2110678, SS 2020, 4 SWS, Language: German, Open in study portal

Practical course (P)

Content
The production technique laboratory (PTL) is a collaboration of the institutes wbk, IFL, IMI and ifab.

1. Computer Aided Product Development (IMI)
2. Computer communication in factory (IMI)
3. Production of parts with CNC turning machines (wbk)
4. Controlling of production systems using PLCs (wbk)
5. Automated assembly systems (wbk)
6. Optical identification in production and logistics (IFL)
7. RFID identification systems (IFL)
8. Storage and order-picking systems (IFL)
9. Production Management (ifab)
10. Time study (ifab)
11. Accomplishment of workplace design (ifab)

Recommendations:

Participation in the following lectures:

- Informationssystems in logistics and supply chain management
- Material flow in logistic systems
- Manufacturing technology
- Human Factors Engineering

Learning Objects:

The students acquire in the lab profound knowledge about the scientific theories, principles and methods of Production Engineering. Afterwards they are able to evaluate and design complex production systems according to problems of manufacturing and process technologies, materials handling, handling techniques, information engineering as well as production organisation and management.

After completion this lab, the students are able

- to analyse and solve planning and layout problems of the discussed fields,
- to evaluate and configure the quality and efficiency of production, processes and products,
- to plan, control and evaluate the production of a production enterprise,
- to configure and evaluate the IT architecture of a production enterprise,
- to design and evaluate appropriate techniques for conveying, handling and picking within a production system,
- to design and evaluate the part production and the assembly by considering the work processes and the work places.

Literature
Das Skript und Literaturhinweise stehen auf ILIAS zum Download zur Verfügung.

T 3.281 Course: Productivity Management in Production Systems [T-MACH-105523]

Responsible: Prof. Dr. Sascha Stowasser
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104852 - Major Field Production Technology

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2110046	Productivity Management in Production Systems	4 SWS		Stowasser
Exams					
SS 2020	76-T-MACH-105523	Productivity Management in Production Systems		Prüfung (PR)	Deml, Stowasser

Competence Certificate
oral exam (approx. 30 min)

The exam is offered in German only!

Prerequisites
none

Below you will find excerpts from events related to this course:

V Productivity Management in Production Systems

2110046, SS 2020, 4 SWS, Language: German, Open in study portal

Content

1. Definition and terminology of process design and industrial engineering
2. Tasks of industrial engineering
3. Actual approaches of organisation of production (Holistic production systems, Guided group work et al.)
4. Methods and principles of industrial engineering and production systems
5. Case studies and exercises for process design
6. Industry 4.0

Requirements:

- Compact course (one week full-time)
- Limited number of participants; seats are assigned according the date of registration
- Registration via ILIAS is required
- Compulsory attendance during the whole lecture

Recommendations:

- Knowledge of work science is helpful

Learning objective:

- Ability to design work operations and processes effecitvely and efficiently
- Instruction in methods of time study (MTM, Data acquisition etc.)
- Instruction in methods and principles of process design
- The Students are able to apply methods for the design of workplaces, work operations and processes.
- The Students are able to apply actual approaches of process and production organisation.

Literature
Das Skript und Literaturhinweise stehen auf ILIAS zum Download zur Verfügung.

T 3.282 Course: Project Management in Global Product Engineering Structures [T-MACH-105347]

Responsible: Prof. Dr.-Ing. Albert Albers
Prof. Dr.-Ing. Peter Gutzmer
Prof. Dr.-Ing. Sven Matthiesen

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104851 - Major Field Product Development and Construction

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2145182	Project management in Global Product Engineering Structures	2 SWS	Lecture (V)	Gutzmer
Exams					
WS 19/20	76-T-MACH-105347	Project Management in Global Product Engineering Structures		Prüfung (PR)	Gutzmer, Albers

Competence Certificate
oral exam (20 min)

Aids: None

Prerequisites
none

Below you will find excerpts from events related to this course:

V Project management in Global Product Engineering Structures
Lecture (V)
2145182, WS 19/20, 2 SWS, Language: German, Open in study portal

Literature
Vorlesungsumdruck

T 3.283 Course: Project Management in Rail Industry [T-MACH-104599]

Responsible: Prof. Dr.-Ing. Peter Gratzfeld
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2115995	Project Management in Rail Industry	2 SWS	Lecture (V)	Gratzfeld
Exams					
WS 19/20	76-T-MACH-104599	Project Management in Rail Industry		Prüfung (PR)	Gratzfeld
SS 2020	76-T-MACH-104599	Project Management in Rail Industry		Prüfung (PR)	Gratzfeld

Competence Certificate
Oral examination

Duration: ca. 20 minutes

No tools or reference materials may be used during the exam.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Project Management in Rail Industry

2115995, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Rail vehicles are capital-intensive goods which are manufactured in small series (like aircraft). The work to done at industry and customers is organized in "projects". This is completely different to the way of working in large-scale production (like car industry). Everybody working in this type of business is part of a project and should be aware of the typical processes.

The lecturer provides a comprehensive overview about modern project management for small series of capital-intensive goods. The content is valid not for rail vehicle business but also for other areas with similar business processes.
The following topics will be discussed:

1. Introduction: definition of project and project management
2. Project management system: project phases, main processes and supporting processes, governance
3. Organization: organizational structure within a company, project organization, roles in a project organization
4. Main processes: project start, project plan, work brake down structure, detailed project schedule, risk and opportunity management, change management, project closure
5. Governance

Literature
Eine Literaturliste steht den Studierenden auf der Ilias-Plattform zum Download zur Verfügung.

A bibliography is available for download (Ilias-platform).

T 3.284 Course: Project Mikromanufacturing: Development and Manufacturing of Microsystems [T-MACH-105457]

Responsible: Prof. Dr.-Ing. Volker Schulze
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104852 - Major Field Production Technology

Type	Credits	Recurrence	Version
Examination of another type	5	Each winter term	2

Events					
WS 19/20	2149680	Project Micro-Manufacturing: Design and Manufacturing of a Microsystem	3 SWS		Schulze, Dehen
Exams					
WS 19/20	76-T-MACH-105457	Project Mikromanufacturing: Development and Manufacturing of Microsystems		Prüfung (PR)	Schulze
SS 2020	76-T-MACH-105457	Project Mikromanufacturing: Development and Manufacturing of Microsystems		Prüfung (PR)	Schulze

Competence Certificate
Alternative test achievement (graded):

- presentation (about 15 min) with weighting 40%
- scientific colloquium (about 15 min) with weighting 40%
- Project work (graded) with weighting 20%

Prerequisites
None

Below you will find excerpts from events related to this course:

V Project Micro-Manufacturing: Design and Manufacturing of a Microsystem

2149680, WS 19/20, 3 SWS, Language: German, Open in study portal

Content
The course "Project micro manufacturing: design and manufacturing of a micro system" combines the basics of micro manufacturing with project work. The project work will be done in cooperation with an industry partner. The students learn the basics of micro milling, micro electric discharge machining, micro laser ablation, micro powder injection molding and micro quality assurance. Furthermore they get to know the CAD-CAM process chain. That is the manufacturing of a production out of a CAD model. The students develop ideas and concepts matching the given task and present the results to the industry partner. Then they create parts that are designed for manufacturability out of their concepts. Those parts are manufactured at the wbk and finally assembled to a prototype.

Learning Outcomes:

The students …

- are able to describe the micro manufacturing processes as well as their characteristics and applications.
- can choose suitable manufacturing processes for a given product.
- are able to describe the process along the CAD-CAM process chain from scratch to manufacturing.
- can explain how the development process for a micro product looks like.
- are able to describe how design for manufacturability works for micro products and where the differences to macroscopic scale are.

Workload:

regular attendance: 31,5 hours
self-study: 148,5 hours

Literature
Medien:
Skript zur Veranstaltung wird über (https://ilias.studium.kit.edu/) bereitgestellt.

Media:
Lecture notes will be provided in Ilias (https://ilias.studium.kit.edu/).

T 3.285 Course: Project Workshop: Automotive Engineering [T-MACH-102156]

Responsible: Dr.-Ing. Michael Frey
Prof. Dr. Frank Gauterin
Dr.-Ing. Martin Gießler

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Oral examination	6	Each term	1

Events					
WS 19/20	2115817	Project Workshop: Automotive Engineering	3 SWS	Lecture (V)	Gauterin, Gießler, Frey
SS 2020	2115817	Project Workshop: Automotive Engineering	3 SWS	Lecture (V)	Gauterin, Gießler, Frey
Exams					
WS 19/20	76-T-MACH-102156	Project Workshop: Automotive Engineering		Prüfung (PR)	Gauterin
SS 2020	76-T-MACH-102156	Project Workshop: Automotive Engineering		Prüfung (PR)	Gauterin

Competence Certificate
Oral examination

Duration: 30 up to 40 minutes

Auxiliary means: none

Prerequisites
none

Below you will find excerpts from events related to this course:

V Project Workshop: Automotive Engineering

2115817, WS 19/20, 3 SWS, Language: German, Open in study portal

Lecture (V)

Content
During the Project Workshop Automotive Engineering a team of six persons will work on a task given by an German industrial partner using the instruments of project management. The task is relevant for the actual business and the results are intended to be industrialized after the completion of the project workshop.

The team will generate approaches in its own responsibility and will develop solutions for practical application. Coaching will be supplied by both, company and institute.

At the beginning in a start-up meeting goals and structure of the project will be specified. During the project workshop there will be weekly team meetings. Also a milestone meeting will be held together with persons from the industrial company. In a final presentation the project results will be presented to the company management and to institute representatives.

Learning Objectives:

During the Project Workshop Automotive Engineering a team of six persons will work on a task given by an German industrial partner using the instruments of project management. The task is relevant for the actual business and the results are intended to be industrialized after the completion of the project workshop.

The team will generate approaches in its own responsibility and will develop solutions for practical application. Coaching will be supplied by both, company and institute.

At the beginning in a start-up meeting goals and structure of the project will be specified. During the project workshop there will be weekly team meetings. Also a milestone meeting will be held together with persons from the industrial company. In a final presentation the project results will be presented to the company management and to institute representatives.

Literature
Steinle, Claus; Bruch, Heike; Lawa, Dieter (Hrsg.), Projektmanagement, Instrument moderner Innovation, FAZ Verlag, Frankfurt a. M., 2001, ISBN 978-3929368277

Skripte werden beim Start-up Meeting ausgegeben.

The scripts will be supplied in the start-up meeting.

V **Project Workshop: Automotive Engineering** **Lecture (V)**
2115817, SS 2020, 3 SWS, Language: German, Open in study portal

Content
During the Project Workshop Automotive Engineering a team of six persons will work on a task given by an German industrial partner using the instruments of project management. The task is relevant for the actual business and the results are intended to be industrialized after the completion of the project workshop.

The team will generate approaches in its own responsibility and will develop solutions for practical application. Coaching will be supplied by both, company and institute.

At the beginning in a start-up meeting goals and structure of the project will be specified. During the project workshop there will be weekly team meetings. Also a milestone meeting will be held together with persons from the industrial company. In a final presentation the project results will be presented to the company management and to institute representatives.

Learning Objectives:

The students are familiar with typical industrial development processes and working style. They are able to apply knowledge gained at the university to a practical task. They are able to analyze and to judge complex relations. They are ready to work self-dependently, to apply different development methods and to work on approaches to solve a problem, to develop practice-oriented products or processes.

Literature
Steinle, Claus; Bruch, Heike; Lawa, Dieter (Hrsg.), Projektmanagement, Instrument moderner Innovation, FAZ Verlag, Frankfurt a. M., 2001, ISBN 978-3929368277

Skripte werden beim Start-up Meeting ausgegeben.

T 3.286 Course: Quality Management [T-MACH-102107]

Responsible: Prof. Dr.-Ing. Gisela Lanza
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104852 - Major Field Production Technology

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	1

Events					
WS 19/20	2149667	Quality Management	2 SWS	Lecture (V)	Lanza
Exams					
WS 19/20	76-T-MACH-102107	Quality Management		Prüfung (PR)	Lanza
SS 2020	76-T-MACH-102107	Quality Management		Prüfung (PR)	Lanza

Competence Certificate
Written Exam (60 min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Quality Management

2149667, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Based on the quality philosophies Total Quality Management (TQM) and Six Sigma, the lecture deals with the requirements of modern quality management. Within this context, the process concept of a modern enterprise and the process-specific fields of application of quality assurance methods are presented. The lecture covers the current state of the art in preventive and non-preventive quality management methods in addition to manufacturing metrology, statistical methods and service related quality management. The content is completed with the presentation of certification possibilities and legal quality aspects.

Main topics of the lecture:

- The term "Quality"
- Total Quality Management (TQM) and Six Sigma
- Universal methods and tools
- QM during early product stages – product denition
- QM during product development and in procurement
- QM in production – manufacturing metrology
- QM in production – statistical methods
- QM in service
- Quality management systems
- Legal aspects of QM

Learning Outcomes:

The students …

- are capable to comment on the content covered by the lecture.
- are capable of substantially quality philosophies.
- are able to apply the QM tools and methods they have learned about in the lecture to new problems from the context of the lecture.
- are able to analyze and evaluate the suitability of the methods, procedures and techniques they have learned about in the lecture for a specific problem.

Workload:

regular attendance: 21 hours
self-study: 99 hours

Literature
Medien:
Skript zur Veranstaltung wird über (https://ilias.studium.kit.edu/) bereitgestellt:

Media:
Lecture notes will be provided in Ilias (https://ilias.studium.kit.edu/).

T 3.287 Course: Rail System Technology [T-MACH-106424]

Responsible: Prof. Dr.-Ing. Peter Gratzfeld
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each term	1

Events					
WS 19/20	2115919	Rail System Technology	2 SWS	Lecture (V)	Gratzfeld
SS 2020	2115919	Rail System Technology	2 SWS	Lecture (V)	Gratzfeld
Exams					
WS 19/20	76-T-MACH-106424	Rail System Technology		Prüfung (PR)	Gratzfeld
SS 2020	76-T-MACH-106424	Rail System Technology		Prüfung (PR)	Gratzfeld

Competence Certificate
Oral examination

Duration: ca. 20 minutes

No tools or reference materials may be used during the exam.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Rail System Technology
2115919, WS 19/20, 2 SWS, Language: German, Open in study portal **Lecture (V)**

Content

1. Railway System: railway as system, subsystems and interdependencies, definitions, laws, rules, railway and environment, economic impact
2. Operation: Transportation, public transport, regional transport, long-distance transport, freight service, scheduling
3. Infrastructure: rail facilities, track alignment, railway stations, clearance diagram
4. Wheel-rail-contact: carrying of vehicle mass, adhesion, wheel guidance, current return
5. Vehicle dynamics: tractive and brake effort, driving resistance, inertial force, load cycles
6. Signaling and Control: operating procedure, succession of trains, European Train Control System, blocking period, automatic train control
7. Traction power supply: power supply of rail vehicles, power networks, filling stations
8. History (optional)

Literature
Eine Literaturliste steht den Studierenden auf der Ilias-Plattform zum Download zur Verfügung.

A bibliography is available for download (Ilias-platform).

V Rail System Technology
2115919, SS 2020, 2 SWS, Language: German, Open in study portal **Lecture (V)**

Content

1. Railway System: railway as system, subsystems and interdependencies, definitions, laws, rules, railway and environment, economic impact
2. Operation: Transportation, public transport, regional transport, long-distance transport, freight service, scheduling
3. Infrastructure: rail facilities, track alignment, railway stations, clearance diagram
4. Wheel-rail-contact: carrying of vehicle mass, adhesion, wheel guidance, current return
5. Vehicle dynamics: tractive and brake effort, driving resistance, inertial force, load cycles
6. Signaling and Control: operating procedure, succession of trains, European Train Control System, blocking period, automatic train control
7. Traction power supply: power supply of rail vehicles, power networks, filling stations
8. History (optional)

Literature
Eine Literaturliste steht den Studierenden auf der Ilias-Plattform zum Download zur Verfügung.

A bibliography is available for download (Ilias-platform).

T 3.288 Course: Rail Vehicle Technology [T-MACH-105353]

Responsible: Prof. Dr.-Ing. Peter Gratzfeld
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each term	1

Events					
WS 19/20	2115996	Rail Vehicle Technology	2 SWS	Lecture (V)	Gratzfeld
SS 2020	2115996	Rail Vehicle Technology	2 SWS	Lecture (V)	Gratzfeld
Exams					
WS 19/20	76-T-MACH-105353	Rail Vehicle Technology		Prüfung (PR)	Gratzfeld
WS 19/20	76-T-MACH-105355	Rail Vehicle Technology		Prüfung (PR)	Gratzfeld
SS 2020	76-T-MACH-105353	Rail Vehicle Technology		Prüfung (PR)	Gratzfeld

Competence Certificate
Oral examination

Duration: ca. 20 minutes

No tools or reference materials may be used during the exam.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Rail Vehicle Technology

2115996, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content

1. Vehicle system technology: structure and main systems of rail vehicles
2. Car body: functions, requirements, design principles, crash elements, interfaces
3. Bogies: forces, running gears, axle configuration
4. Drives: vehicle with/without contact wire, dual-mode vehicle
5. Brakes: tasks, basics, principles, blending, brake control
6. Train control management system: definitions, networks, bus systems, components, examples
7. Vehicle concepts: trams, metros, regional trains, intercity trains, high speed trains, double deck coaches, locomotives, freight wagons

Literature
Eine Literaturliste steht den Studierenden auf der Ilias-Plattform zum Download zur Verfügung.

A bibliography is available for download (Ilias-platform).

V Rail Vehicle Technology

2115996, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content

1. Vehicle system technology: structure and main systems of rail vehicles
2. Car body: functions, requirements, design principles, crash elements, interfaces
3. Bogies: forces, running gears, axle configuration
4. Drives: vehicle with/without contact wire, dual-mode vehicle
5. Brakes: tasks, basics, principles, blending, brake control
6. Train control management system: definitions, networks, bus systems, components, examples
7. Vehicle concepts: trams, metros, regional trains, intercity trains, high speed trains, double deck coaches, locomotives, freight wagons

Literature

Eine Literaturliste steht den Studierenden auf der Ilias-Plattform zum Download zur Verfügung.

A bibliography is available for download (Ilias-platform).

T 3.289 Course: Railways in the Transportation Market [T-MACH-105540]

Responsible: Prof. Dr.-Ing. Peter Gratzfeld
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2114914	Railways in the Transportation Market	2 SWS	Block (B)	Gratzfeld
Exams					
WS 19/20	76-T-MACH-105540	Railways in the Transportation Market		Prüfung (PR)	Gratzfeld
SS 2020	76-T-MACH-105540	Railways in the Transportation Market		Prüfung (PR)	Gratzfeld

Competence Certificate
Oral examination

Duration: ca. 20 minutes

No tools or reference materials may be used during the exam.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Railways in the Transportation Market
2114914, SS 2020, 2 SWS, Language: German, Open in study portal

Block (B)

Content
The lecture conveys the entrepreneurial view on chances and challenges of rail systems in the market. Following items will be discussed:

- Introduction and basics
- Rail reform in Germany
- Overview of Deutsche Bahn
- Financing and development of infrastructure
- Regulation of railways
- Intra- and intermodal competition
- Field of actions in transport policy
- Railways and enviroment
- Trends in the transportation market
- Future of Deutsche Bahn
- Digitalization

Qualification aims:

The students learn about the entrepreneurial perspective of transport authorities and can follow their fields of action. They understand regulative policies and learn to assess intra- and intermodal competition.

Literature
keine

T 3.290 Course: Reactor Safety I: Fundamentals [T-MACH-105405]

Responsible: Dr. Victor Hugo Sanchez-Espinoza
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2189465	Reactor Safety I: Fundamentals	2 SWS	Lecture (V)	Sanchez-Espinoza
Exams					
WS 19/20	76-T-MACH-105405	Reactor Safety I: Fundamentals		Prüfung (PR)	Sanchez-Espinoza
SS 2020	76-T-MACH-105405	Reactor Safety I: Fundamentals		Prüfung (PR)	Sanchez-Espinoza

Competence Certificate
oral exam about 30 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Reactor Safety I: Fundamentals

Lecture (V)

2189465, SS 2020, 2 SWS, Language: German/English, Open in study portal

Content
This lecture will be given in English, if required in German

The lecture discuss the fundamental principles and concepts of reactor safety including the methologies for safety assessment and major accidents.

In the lecture, the fundamental principles and concepts of reactor safety are discussed. They facilitate the assessment of the safety status of nuclear power plants and the interpretation of incidents or accidents as such as Chernobyl or Fukushima. Starting with the explanations of the technical safety features of reactor systems, the safety concepts of different reactor types are discussed. The initiation and progression of incidents/accidents as well as the methods for the safety evaluation are also treated in the lecture. Discussing the Fukushima accident, the radiological risk from nuclear power plants together with the counter measures to stop severe accident and to limit the consequences will be explained. Finally, new development to increase the safety or reactors of Generation III and IV will be presented.

Lecture Content:

- National and international nuclear regulations
- Fundamental principles of reactor safety
- Implementation of safety principles in nuclear power plants of generation 2
- Safety analysis and methods for safety assessment
- Nuclear events and accidents and its evaluation methods
- Discussion severe accidents e.g. the Fukushima accident
- Safety features of reactor systems of generation 3 and 4

Lernziele

Lecture Content:

- National and international nuclear regulations
- Fundamental principles of reactor safety
- Implementation of safety principles in nuclear power plants of generation 2
- Safety analysis and methods for safety assessment
- Nuclear events and accidents and its evaluation methods
- Discussion severe accidents e.g. the Fukushima accident
- Safety features of reactor systems of generation 3 and 4

Knowledge in energy technology, nuclear power plants, reactor physics, thermal hydraulic of nuclear reactors is welcomed

regular attendance: 30 h
self-study: 60 h

Zielgruppe: Students of Mechanical Engineering,

oral examination, duration approximately 30 minutes

Literature

- A. Ziegler, Lehrbuch der Reaktortechnik Band 1 und 2, Springer Verlag, 1986
- D. Smidt, Reaktorsicherheitstechnik. Springer-Verlag Berlin Heidelberg New York. 1979
- D. Smidt, Reaktortechnik, Band 2, Verlag G. Braun, Karlsruhe, 1976

- G. Kessler at al; Risks of Nuclear Energy Technology- Safety Concepts of Light Water Reactors. Springer Verlag 2014.
- B. R. Sehgal; Nuclear Safety in LWR: Severe Accident Phenomenology. Academic Press Elsevier. 2012.
- John C. Lee and Norman J. McCormick.July; Risk and Safety Analysis of Nuclear Systems. 2011
- G. Petrangeli; Nuclear Safety. Elsevier Butterworth-Heinemann. 2006
- J. N. Lillington; Light Water Reactor Safety: The Development of Advanced Models and Codes for Light Water Reactor Safety Analysis. Elsevier 1995.

T 3.291 Course: Reduction Methods for the Modeling and the Simulation of Vombustion Processes [T-MACH-105421]

Responsible: Dr. Viatcheslav Bykov
Prof. Dr. Ulrich Maas

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2166543	Reduction methods for the modeling and the simulation of combustion processes	2 SWS	Lecture (V)	Bykov
Exams					
SS 2020	76-T-MACH-105421	Reduction Methods for the Modeling and the Simulation of Vombustion Processes		Prüfung (PR)	Maas

Competence Certificate
oral exam (20 min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Reduction methods for the modeling and the simulation of combustion processes

Lecture (V)

2166543, SS 2020, 2 SWS, Language: German, Open in study portal

Content
The course will introduce the principles of model reduction of chemical kinetic models of combustion processes. The basic mathematical concepts and methods of analysis of chemical reaction mechanisms will be outlined in the context of model reduction. The detailed implementation scheme of model reduction will be introduced. The course will cover simplified and idealized models of combustion (e.g. auto-ignition, explosion, deflagration etc.), which will be analyzed and reduced. The main analytical methods and numerical tools will be presented, evaluated and illustrated by using these simple examples.

Literature
N. Peters, B. Rogg: Reduced kinetic mechanisms for aplication in combustion systems, Lecture notes in physics, 15, Springer Verlag, 1993.

T 3.292 Course: Reliability Engineering 1 [T-MACH-107447]

Responsible: Dr.-Ing. Alexei Konnov
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Written examination	3	Each winter term	1

Events					
WS 19/20	2169550	Reliability Engineering 1	2 SWS	Lecture (V)	Konnov

Competence Certificate
written exam

Prerequisites
none

Below you will find excerpts from events related to this course:

V Reliability Engineering 1
2169550, WS 19/20, 2 SWS, Language: English, Open in study portal

Lecture (V)

Content
This module should provide an introduction to the theoretical and practical aspects of the reliability engineering using the example of availability and safety analysis of the power plant digital control system (DCS).

It contains the necessary basics of the probability and dependability theory as well as a general introduction to the digital control systems (DCS).

In the next step, the principal approach of the availibilty and safety analysis of the complex systems will be explained.

The main point of the module is "the balance between safety and process related functions" and their influence on the economic effectiveness of the technical installation.

Technical background: instrumentation and control systems in power plants

Introduction to reliability theory
Introduction to probability theory
Introduction to formal logic
Introduction to statistic

Basic knowledge in formal logic, KV-maps, probility calculus.

Recommendation:

In combination with lesson "Combined Cycle Power Plants" - Lesson No. 2170490

After having successfully completed the course, the students should

- have a general understanding of the sturcutre and operating principal of the digital control systems,

- have an understanding of availability and safety importance in modern technical systems (e.g. DCS),

- understand and be able to use the fundamnental concepts of availability and safety analysis,

- be aware of the necessity of finding an ooptimum balance between safety and availability in a technical installation,

-be able to use the appropriate terminology in English

regular attandance: 25 h

self-study: 65 h

written exam

duration: 90 min.

Auxiliary: no tools or reference materials may be used during the exam

Literature
Lesson script (link will be available)

Recommended books:

o Birolini, Alessandro: *Reliability Engineering Theory and Practice*

o Pham, Hoang: *Handbook of reliability engineering*

T 3.293 Course: Renewable Energy-Resources, Technologies and Economics [T-WIWI-100806]

Responsible: PD Dr. Patrick Jochem
Prof. Dr. Russell McKenna

Organisation: KIT Department of Economics and Management

Part of: M-MACH-104878 - Specification in Mechanical Engineering
M-MACH-104884 - Courses of the Department of Economics and Management

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	3

Events					
WS 19/20	2581012	Renewable Energy – Resources, Technologies and Economics	2 SWS	Lecture (V)	McKenna, Jochem
Exams					
WS 19/20	7981012	Renewable Energy-Resources, Technologies and Economics		Prüfung (PR)	Fichtner

Competence Certificate
The assessment consists of a written exam (60 min., in English, answers in English or German).

Prerequisites
None.

Below you will find excerpts from events related to this course:

V Renewable Energy – Resources, Technologies and Economics

Lecture (V)

2581012, WS 19/20, 2 SWS, Language: English, Open in study portal

Content

1. General introduction: Motivation, Global situation

2. Basics of renewable energies: Energy balance of the earth, potential definition

3. Hydro

4. Wind

5. Solar

6. Biomass

7. Geothermal

8. Other renewable energies

9. Promotion of renewable energies

10. Interactions in systemic context

11. Excursion to the "Energieberg" in Mühlburg

Learning Goals:

The student

- understands the motivation and the global context of renewable energy resources.
- gains detailed knowledge about the different renewable resources and technologies as well as their potentials.
- understands the systemic context and interactions resulting from the increased share of renewable power generation.
- understands the important economic aspects of renewable energies, including electricity generation costs, political promotion and marketing of renewable electricity.
- is able to characterize and where required calculate these technologies.

Literature
Weiterführende Literatur:

- Kaltschmitt, M., 2006, Erneuerbare Energien : Systemtechnik, Wirtschaftlichkeit, Umweltaspekte, aktualisierte, korrigierte und ergänzte Auflage Berlin, Heidelberg : Springer-Verlag Berlin Heidelberg.
- Kaltschmitt, M., Streicher, W., Wiese, A. (eds.), 2007, Renewable Energy: Technology, Economics and Environment, Springer, Heidelberg.
- Quaschning, V., 2010, Erneuerbare Energien und Klimaschutz : Hintergründe - Techniken - Anlagenplanung – Wirtschaftlichkeit München : Hanser, Ill.2., aktualis. Aufl.
- Harvey, D., 2010, Energy and the New Reality 2: Carbon-Free Energy Supply, Eathscan, London/Washington.
- Boyle, G. (ed.), 2004, Renewable Energy: Power for a Sustainable Future, 2nd Edition, Open University Press, Oxford.

T 3.294 Course: Robotics I - Introduction to Robotics [T-INFO-108014]

Responsible: Prof. Dr.-Ing. Tamim Asfour
Organisation: KIT Department of Informatics
Part of: M-MACH-104883 - Courses of the Department of Informatics

Type	Credits	Recurrence	Version
Written examination	6	Each winter term	1

Events					
WS 19/20	2424152	Robotics I - Introduction to Robotics	3/1 SWS	Lecture (V)	Asfour, Paus
Exams					
WS 19/20	7500106	Robotics I - Introduction to Robotics		Prüfung (PR)	Asfour
SS 2020	7500218	Robotik I - Einführung in die Robotik		Prüfung (PR)	Asfour

T 3.295 Course: Robotics II: Humanoid Robotics [T-INFO-105723]

Responsible: Prof. Dr.-Ing. Tamim Asfour
Organisation: KIT Department of Informatics
Part of: M-MACH-104883 - Courses of the Department of Informatics

Type	Credits	Recurrence	Version
Written examination	3	Each summer term	4

Events					
SS 2020	2400074	Robotics II: Humanoid Robotics	2 SWS	Lecture (V)	Asfour, Peller-Konrad, Hitzler
Exams					
WS 19/20	7500211	Robotics II: Humanoid Robotics		Prüfung (PR)	Asfour
SS 2020	7500086	Robotics II: Humanoid Robotics		Prüfung (PR)	Asfour

Below you will find excerpts from events related to this course:

V Robotics II: Humanoid Robotics

2400074, SS 2020, 2 SWS, Language: German/English, Open in study portal

Lecture (V)

Content
The lecture presents current work in the field of humanoid robotics that deals with the implementation of complex sensorimotor and cognitive abilities. In the individual topics different methods and algorithms, their advantages and disadvantages, as well as the current state of research are discussed.

The topics addressed are: biomechanical models of the human body, biologically inspired and data-driven methods of grasping, active perception, imitation learning and programming by demonstration as well as semantic representations of sensorimotor experience

Learning Objectives:

The students have an overview of current research topics in autonomous learning robot systems using the example of humanoid robotics. They are able to classify and evaluate current developments in the field of cognitive humanoid robotics.

The students know the essential problems of humanoid robotics and are able to develop solutions on the basis of existing research.

Literature
Weiterführende Literatur

Wissenschaftliche Veröffentlichungen zum Thema, werden auf der VL-Website bereitgestellt.

T 3.296 Course: Robotics III - Sensors and Perception in Robotics [T-INFO-109931]

Responsible: Prof. Dr.-Ing. Tamim Asfour
Organisation: KIT Department of Informatics
Part of: M-MACH-104883 - Courses of the Department of Informatics

Type	Credits	Recurrence	Version
Written examination	3	Each summer term	2

Events					
SS 2020	2400067	Robotics III - Sensors and Perception in Robotics	2 SWS	Lecture (V)	Asfour, Grotz, Pohl
Exams					
WS 19/20	7500207	Robotics III - Sensors and Perception in Robotics		Prüfung (PR)	Asfour
SS 2020	7500242	Robotics III - Sensors and Perception in Robotics		Prüfung (PR)	Asfour

Below you will find excerpts from events related to this course:

V Robotics III - Sensors and Perception in Robotics

Lecture (V)

2400067, SS 2020, 2 SWS, Language: German/English, Open in study portal

Content

The lecture supplements the lecture Robotics I with a broad overview of sensors used in robotics. The lecture focuses on visual perception, object recognition, simultaneous localization and mapping (SLAM) and semantic scene interpretation. The lecture is divided into two parts:

In the first part a comprehensive overview of current sensor technologies is given. A basic distinction is made between sensors for the perception of the environment (exteroceptive) and sensors for the perception of the internal state (proprioceptive).

The second part of the lecture concentrates on the use of exteroceptive sensors in robotics. The topics covered include tactile exploration and visual data processing, including advanced topics such as feature extraction, object localization, simultaneous localization and mapping (SLAM) and semantic scene interpretation.

Learning Obejctives:

Students know the main sensor principles used in robotics and understand the data flow from physical measurement through digitization to the use of the recorded data for feature extraction, state estimation and environmental modeling.

Students are able to propose and justify suitable sensor concepts for common tasks in robotics.

Literature

Eine Foliensammlung wird im Laufe der Vorlesung angeboten.

Begleitende Literatur wird zu den einzelnen Themen in der Vorlesung bekannt gegeben.

T 3.297 Course: Safety Engineering [T-MACH-105171]

Responsible: Hans-Peter Kany
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104852 - Major Field Production Technology

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	2

Events					
WS 19/20	2117061	Safety Engineering	2 SWS	Lecture (V)	Kany
Exams					
WS 19/20	7600004	Safety Engineering		Prüfung (PR)	Kany

Competence Certificate
The assessment consists of an oral exam (20 min.) taking place in the recess period according to § 4 paragraph 2 Nr. 2 of the examination regulation.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Safety Engineering

2117061, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Media
Presentations

Learning content
The course provides basic knowledge of safety engineering. In particular the basics of health at the working place, job safety in Germany, national and European safety rules and the basics of safe machine design are covered. The implementation of these aspects will be illustrated by examples of material handling and storage technology. This course focuses on: basics of safety at work, safety regulations, basic safety principles of machine design, protection devices, system security with risk analysis, electronics in safety engineering, safety engineering for storage and material handling technique, electrical dangers and ergonomics. So, mainly, the technical measures of risk reduction in specific technical circumstances are covered.

Learning goals
The students are able to:

- Name and describe relevant safety concepts of safety engineering,
- Discuss basics of health at work and labour protection in Germany,
- Evaluate the basics for the safe methods of design of machinery with the national and European safety regulations and
- Realize these objectives by using examples in the field of storage and material handling systems.

Recommendations
None

Workload
Regular attendance: 21 hours
Self-study: 99 hours

Note
Dates: See IFL-Homepage

Literature
Defren/Wickert: Sicherheit für den Maschinen- und Anlagenbau, Druckerei und
Verlag: H. von Ameln, Ratingen

T 3.298 Course: Scaling in Fluid Dynamics [T-MACH-105400]

Responsible: Prof. Dr. Leo Bühler
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2154044	Scaling in fluid dynamics	2 SWS	Lecture (V)	Bühler
Exams					
WS 19/20	76-T-MACH-105400	Scaling in Fluid Dynamics		Prüfung (PR)	Bühler

Competence Certificate
Oral exam

Duration: 20-30 minutes

No auxiliary means

Prerequisites
none

Recommendation
Fluid Mechanics (T-MACH-105207)

Below you will find excerpts from events related to this course:

V Scaling in fluid dynamics — Lecture (V)
2154044, SS 2020, 2 SWS, Language: German, Open in study portal

Content

- Introduction
- Similarity rules (examples)
- Dimensional analysis (Pi-theorem)
- Scaling in differential equations
- Scaling in boundary layers
- Self-similar solutions
- Scaling in turbulent shear layers
- Rotating flows
- Magnetohydrodynamic flows

Educational objective: The student can extract non-dimensional number from the characteristic properties of flows. From the insights on scaling laws, the students are qualified to identify the influencing quantities from generic experiments and transfer these to real applications. The students can simplify the governing equations of fluid mechanic appropriately and can interpret the achieved results as a basis for efficient solution strategies.

Literature
G. I. Barenblatt, 1979, Similarity, Self-Similarity, and Intermediate Asymptotics, Plenum Publishing Corporation (Consultants Bureau)

J. Zierep, 1982, Ähnlichkeitsgesetze und Modellregeln der Strömungsmechanik, Braun

J. H. Spurk, 1992, Dimensionsanalyse in der Strömungslehre, Springer

T 3.299 Course: Selected Chapters of the Combustion Fundamentals [T-MACH-105428]

Responsible: Prof. Dr. Ulrich Maas
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each term	1

Events					
WS 19/20	2167541	Selected chapters of the combustion fundamentals	2 SWS	Lecture (V)	Maas
SS 2020	2167541	Selected chapters of the combustion fundamentals	2 SWS	Lecture (V)	Maas

Competence Certificate
Oral exam (20 min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Selected chapters of the combustion fundamentals — Lecture (V)
2167541, WS 19/20, 2 SWS, Language: German, Open in study portal

Literature
Vorlesungsunterlagen

Verbrennung - Physikalisch-Chemische Grundlagen, Modellbildung, Schadstoffentstehung, Autoren: U. Maas, J. Warnatz, R.W. Dibble, Springer-Lehrbuch, Heidelberg 1996

V Selected chapters of the combustion fundamentals — Lecture (V)
2167541, SS 2020, 2 SWS, Language: German, Open in study portal

Content
Depending on the lecture: Fundamentals of chemical kinetics, of statistical modeling of turbulent flames or of droplet and spray combustion.

Literature
Vorlesungsunterlagen

Verbrennung - Physikalisch-Chemische Grundlagen, Modellbildung, Schadstoffentstehung, Autoren: U. Maas, J. Warnatz, R.W. Dibble, Springer-Lehrbuch, Heidelberg 1996

T 3.300 Course: Selected Problems of Applied Reactor Physics and Exercises [T-MACH-105462]

Responsible: apl. Prof. Dr. Ron Dagan
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2190411	Selected Problems of Applied Reactor Physics and Exercises	2 SWS	Lecture (V)	Dagan, Metz
Exams					
WS 19/20	76-T-MACH-105462	Selected Problems of Applied Reactor Physics and Exercises		Prüfung (PR)	Dagan, Stieglitz
SS 2020	76-T-MACH-105462	Selected Problems of Applied Reactor Physics and Exercises		Prüfung (PR)	Dagan

Competence Certificate
oral exam, 1/2 hour

Prerequisites
none

Below you will find excerpts from events related to this course:

V Selected Problems of Applied Reactor Physics and Exercises

2190411, SS 2020, 2 SWS, Language: German/English, Open in study portal

Lecture (V)

Content

- Nuclear energy and forces
- Radioactive decay
- Nuclear processes
- Fission and the importance of delayed neutrons
- Basics of nuclear cross sections
- Principles of chain reaction
- Static theory of mono energetic reactors
- Introduction to reactor kinetic
- student laboratory

The students

- have solid understanding of the basic reactor physics
- are able to estimate processes of growth and decay of radionuclides; out of it, they can perform dose calculation and introduce their biological hazards
- can calculate the relationship of basic parameters which are needed for a stable reactor operation
- understand important dynamical processes of nuclear reactors.

Regular attendance: 26 h

self study 94 h

oral exam about 30 min.

Literature

K. Wirtz Grundlagen der Reaktortechnik Teil I, II, Technische Hochschule Karlsruhe 1966

D. Emendorfer. K.H. Höcker Theorie der Kernreaktoren, BI- Hochschultaschenbücher 1969

J. Duderstadt and L. Hamilton, Nuclear reactor Analysis, J. Wiley $ Sons, Inc. 1975 (in English)

T 3.301 Course: Seminar in Materials Science [T-MACH-100290]

Responsible: Dr. Patric Gruber
Dr. rer. nat. Stefan Wagner

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Completed coursework	2	Each summer term	2

Events					
SS 2020	2178450	Seminar in Materials Science	2 SWS	Seminar (S)	Gruber, Wagner
Exams					
SS 2020	76-T-MACH-100290	Seminar in Materials Science		Prüfung (PR)	Gruber, Wagner

Competence Certificate
Attendance on all seminars

Preparation of an oral talk (meeting with mentor)

Presentation of oral talk

Prerequisites
Materials Physics, Metals, basics in Ceramics

Below you will find excerpts from events related to this course:

V Seminar in Materials Science

Seminar (S)

2178450, SS 2020, 2 SWS, Language: German, Open in study portal

Content
Topics in materials science within the framework of the lectures Materials Physics, Metals and Introduction to Ceramics.

The students are able to work target- and resources-oriented on a scientific case in the field of material science under specified conditions. They are able to research and select scientifical and technical informations according to set criteria. The students are able to prepare and present the scientific case in a clear and convincing manner in an oral presentation.

Literature
Themenspezifisch

3.302 Course: Seminar Novel Concepts for Solar Energy Harvesting [T-ETIT-108344]

Responsible: Prof. Dr. Bryce Sydney Richards
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the Department of Electrical Engineering and Information Technology

Type	Credits	Recurrence	Version
Examination of another type	3	Each summer term	2

Events					
SS 2020	2313761	Seminar Novel Concepts for Solar Energy Harvesting	2 SWS	Seminar (S)	Paetzold, Richards

Prerequisites
none

T 3.303 Course: Sensors [T-ETIT-101911]

Responsible: Dr. Wolfgang Menesklou
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the Department of Electrical Engineering and Information Technology

Type	Credits	Recurrence	Version
Written examination	3	Each winter term	1

Events					
WS 19/20	2304231	Sensors	2 SWS	Lecture (V)	Menesklou
Exams					
WS 19/20	7304231	Sensors		Prüfung (PR)	Menesklou
SS 2020	7304231	Sensors		Prüfung (PR)	Menesklou

T 3.304 Course: Signals and Systems [T-ETIT-109313]

Responsible: Prof. Dr.-Ing. Fernando Puente Leon
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the Department of Electrical Engineering and Information Technology

Type	Credits	Recurrence	Expansion	Version
Written examination	6	Each winter term	1 terms	1

Events					
WS 19/20	2302109	Signals and Systems	2 SWS	Lecture (V)	Puente Leon
Exams					
WS 19/20	7302109	Signals and Systems		Prüfung (PR)	Puente Leon, Jäschke

Prerequisites
none

T 3.305 Course: Simulation of Coupled Systems [T-MACH-105172]

Responsible: Prof. Dr.-Ing. Marcus Geimer
Yusheng Xiang

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	2

Events					
SS 2020	2114095	Simulation of Coupled Systems	2 SWS	Lecture (V)	Geimer, Xiang , Daiß
Exams					
WS 19/20	76T-MACH-105172	Simulation of Coupled Systems		Prüfung (PR)	Geimer
WS 19/20	76-T-MACH-105172	Simulation of Coupled Systems		Prüfung (PR)	Geimer
SS 2020	76T-MACH-105172	Simulation of Coupled Systems		Prüfung (PR)	Geimer

Competence Certificate
The assessment consists of an oral exam (20 min) taking place in the recess period. The exam takes place in every semester. Re-examinations are offered at very ordinary examination date.

A registration in mandatory, the details will be announced on the webpages of the *Institute of Vehicle System Technology / Institute of Mobile Machines.* In case of too many applications, attendance will be granted based on pre-qualification.

Prerequisites
Required for the participation in the examination is the preparation of a report during the semester. The partial service with the code T-MACH-108888 must have been passed.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-108888 - Simulation of Coupled Systems - Advance must have been passed.

Recommendation

- Knowledge of ProE (ideally in actual version)
- Basic kniwledge of Matlab/Simulink
- Basic knowledge of dynamics of machnies
- Basic knowledge of hydraulics

Annotation
After completion of course, students are able to:

- build a coupled simulation
- parametrize models
- perform simulations
- conduct troubleshooting
- check results for plausibility

The number of participants is limited.

Content:

- Basics of multi-body and hydralics simulation programs
- Possibilities of coupled simulations
- Modelling and Simulation of Mobile Machines using a wheel loader
- Documentation of the result in a short report

Literature:

Software guide books (PDFs)

Information about wheel-type loader specifications

Below you will find excerpts from events related to this course:

V **Simulation of Coupled Systems** **Lecture (V)**
2114095, SS 2020, 2 SWS, Language: German, Open in study portal

Content

- Knowledge of the basics of multi-body and hydraulic simulation programs
- Possibilities of coupled simulations
- Development of a simulation model by using the example of a wheel loader
- Documentation of the result in a short report

It is recommended to have:

- Knowledge of ProE (ideally in current version)
- Basic knowledge of Matlab/Simulink
- Basic knowledge of dynamics of machines
- Basic knowledge of hydraulics

- regular attendance: 21 hours
- total self-study: 92 hours

Literature
Weiterführende Literatur:

- Diverse Handbücher zu den Softwaretools in PDF-Form
- Informationen zum verwendeten Radlader

T 3.306 Course: Simulation of Coupled Systems - Advance [T-MACH-108888]

Responsible: Prof. Dr.-Ing. Marcus Geimer
Yusheng Xiang

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Completed coursework	0	Each summer term	1

Exams				
WS 19/20	76-T-MACH-108888	Simulation of Coupled Systems - Advance	Prüfung (PR)	Geimer
SS 2020	76-T-MACH-108888	Simulation of Coupled Systems - Advance	Prüfung (PR)	Geimer

Competence Certificate
Preparation of semester report

Prerequisites
none

T 3.307 Course: Simulator Exercises Combined Cycle Power Plants [T-MACH-105445]

Responsible: Prof. Dr.-Ing. Thomas Schulenberg
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104878 - Specification in Mechanical Engineering
M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	2	Each summer term	1

Events					
SS 2020	2170491	Simulator Exercises Combined Cycle Power Plants	2 SWS	Practical course (P)	Schulenberg
Exams					
WS 19/20	76-T-MACH-105445	Simulator Exercises Combined Cycle Power Plants		Prüfung (PR)	Schulenberg

Competence Certificate
oral exam (ca. 15 min)

Prerequisites
none

Recommendation
Participation at LV-No. 2170490 "Combined Cycle Power Plants" (T-MACH-105444) is recommended.

Below you will find excerpts from events related to this course:

V Simulator Exercises Combined Cycle Power Plants

Practical course (P)

2170491, SS 2020, 2 SWS, Language: English, Open in study portal

Content
The training objective of the course is the qualification for a research-related professional activity in power plant engineering. On the basis of the learned fundamentals in thermodynamics, in instrumentation and control engineering, as well as on the basis of the acquired knowledge of design of combined cycle plants, the participants can operate a real combined cycle power plant. This application creates a deeper understanding of the dynamic processes of the power plant, the specific importance of the plant components and the limits of the load capacity of the components. Participants can optimize normal operation and analyze incidents. They can work self-organized and reflexive. They have communicative and organizational skills in teamwork, even under major technical challenges.

Start-up of the power plant from scratch; load changes and shut down; dynamic response of the power plant in case of malfuctions and of sudden load changes; manual operation of selected components.

Literature
Vorlesungsskript und weitere Unterlagen der Vorlesung Gas- und Dampfkraftwerke.

Slides and other documents of the lecture Combined Cycle Power Plants.

T 3.308 Course: Solar Energy [T-ETIT-100774]

Responsible: Prof. Dr. Bryce Sydney Richards
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the Department of Electrical Engineering and Information Technology

Type	Credits	Recurrence	Version
Written examination	6	Each winter term	1

Events					
WS 19/20	2313745	Solar Energy	3 SWS	Lecture (V)	Richards, Paetzold
WS 19/20	2313750	Tutorial 2313745 Solar Energy	1 SWS	Practice (Ü)	Richards, Paetzold
Exams					
WS 19/20	7313745	Solar Energy		Prüfung (PR)	Richards

Prerequisites
Students not allowed to take either of the following modules in addition to this one: „Solarenergie“ (M-ETIT-100476) and „Photovoltaik“ (M-ETIT-100513).

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-ETIT-101939 - Photovoltaics must not have been started.

T 3.309 Course: Solar Thermal Energy Systems [T-MACH-106493]

Responsible: apl. Prof. Dr. Ron Dagan
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	3

Events					
WS 19/20	2189400	Solar Thermal Energy Systems	2 SWS	Lecture (V)	Dagan
Exams					
WS 19/20	76-T-MACH-106493	Solar Thermal Energy Systems		Prüfung (PR)	Dagan, Stieglitz
SS 2020	76-T-MACH-106493	Solar Thermal Energy Systems		Prüfung (PR)	Dagan

Competence Certificate
oral exam of about 30 minutes

Prerequisites
none

Recommendation
Literature

1. "Solar Engineering of Thermal Processes", 4th Edition, J. Duffie &W. Beckman. Published by Wiley & Sons
2. “Heat Transfer”, 10th Edition, J. P. Holman Mc. Graw Hill publisher
3. “Fundamentals of classical Thermodynamics”, G. Van Wylen & R. E. Sonntag. Published by Wiley &Sons

Below you will find excerpts from events related to this course:

V Solar Thermal Energy Systems
2189400, WS 19/20, 2 SWS, Language: English, Open in study portal

Lecture (V)

Content

The course deals with fundamental aspects of solar energy

1. Introduction to solar energy – global energy panorama

2. Solar energy resource-

Structure of the sun, Black body radiation, solar constant, solar spectral distribution

Sun-Earth geometrical relationship

3. Passive and active solar thermal applications.

4. Solar thermal systems- solar collector-types, concentrating collectors, solar towers,
Heat losses, efficiency

5. Selected topics on thermodynamics and heat transfer which are relevant for solar systems.

6. Introduction to Solar induced systems: Wind , Heat pumps, Biomass , Photovoltaic

7. Energy storage

The course deals with fundamental aspects of solar energy. Starting from a global energy panorama the course deals with the sun as a thermal energy source. In this context, basic issues such as the sun's structure, blackbody radiation and solar–earth geometrical relationship are discussed. In the next part, the lectures cover passive and active thermal applications and review various solar collector types including concentrating collectors and solar towers and the concept of solar tracking. Further, the collector design parameters determination is elaborated, leading to improved efficiency. This topic is augmented by a review of the main laws of thermodynamics and relevant heat transfer mechanisms.

The course ends with an overview on energy storage concepts which enhance practically the benefits of solar thermal energy systems.

The students get familiar with the global energy demand and the role of renewable energies learn about improved designs for using efficiently the potential of solar energy gain basic understanding of the main thermal hydraulic phenomena which support the work on future innovative applications will be able to evaluate quantitatively various aspects of the thermal solar systems.

Total 120 h, hereof 30 h contact hours and 90 h homework and self-studies

oral exam about 30 min.

Literature

- "Solar Engineering of Thermal Processes "4th Edition, J. Duffie &W. Beckman. Published by Wiley & Sons.
- "Heat Transfer", 10th Edition, P. Holman Mc. Graw Hill publisher.
- "Fundamentals of classical Thermodynamics", G. Van Wylen & R. E. Sonntag. Published by Wiley & Sons

T 3.310 Course: Solid State Reactions and Kinetics of Phase [T-MACH-107667]

Responsible: Dr. Peter Franke
Prof. Dr. Hans Jürgen Seifert

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	3

Events					
WS 19/20	2193003	Solid State Reactions and Kinetics of Phase Transformations (with exercises)	2 SWS	Lecture (V)	Franke
Exams					
WS 19/20	76-T-MACH-107667	Solid State Reactions and Kinetics of Phase		Prüfung (PR)	Seifert, Franke

Competence Certificate
oral examination (about 30 min)

Prerequisites
The successful participation in Exercises for Solid State Reactions and Kinetics of Phase Transformations is the condition for the admittance to the oral exam in Solid State Reactions and Kinetics of Phase.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-107632 - Exercises for Solid State Reactions and Kinetics of Phase Transformations must have been passed.

Recommendation
Bacic course in materials science and engineering

Basic course in mathematics

physical chemistry

Below you will find excerpts from events related to this course:

V Solid State Reactions and Kinetics of Phase Transformations (with exercises) — Lecture (V)

2193003, WS 19/20, 2 SWS, Language: German, Open in study portal

Content

Oral examination (about 30 min)

Teaching Content:

1. Crystal Defects and Mechanisms of Diffusion
2. Microscopic Description of Diffusion
3. Phenomenological Treatment
4. Diffusion Coefficients
5. Diffusion Problems; Analytical Solutions
6. Diffusion with Phase Transformation
7. Kinetics of Microstructural Transformations
8. Diffusion at Surfaces, Grain Boundaries and Dislocations
9. Numerical treatment of diffusion controlled phase transformations

Recommendations:

knowledge of the course "Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria" (Seifert); Bacic course in materials science and Engineering; Basic course in mathematics; physical chemistry

regular attendance: 22 hours

self-study: 98 hours

The students acquire knowledge about:

- diffusion mechanisms
- Fick's laws
- basic solutions of the diffusion equation
- evaluation of diffusion experiments
- interdiffusion processes
- the thermodynamic factor
- parabolic growth of layers
- formation of pearlite
- microstructural transformations according to the models of Avrami and Johnson-Mehl
- TTT diagrams

Literature

1. J. Crank, "The Mathematics of Diffusion", 2nd Ed., Clarendon Press, Oxford, 1975.
2. J. Philibert, "Atom Movements", Les Éditions de Physique, Les Ulis, 1991.
3. D.A. Porter, K.E. Easterling, M.Y. Sherif, "Phase Transformations in Metals and Alloys", 3rd edition, CRS Press, 2009.
4. H. Mehrer, "Diffusion in Solids", Springer, Berlin, 2007.

T 3.311 Course: Strategic Product Development - Identification of Potentials of Innovative Products [T-MACH-105696]

Responsible: Prof. Dr.-Ing. Albert Albers
Prof. Dr.-Ing. Sven Matthiesen
Dr.-Ing. Andreas Siebe

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104851 - Major Field Product Development and Construction

Type	Credits	Recurrence	Version
Oral examination	3	Each summer term	2

Events					
SS 2020	2146198	Strategic product development - identification of potentials of innovative products	2 SWS	Lecture (V)	Siebe

Competence Certificate
Oral exam in small groups (30 minutes)

Prerequisites
The precondition of this partial work is the successful processing of a case study(T-MACH-110396): written elaboration & presentation of the results (15 minutes)

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-110396 - Strategic Product Development - Identification of Potentials of Innovative Products - Case Study must have been passed.

Below you will find excerpts from events related to this course:

V Strategic product development - identification of potentials of innovative products — Lecture (V)

2146198, SS 2020, 2 SWS, Language: German, Open in study portal

Content
Introduction into future management, Development of scenarios, scenariobased strategy development, trendmanagement, strategic early detection, innovation- and technologymanagement, scenarios in product development, from profiles of requirements to new products, examples out of industrial praxis.

T 3.312 Course: Structural Analysis of Composite Laminates [T-MACH-105970]

Responsible: Dr.-Ing. Luise Kärger
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2113106	Structural Analysis of Composite Laminates	2 SWS	Lecture (V)	Kärger
Exams					
WS 19/20	76-T-MACH 105970	Structural Analysis of Composite Laminates		Prüfung (PR)	Kärger

Competence Certificate
oral exam, 20 min

Prerequisites
none

Below you will find excerpts from events related to this course:

V Structural Analysis of Composite Laminates

Lecture (V)

2113106, WS 19/20, 2 SWS, Language: German, Open in study portal

T 3.313 Course: Structural Ceramics [T-MACH-102179]

Responsible: Prof. Dr. Michael Hoffmann
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2126775	Structural Ceramics	2 SWS	Lecture (V)	Hoffmann
Exams					
WS 19/20	76-T-MACH-102179	Structural Ceramics		Prüfung (PR)	Hoffmann, Wagner, Schell

Competence Certificate
Oral examination, 20 min

Prerequisites
none

Below you will find excerpts from events related to this course:

V Structural Ceramics

2126775, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Literature
W.D. Kingery, H.K. Bowen, D.R. Uhlmann, "Introduction to Ceramics", John Wiley & Sons, New York, (1976)

E. Dörre, H. Hübner, "Aluminia", Springer Verlag Berlin, (1984)

M. Barsoum, "Fundamentals of Ceramics", McGraw-Hill Series in Material Science and Enginewering (2003)

T 3.314 Course: Structural Materials [T-MACH-100293]

Responsible: Dr.-Ing. Stefan Guth
Dr. Karl-Heinz Lang

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Oral examination	6	Each summer term	2

Events					
SS 2020	2174580	Structural Materials	4 SWS	Lecture / Practice (VÜ)	Guth, Lang
Exams					
WS 19/20	76-T-MACH-100293	Structural Materials		Prüfung (PR)	Lang, Guth
SS 2020	76-T-MACH-100293	Structural Materials		Prüfung (PR)	Lang, Guth

Competence Certificate
Oral exam, about 25 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Structural Materials

2174580, SS 2020, 4 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Content
The lectures will be held online. Further information will be available on ILIAS.

Lectures and tutorialy on the topics:

- basic loading types and superimposed loadings
- high-temperature loading
- influence of notches
- uniaxial, multiaxial and superimposed cyclic loading
- notch fatigue
- structural durability
- impact of residual stresses
- basic principles of materials selection
- dimensioning of components

learning objectives:
The students are able to select materials for mechanical design and to dimension structural components according to the state of the art. They are familiar with the most important engineering materials. They can assess these materials on base of their characteristic properties and and they can match property profiles and requirement profiles. The dimensioning includes complex situations, such as multiaxial loading, notched components, static and dynamic loading, componetns with residual stresses and loading at high homologous temperatures.

requirements:
none

workload:

Precence: 42h

Self study: 138h

T 3.315 Course: Superconducting Materials for Energy Applications [T-ETIT-106970]

Responsible: Dr. Francesco Grilli
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the Department of Electrical Engineering and Information Technology

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	1

Prerequisites
none

Recommendation
Basic knowledge in the fields of Electrical Engineering and Thermodynamics is helpful.

Annotation
Exam and Lecture will be held in English.

Elective Course in other Field of Specializations.

T 3.316 Course: Superhard Thin Film Materials [T-MACH-102103]

Responsible: Prof. Dr. Sven Ulrich
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	2

Events					
WS 19/20	2177618	Superhard Thin Film Materials	2 SWS	Lecture (V)	Ulrich
Exams					
WS 19/20	76-T-MACH-102103	Superhard Thin Film Materials		Prüfung (PR)	Ulrich
SS 2020	76-T-MACH-102103	Superhard Thin Film Materials		Prüfung (PR)	Ulrich

Competence Certificate
oral examination (ca. 30 Minuten)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Superhard Thin Film Materials

Lecture (V)

2177618, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
oral examination (about 30 min), no tools or reference materials

Teaching Content:

Introduction

Basics

Plasma diagnostics

Particle flux analysis

Sputtering and ion implantation

Computer simulations

Properties of materials, thin film deposition technology,
thin film analysis and modelling of superhard materials

Amorphous hydrogenated carbon

Diamond like carbon

Diamond

Cubic Boronnitride

Materials of the system metall-boron-carbon-nitrogen-silicon

regular attendance: 22 hours
self-study: 98 hours

Superhard materials are solids with a hardness higher than 4000 HV 0,05. The main topics of this lecture are modelling, deposition, characterization and application of superhard thin film materials.

Recommendations: none

Literature
G. Kienel (Herausgeber): Vakuumbeschichtung 1 - 5, VDI Verlag, Düsseldorf, 1994

Abbildungen und Tabellen werden verteilt; Copies with figures and tables will be distributed

T 3.317 Course: Sustainable Product Engineering [T-MACH-105358]

Responsible: Prof. Dr.-Ing. Albert Albers
Prof. Dr.-Ing. Sven Matthiesen
Dr. Karl-Friedrich Ziegahn

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104851 - Major Field Product Development and Construction

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	1

Events					
SS 2020	2146192	Sustainable Product Engineering	2 SWS	Lecture (V)	Ziegahn

Competence Certificate
written exam (60 min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V Sustainable Product Engineering
2146192, SS 2020, 2 SWS, Open in study portal

Lecture (V)

Content
understanding of sustainability objectives and their role in product development, the interaction between technical products and their environment, the holistic approach and the equality of economic, social and environmental aspects and environmental aspects

skills for life-cycle product design using the example of complex automotive components such as airbag systems and other current products

understanding of product environmental stresses with relevancy to praxis at the example of technology-intensive components, robustness and durability of products as the basis for a sustainable product development, development of skills for the application of environmental simulationduring the process of developement of technical products

delivery of key skills such as team skills / project / self / presentation based on realistic projects

The goal of the lecture is to convey the main elements of sustainable product development in the economic, social and ecological context.

The students are able to ...

- identify und describe the sustainability objectives and their role in product development, the interaction between technical products and their environment, the holistic approach and the equality of economic, social and environmental aspects and environmental aspects.
- discuss the skills for life-cycle product design using the example of complex automotive components such as airbag systems and other current products.
- understand the product environmental stresses with relevancy to praxis at the example of technology-intensive components, robustness and durability of products as the basis for a sustainable product development, development of skills for the application of environmental simulationduring the process of developement of technical products.
- develop skills such as team skills / project / self / presentation based on realistic projects.

T 3.318 Course: System Dynamics and Control Engineering [T-ETIT-101921]

Responsible: Prof. Dr.-Ing. Sören Hohmann
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the Department of Electrical Engineering and Information Technology

Type	Credits	Recurrence	Version
Written examination	6	Each winter term	2

Exams				
WS 19/20	7303155	System Dynamics and Control Engineering	Prüfung (PR)	Hohmann

Prerequisites
none

T 3.319 Course: System Integration in Micro- and Nanotechnology [T-MACH-105555]

Responsible: Dr. Ulrich Gengenbach
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104850 - Major Field Mechatronics and Microsystem Technology

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2106033	System Integration in Micro- and Nanotechnology I	2 SWS	Lecture (V)	Gengenbach

Competence Certificate
oral exam (Duration: 30 min)

Prerequisites
none

Below you will find excerpts from events related to this course:

V System Integration in Micro- and Nanotechnology I

2106033, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Content:

- Introduction to system integration (fundamentals)
- Brief introduction to MEMS processes
- Flexures
- Surfaces and plasma processes for surface treatment
- Adhesive bonding in engineering
- Mounting techniques in electronics
- Molded Interconnect devices (MID)
- Functional Printing
- Low temperature cofired ceramics in system integration
- 3D-Integration in semiconductor technology

Learning objectives:
The students acquire basic knowledge of challenges and system integration technologies from mechanical engineering, precision engineering and electronics.

Literature

- A. Risse, Fertigungsverfahren der Mechatronik, Feinwerk- und Präzisionsgerätetechnik, Vieweg+Teubner Verlag, Wiesbaden, 2012
- M. Madou, Fundamentals of microfabrication and nanotechnology, CRC Press Boca Raton, 2012
- G. Habenicht, Kleben Grundlagen, Technologien, Anwendungen, Springer-Verlag Berlin Heidelberg, 2009
- J. Franke, Räumliche elektronische Baugruppen (3D-MID), Carl Hanser-Verlag München, 2013

3.320 Course: Systematic Materials Selection [T-MACH-100531]

Responsible: Dr.-Ing. Stefan Dietrich
Prof. Dr.-Ing. Volker Schulze

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	3

Events					
SS 2020	2174576	Systematic Materials Selection	3 SWS	Lecture (V)	Dietrich
SS 2020	2174577	Übungen zu 'Systematische Werkstoffauswahl'	1 SWS	Practice (Ü)	Dietrich, Mitarbeiter
Exams					
WS 19/20	76-T-MACH-100531	Systematic Materials Selection		Prüfung (PR)	Dietrich
SS 2020	76-T-MACH-100531	Systematic Materials Selection		Prüfung (PR)	Dietrich

Competence Certificate
The assessment is carried out as a written exam of 2 h.

Prerequisites
none

Recommendation
Basic knowledge in materials science, mechanics and mechanical design due to the lecture Materials Science I/II.

Below you will find excerpts from events related to this course:

V Systematic Materials Selection

Lecture (V)

2174576, SS 2020, 3 SWS, Language: German, Open in study portal

Content
Important aspects and criteria of materials selection are examined and guidelines for a systematic approach to materials selection are deeloped. The following topics are covered:

- Information and introduction
- Necessary basics of materials
- Selected methods / approaches of the material selection
- Examples for material indices and materials property charts
- Trade-off and shape factors
- Sandwich materials and composite materials
- High temperature alloys
- Regard of process influences
- Material selection for production lines
- Incorrect material selection and the resulting consequences
- Abstract and possibility to ask questions

learning objectives:
The students are able to select the best material for a given application. They are proficient in selecting materials on base of performance indices and materials selection charts. They can identify conflicting objectives and find sound compromises. They are aware of the potential and the limits of hybrid material concepts (composites, bimaterials, foams) and can determine whether following such a concept yields a useful benefit.
requirements:

WiIng SPO 2007 (B.Sc.)

The course Material Science I [21760] has to be completed beforehand.

WiIng (M.Sc.)

The course Material Science I [21760] has to be completed beforehand.

workload:

The workload for the lecture is 120 h per semester and consists of the presence during the lecture (30 h) as well as preparation and rework time at home (30 h) and preparation time for the oral exam (60 h).

Literature
Vorlesungsskriptum; Übungsblätter; Lehrbuch: M.F. Ashby, A. Wanner (Hrsg.), C. Fleck (Hrsg.);
Materials Selection in Mechanical Design: Das Original mit Übersetzungshilfen
Easy-Reading-Ausgabe, 3. Aufl., Spektrum Akademischer Verlag, 2006
ISBN: 3-8274-1762-7

Lecture notes; Problem sheets; Textbook: M.F. Ashby, A. Wanner (Hrsg.), C. Fleck (Hrsg.);
Materials Selection in Mechanical Design: Das Original mit Übersetzungshilfen
Easy-Reading-Ausgabe, 3. Aufl., Spektrum Akademischer Verlag, 2006
ISBN: 3-8274-1762-7

T 3.321 Course: Systems Engineering for Automotive Electronics [T-ETIT-100677]

Responsible: Dr.-Ing. Jürgen Bortolazzi
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the Department of Electrical Engineering and Information Technology

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	1

Events					
SS 2020	2311642	Systems Engineering for Automotive Electronics	2 SWS	Lecture (V)	Bortolazzi
SS 2020	2311644	Tutorial for 2311642 Systems Engineering for Automotive Electronics	1 SWS	Practice (Ü)	Pistorius
Exams					
SS 2020	7311642	Systems Engineering for Automotive Electronics		Prüfung (PR)	Bortolazzi

Prerequisites
none

T 3.322 Course: Technical Design in Product Development [T-MACH-105361]

Responsible: Prof. Dr.-Ing. Albert Albers
Prof. Dr.-Ing. Sven Matthiesen
Dr.-Ing. Markus Schmid

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104851 - Major Field Product Development and Construction

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	1

Events					
SS 2020	2146179	Technical Design in Product Development	2 SWS	Lecture (V)	Schmid

Competence Certificate
Written exam (60 min)

Only dictionnary is allowed

Prerequisites
none

Below you will find excerpts from events related to this course:

V Technical Design in Product Development

2146179, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Introduction
Relevant parameters on product value in Technical Design
Design in Methodical Development and Engineering and for a differentiated validation of products
Design in the concept stage of Product Development
Design in the draft and elaboration stage of Product Development

Best Practice

After listening the module "technical design" the students should have knowledge about the basics of technical oriented design as an integral part of the methodical product development

The students have knowledge about ...

- the interface between engineer and designer.
- all relevant human-product requirements as f. exp. demographic/ geographic and psychographic features, relevant perceptions, typical content recognition as well as ergonomic bases.
- the approaches concerning the design of a product, product program or product system with focus on structure, form-, color- and graphic design within the phases of the design process.
- the design of functions and supporting structures as well as the important interface between human and machine.
- relevant parameters of a good corporate design.

Literature

Markus Schmid, Thomas Maier
Technisches Interface Design
Anforderungen, Bewertung, Gestaltung.
Springer Vieweg Verlag (http://www.springer.com/de/book/9783662549476)
Hardcover ISBN: 978-3-662-54947-6 / eBook ISBN: 978-3-662-54948-3
2017

Hartmut Seeger
Design technischer Produkte, Produktprogramme und -systeme
Industrial Design Engineering.
2. , bearb. und erweiterte Auflage.
Springer-Verlag GmbH (http://www.springer.com/de/book/9783540236535)
ISBN: 3540236538
September 2005 - gebunden - 396 Seiten

T 3.323 Course: Technical Energy Systems for Buildings 1: Processes & Components [T-MACH-105559]

Responsible: Dr. Ferdinand Schmidt
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2157200	Technical energy systems for buildings 1: Processes & components	2 SWS	Lecture (V)	Schmidt
Exams					
WS 19/20	76-T-MACH-105559	Technical Energy Systems for Buildings 1: Processes & Components		Prüfung (PR)	Schmidt
SS 2020	76-T-MACH-105559	Technical Energy Systems for Buildings 1: Processes & Components		Prüfung (PR)	Schmidt

Competence Certificate
oral exam, 30 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Technical energy systems for buildings 1: Processes & components — Lecture (V)

2157200, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
Introduction to heating and cooling technologies for buildings, solar energy utilization in buildings (solar radiation, solar thermal energy, photovoltaics) and to energy storage in buildings (thermal and electric storage technologies). Topics covered:

- Burners, condensing and non-condensing boilers
- Cogeneration units for use in buildings
- Heat transformation: Fundamentals, vapor compression, absorption, adsorption
- Solar energy: Radiation, solar thermal collectors, photovoltaics
- energy storage in buildings: thermal and electric storage

Learning objectives:

Students know relevant technical components of energy supply systems in buildings (heating and cooling, dehumidification). They know the energy conversion processes associated with these components and can estimate their energy efficiencies as well as the most important factors influencing efficiency.

Students are familiar with the underlying physics (mostly thermodynamics) of the relevant processes. They can derive relevant figures of merit from these principles. They know the degree of technological development for the various processes and components and are aware of current research and development objectives in this field.

Oral exam: about 25 min.
No tools

T 3.324 Course: Technical Energy Systems for Buildings 2: System Concept [T-MACH-105560]

Responsible: Dr. Ferdinand Schmidt
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2158201	Technical energy systems for buildings 2: System concepts	2 SWS	Lecture (V)	Schmidt
Exams					
WS 19/20	76-T-MACH-105560	Technical Energy Systems for Buildings 2: System Concept		Prüfung (PR)	Schmidt
SS 2020	76-T-MACH-105560	Technical Energy Systems for Buildings 2: System Concept		Prüfung (PR)	Schmidt

Competence Certificate
oral exam, 30 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Technical energy systems for buildings 2: System concepts

Lecture (V)

2158201, SS 2020, 2 SWS, Language: German, Open in study portal

Content
Introduction of relevant figures of merit for technical energy systems in buildings. Description of different system concepts for energy supply of buildings (heating, cooling, dehumidification) and evaluation according to figures of merit. Systems covered include

- Heat pumps and heat pump systems including combination with solar thermal energy
- cogeneration and trigeneration system (heating, cooling, power)
- Solar thermal systems: Domestic hot water, heating support, cooling and dehumidification
- District heating systems including solar thermal heat
- Photovoltaics and heat pump systems including thermal and battery storage
- Grid-reactive building technology: Smart-Metering, Smart Home, Smart Grid

Learning outcomes:

Students are able to develop system concepts for technical energy systems in buildings and to rationally design such systems. They know the relevant figures of merit for an energy-related as well as an economical or combined evaluation of systems, and know how to employ these figures of merit in sizing systems and components. Students are able to employ plausibility checks and to give rough estimates on building energy concepts and they know which technologies can be combined for highly efficient system combinations.

Workload: 30 hours course attendance, 90 hours self-study

Oral exam appr. 25 minutes

T 3.325 Course: Technical Thermodynamics and Heat Transfer I [T-MACH-104747]

Responsible: Prof. Dr. Ulrich Maas
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104847 - Major Field Fundamentals of Engineering

Type	Credits	Recurrence	Version
Written examination	8	Each winter term	2

Events					
WS 19/20	2165501	Technical Thermodynamics and Heat Transfer I	4 SWS	Lecture (V)	Maas
WS 19/20	3165014	Technical Thermodynamics and Heat Transfer I	4 SWS	Lecture (V)	Schießl, Maas
Exams					
WS 19/20	76-T-MACH-104747	Technical Thermodynamics and Heat Transfer I		Prüfung (PR)	Maas
WS 19/20	76-T-MACH-104747-english	Technical Thermodynamics and Heat Transfer I		Prüfung (PR)	Maas
WS 19/20	76-T-MACH-104747-Wiederholer	Technical Thermodynamics and Heat Transfer I		Prüfung (PR)	Maas

Competence Certificate
Written exam [duration: 180 min]

Prerequisites
Successful participation in the tutorial (T-MACH-105204 - Excercises in Technical Thermodynamics and Heat Transfer I)

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105204 - Excercises in Technical Thermodynamics and Heat Transfer I must have been passed.

Below you will find excerpts from events related to this course:

V Technical Thermodynamics and Heat Transfer I

Lecture (V)

2165501, WS 19/20, 4 SWS, Language: German, Open in study portal

Literature
Vorlesungsskriptum

Elsner, N.; Dittmann, A.: Energielehre und Stoffverhalten (Grundlagen der technischen Thermodynamik Bd. 1 und 2), 8. Aufl., Akademie-Verlag, 680 S. 1993.

Baehr, H.D.: Thermodynamik: eine Einführung in die Grundlagen und ihre technischen Anwendungen, 9. Aufl., Springer-Verlag, 460 S., 1996.

T 3.326 Course: Technical Thermodynamics and Heat Transfer II [T-MACH-105287]

Responsible: Prof. Dr. Ulrich Maas
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104847 - Major Field Fundamentals of Engineering

Type	Credits	Recurrence	Version
Written examination	7	Each summer term	1

Events					
SS 2020	2166526	Technical Thermodynamics and Heat Transfer II	3 SWS	Lecture (V)	Maas
SS 2020	3166526	Technical Thermodynamics and Heat Transfer II	3 SWS	Lecture (V)	Schießl
Exams					
WS 19/20	76-T-MACH-105287	Technical Thermodynamics and Heat Transfer II		Prüfung (PR)	Maas
WS 19/20	76-T-MACH-105287-english	Technical Thermodynamics and Heat Transfer II		Prüfung (PR)	Maas
WS 19/20	76-T-MACH-105287-Wiederholer	Technical Thermodynamics and Heat Transfer II		Prüfung (PR)	Maas

Competence Certificate
Written exam [duration: 180 min]

Prerequisites
Successful participation in the tutorial (T-MACH-105288 - Exercises in Technical Thermodynamics and Heat Transfer II)

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105288 - Excercises in Technical Thermodynamics and Heat Transfer II must have been passed.

Below you will find excerpts from events related to this course:

V Technical Thermodynamics and Heat Transfer II

Lecture (V)

2166526, SS 2020, 3 SWS, Language: German, Open in study portal

Content
Repetition of the topics of "Thermodynamics and Heat Transfer I"
Mixtures of ideal gases
Moist air
Behaviour of real substances described by equations of state
Applications of the laws of thermodynamics to chemical reactions

Literature
Vorlesungsskriptum

Elsner, N.; Dittmann, A.: Energielehre und Stoffverhalten (Grundlagen der technischen Thermodynamik Bd. 1 und 2), 8. Aufl., Akademie-Verlag, 680 S. 1993.

Baehr, H.D.: Thermodynamik: eine Einführung in die Grundlagen und ihre technischen Anwendungen, 9. Aufl., Springer-Verlag, 460 S., 1996.

T 3.327 Course: Technology of Steel Components [T-MACH-105362]

Responsible: Prof. Dr.-Ing. Volker Schulze
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	2

Events					
SS 2020	2174579	Technology of steel components	2 SWS	Lecture (V)	Schulze
Exams					
WS 19/20	76-T-MACH-105362	Technology of Steel Components		Prüfung (PR)	Schulze
SS 2020	76-T-MACH-105362	Technology of Steel Components		Prüfung (PR)	Schulze

Competence Certificate
Oral exam, about 25 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Technology of steel components
2174579, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Meaning, Development and characterization of component states

Description of the influence of component state on mechanical properties

Stability of component states

Steel manufacturing

Component states due to forming

Component states due to heat treatments

Component states due to surface hardening

Component states due to machining

Component states due to mechanical surface treatments

Component states due to joining

Summarizing evaluation

learning objectives:
The students have the background to evaluate the influence of manufacture processes on the compound state of metallic compounds. The students can assess the influence and the stability of compound state under mechanical load. The students are capable to describe the individual aspects of interaction of the compound state of steel components due to forming, heat treatment, mechanical surface treatment and joining processes.
requirements:
Materials Science and Engineering I & II
workload:

regular attendance: 21 hours
self-study: 99 hours

Literature
Skript wird in der Vorlesung ausgegeben

VDEh: Werkstoffkunde Stahl, Bd. 1: Grundlagen, Springer-Verlag, 1984

H.-J. Eckstein: Technologie der Wärmebehandlung von Stahl, Deutscher Verlag Grundstoffindustrie, 1977

H.K.D.H. Badeshia, R.W.K. Honeycombe, Steels - Microstructure and Properties, CIMA Publishing, 3. Auflage, 2006

V. Schulze: Modern Mechanical Surface Treatments, Wiley, Weinheim, 2005

T 3.328 Course: Ten Lectures on Turbulence [T-MACH-105456]

Responsible: Dr. Ivan Otic
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104878 - Specification in Mechanical Engineering
M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2189904	Ten lectures on turbulence	2 SWS	Lecture (V)	Otic
Exams					
WS 19/20	76-T-MACH-105456	Ten Lectures on Turbulence		Prüfung (PR)	Otic

Competence Certificate
oral exam, 20 min

Prerequisites
none

Below you will find excerpts from events related to this course:

V Ten lectures on turbulence
2189904, WS 19/20, 2 SWS, Language: English, Open in study portal

Lecture (V)

Content
Contents:

The course is aimed of giving the fundamentals of turbelence theory, modelling and simulation. Governing equations and statistical description of turbulence are introduced. Reynolds equations, Kolmogorov's theory and scales of turbulent ows are discussed. Homogeneous and isotropic turbulence. Turbulent free-shear ows and wall-bounded turbulent ows are discussed. Turbulence modelling approaches and simulation methods are introduced.

1 Introduction
2 Turbulent transport of momentum and heat
3 Statistical description of turbulence
4 Scales of turbulent flows
5 Homogeneous turbulent shear flows
6 Free turbulent shear flows
7 Wall-Bounded turbulent flows
8 Turbulence Modelling
9 Reynolds Averaged Navier-Stokes (RANS) Simulation Approach
10 Large Eddy Simulation (LES) Approach

Objectives:

At the completion of this course, students
- are able to understand fundamentals of statistical fluid mechanics, turbulence theory and turbulence modelling
- are able to derive RANS and LES transport equations
- get working knowledge of modelling techniques that can be used for solving engineering heat and mass transfer problems.

Literature
Reference texts:
- Lecture Notes
- Presentation slides

Recommended Books:
- Pope, S. B.: Turbulent Flows. Cambridge University Press, 2003.
- Hinze J. O.: Turbulence. McGraw-Hill, 1975.

T 3.329 Course: Theory of Probability [T-ETIT-101952]

Responsible: Dr.-Ing. Holger Jäkel
Organisation: KIT Department of Electrical Engineering and Information Technology
Part of: M-MACH-104882 - Courses of the Department of Electrical Engineering and Information Technology

Type	Credits	Recurrence	Version
Written examination	5	Each winter term	1

Events					
WS 19/20	2310505	Theory of Probability	2 SWS	Lecture (V)	Jäkel
WS 19/20	2310507	Tutorial for 2310505 Theory of Probability	1 SWS	Practice (Ü)	Müller
Exams					
WS 19/20	7310505	Theory of Probability		Prüfung (PR)	Jäkel

Prerequisites
none

T 3.330 Course: Theory of Stability [T-MACH-105372]

Responsible: Prof. Dr.-Ing. Alexander Fidlin
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104853 - Major Field Theoretical Foundations of Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	6	Each summer term	1

Events					
SS 2020	2163113	Theory of Stability	2 SWS	Lecture (V)	Fidlin
SS 2020	2163114	Übungen zu Stabilitätstheorie	2 SWS	Practice (Ü)	Fidlin, Aramendiz Fuentes
Exams					
WS 19/20	76-T-MACH-105372	Theory of Stability		Prüfung (PR)	Fidlin
SS 2020	76-T-MACH-105372	Theory of Stability		Prüfung (PR)	Fidlin

Competence Certificate
oral exam, 30 min.

Prerequisites
none

Recommendation
Vibration theory, Mathematical Methods of Vibration Theory

Below you will find excerpts from events related to this course:

V Theory of Stability

Lecture (V)

2163113, SS 2020, 2 SWS, Language: German, Open in study portal

Content

- Basic concepts of stability
- Lyapunov's functions
- Direct lyapunov's methods
- Stability of equilibria positions
- Attraction area of a stable solution
- Stability according to the first order approximation
- Systems with parametric excitation
- Stability criteria in the control theory

Literature

- Pannovko Y.G., Gubanova I.I. Stability and Oscillations of Elastic Systems, Paradoxes, Fallacies and New Concepts. Consultants Bureau, 1965.
- Hagedorn P. Nichtlineare Schwingungen. Akademische Verlagsgesellschaft, 1978.
- Thomsen J.J. Vibration and Stability, Order and Chaos. McGraw-Hill, 1997.

T 3.331 Course: Thermal Solar Energy [T-MACH-105225]

Responsible: Prof. Dr. Robert Stieglitz
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2169472	Thermal Solar Energy	2 SWS	Lecture (V)	Stieglitz
Exams					
WS 19/20	76-T-MACH-105225	Thermal Solar Energy		Prüfung (PR)	Stieglitz
SS 2020	76-T-MACH-105225	Thermal Solar Energy		Prüfung (PR)	Stieglitz

Competence Certificate
Oral examination, 30 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Thermal Solar Energy

2169472, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Basics of thermal solar energy (radiation, heat conduction, storage, efficiency...) Active and passive use of solar energy. Solar collectors (design types, efficiency, system technology). Solar plants (heliostats etc.). Solar climatisation.

In detail:

1 Introduction to energy requirements and evaluation of the potential use of solar thermal energy.

2 Primary energy source SUN: sun, solar constant, radiation (direct, diffuse scattering, absorption, impact angle, radiation balance).

3 Solar collectors: schematic structure of a collector, fundamentals of efficiency, meaning of concentration and their limitations.

4 Passive solar mechanisms: heat conduction in solids and gases, radiation heat transfer in transparent and opaque bodies, selective absorber - typical materials and manufacturing processes.

5 Momentum and heat transport: basic equations of single and multiphase transport, calculation methods, stability limits.

optional

6 Low temperature solar thermal systems: collector types, methods for system simulation, planning and dimensioning of systems, system design and stagnation scenarios.

7 High temperature solar thermal systems: solar towers and solar-farm concept, loss mechanisms, chimney power plants and energy production processes

The lecture elaborates the basics of the solar technology and the definition of the major wordings and its physical content such as radiation, thermal use, insulation etc.. Further the design of solar collectors for different purposes is discussed and analyzed. The functional principle of solar plants is elaborated before at the end the ways for solar cooling is discussed.

The aim of the course is to provide the basic physical principles and the derivation of key parameters for the individual solar thermal use. This involves in addition to the selective absorber, mirrors, glasses, and storage technology. In addition, a utilization of solar thermal energy means an interlink of the collector with a thermal-hydraulic circuit and a storage. The goal is to capture the regularities of linking to derive efficiency correlations as a function of their use and evaluate the performance of the entire system.

Recommendations / previous knowledge

Basics in heat and mass transfer, material science and fluid mechanics, desirable are reliable knowledge in physics in optics and thermodynamics

Oral exam of about 25 minutes, no tools or reference materials may be used during the exam

Literature

Bereitstellung des Sudienmaterials in gedruckter und elektronischer Form.

Stieglitz & Heinzel; Thermische Solarenergie -Grundlagen-Technologie- Anwendungen. Springer Vieweg Verlag. 711 Seiten. ISBN 978-3-642-29474-7

T 3.332 Course: Thermal Turbomachines I [T-MACH-105363]

Responsible: Prof. Dr.-Ing. Hans-Jörg Bauer
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering
M-MACH-104878 - Specification in Mechanical Engineering
M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	6	Each winter term	1

Events					
WS 19/20	2169453	Thermal Turbomachines I	3 SWS	Lecture / Practice (VÜ)	Bauer
WS 19/20	2169454	Tutorial - Thermal Turbo Machines I (Übungen zu Thermische Turbomaschinen I)	2 SWS	Practice (Ü)	Bauer
WS 19/20	2169553	Thermal Turbomachines I (in English)	3 SWS	Lecture / Practice (VÜ)	Bauer
Exams					
WS 19/20	76-T-MACH-105363	Thermal Turbomachines I		Prüfung (PR)	Bauer
WS 19/20	76-T-MACH-105363-Wdh	Thermal Turbomachines I (for repeaters)		Prüfung (PR)	Bauer
SS 2020	76-T-MACH-105363	Thermal Turbomachines I		Prüfung (PR)	Bauer

Competence Certificate
oral exam, duration 30 min.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Thermal Turbomachines I

2169453, WS 19/20, 3 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Content
Basic concepts of thermal turbomachinery

Steam Turbines - Thermodynamic process analysis

Gas Turbines - Thermodynamic process analysis

Combined cycle and cogeneration processes

Overview of turbomachinery theory and kinematics

Energy transfer process within a turbine stage

Types of turbines (presented through examples)

1-D streamline analysis techniques

3-D flow fields and radial momentum equilibrium in turbines

Compressor stage analysis and future trends in turbomachinery

The students are able to explain and comment on the design and operation of thermal turbomachines in detail. Moreover, they can evaluate the range of applications for turbomachinery. Therefore, students are able to to describe and analyse not only the individual components but also entire assemblies. The students can asses and evaluate the effects of physical, economical and ecological boundary conditions.

regular attendance: 31,50 h
self-study: 64,40 h

Recommendations:

Recommended in combination with the lecture 'Thermal Turbomachines II'.

Examination:

oral
Duration: approximately 30 min

no tools or reference materials may be used during the exam

Literature
Vorlesungsskript (erhältlich im Internet)

Bohl, W.: Strömungsmaschinen, Bd. I, II; Vogel Verlag, 1990, 1991

Sigloch, H.: Strömungsmaschinen, Carl Hanser Verlag, 1993

Traupel, W.: Thermische Turbomaschinen Bd. I, II, Springer-Verlag, 1977, 1982

V **Thermal Turbomachines I (in English)** **Lecture / Practice (VÜ)**
2169553, WS 19/20, 3 SWS, Language: English, Open in study portal

Content
Basic concepts of thermal turbomachinery

Steam Turbines - Thermodynamic process analysis

Gas Turbines - Thermodynamic process analysis

Combined cycle and cogeneration processes

Overview of turbomachinery theory and kinematics

Energy transfer process within a turbine stage

Types of turbines (presented through examples)

1-D streamline analysis techniques

3-D flow fields and radial momentum equilibrium in turbines

Compressor stage analysis and future trends in turbomachinery

Recommendations:

Recommended in combination with the lecture 'Thermal Turbomachines II'.

The students are able to explain and comment on the design and operation of thermal turbomachines in detail. Moreover, they can evaluate the range of applications for turbomachinery. Therefore, students are able to to describe and analyse not only the individual components but also entire assemblies. The students can asses and evaluate the effects of physical, economical and ecological boundary conditions.

regular attendance: 31,50 h
self-study: 64,40 h

Exam:

oral
Duration: approximately 30 min

no tools or reference materials may be used during the exam

Literature

Vorlesungsskript (erhältlich im Internet)

Bohl, W.: Strömungsmaschinen, Bd. I, II; Vogel Verlag, 1990, 1991

Sigloch, H.: Strömungsmaschinen, Carl Hanser Verlag, 1993

Traupel, W.: Thermische Turbomaschinen Bd. I, II, Springer-Verlag, 1977, 1982

T 3.333 Course: Thermal Turbomachines II [T-MACH-105364]

Responsible: Prof. Dr.-Ing. Hans-Jörg Bauer
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering
M-MACH-104878 - Specification in Mechanical Engineering
M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	6	Each summer term	2

Events					
SS 2020	2170476	Thermal Turbomachines II	3 SWS	Lecture (V)	Bauer
SS 2020	2170477	Tutorial - Thermal Turbomachines II (Übung - Thermische Turbomaschinen II)	2 SWS	Practice (Ü)	Bauer, Mitarbeiter
SS 2020	2170553	Thermal Turbomachines II (in English)	3 SWS	Lecture / Practice (VÜ)	Bauer, Mitarbeiter
Exams					
WS 19/20	76-T-MACH-105364	Thermal Turbomachines II		Prüfung (PR)	Bauer
SS 2020	76-T-MACH-105364	Thermal Turbomachines II		Prüfung (PR)	Bauer

Competence Certificate
oral exam, duration: 30 min.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Thermal Turbomachines II — Lecture (V)
2170476, SS 2020, 3 SWS, Language: German, Open in study portal

Content
General overview, trends in design and development

Comparison turbine - compressor

Integrating resume of losses

Principal equations and correlations in turbine and compressor design, stage performance

Off-design performance of multi-stage turbomachines

Control system considerations for steam and gas turbines

Components of turbomachines

Critical components

Materials for turbine blades

Cooling methods for turbine blades (steam and air cooling methods)

Short overview of power plant operation

Combustion chamber and environmental issues

Based on the fundamental skills learned in 'Thermal Turbomachines I' the students have the ability to design turbines and compressors and to analyse the operational behavior of these machines.

Recommendations:

Recommended in combination with the lecture 'Thermal Turbomachines I'.

regular attendance: 31,50 h
self-study: 64,40 h

Exam:

oral (can only be taken in combination with 'Thermal Turbomachines I')
Duration: 30 min (--> 1 hour including Thermal Turbomachines I)

Auxiliary: no tools or reference materials may be used during the exam

Literature
Vorlesungsskript (erhältlich im Internet)
Bohl, W.: Strömungsmaschinen, Bd. I,II, Vogel Verlag 1990, 1991
Sigloch, H.: Strömungsmaschinen, Carl Hanser Verlag, 1993
Traupel, W.: Thermische Turbomaschinen, Bd. I,II, Springer-Verlag, 1977, 1982

V **Thermal Turbomachines II (in English)** **Lecture / Practice (VÜ)**
2170553, SS 2020, 3 SWS, Language: English, Open in study portal

Content
Basic concepts of thermal turbomachinery

Steam Turbines - Thermodynamic process analysis

Gas Turbines - Thermodynamic process analysis

Combined cycle and cogeneration processes

Overview of turbomachinery theory and kinematics

Energy transfer process within a turbine stage

Types of turbines (presented through examples)

1-D streamline analysis techniques

3-D flow fields and radial momentum equilibrium in turbines

Compressor stage analysis and future trends in turbomachinery

Recommendations:

Recommended in combination with the lecture 'Thermal Turbomachines II'.

regular attendance: 31,50 h
self-study: 64,40 h

The students are able to explain and comment on the design and operation of thermal turbomachines in detail. Moreover, they can evaluate the range of applications for turbomachinery. Therefore, students are able to to describe and analyse not only the individual components but also entire assemblies. The students can asses and evaluate the effects of physical, economical and ecological boundary conditions.

Exam:

oral

Duration: approximately 30 min

no tools or reference materials may be used during the exam.

Literature
Vorlesungsskript (erhältlich im Internet)

Bohl, W.: Strömungsmaschinen, Bd. I, II; Vogel Verlag, 1990, 1991

Sigloch, H.: Strömungsmaschinen, Carl Hanser Verlag, 1993

Traupel, W.: Thermische Turbomaschinen Bd. I, II, Springer-Verlag, 1977, 1982

T 3.334 Course: Thermal-Fluid-Dynamics [T-MACH-106372]

Responsible: Dr. Sebastian Ruck
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2189423	Thermal-Fluid-Dynamics	2 SWS	Lecture (V)	Ruck
Exams					
WS 19/20	76-T-MACH-106372	Thermal-Fluid-Dynamics		Prüfung (PR)	Ruck, Stieglitz
SS 2020	76-T-MACH-106372	Thermal-Fluid-Dynamics		Prüfung (PR)	Ruck

Competence Certificate
oral exam of about 30 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Thermal-Fluid-Dynamics

Lecture (V)

2189423, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
Content

- Fundamentals of flows and heat transfer
- Dimensionless parameters of thermal fluid dynamics
- Laminar and turbulent thermal boundary layer equations
- Velocity and temperature laws in boundary layers
- Convective heat transfer of external and internal flows
- Heat transfer analogies (Prandtl-, von Kárman, Martinelli,…)
- Methods for enhancing heat transfer
- Strategies and methods for investigation of thermal-hydraulics in R&D

The lecture provides an overview of momentum and energy transport as occurring in power engineering components and heat exchangers. On the basis of the conservation equations and the fundamentals of thermal-hydraulics, dimensionless parameters for forced and free convection are evolved. Flows close to walls play a crucial role for the convective heat transfer and for heat exchanger components. Thus, with scaling rules the laminar and turbulent thermal boundary layer equations are introduced. In the following, velocity and temperature laws of the wall as a basis for analogies and models of computational tools are discussed and the influence of roughness and surface design are shown. Concepts of state-of-the-art turbulence modelling and their applicability for different conditions or different heat transfer fluids (e.g. liquid metals, gas, oil) are described. Analogies and correlations for internal and external forced convection are developed by means of approximation concepts. Design options to enhance the efficiency and effectiveness of heat exchangers are discussed.

The objectives of the lecture are the fundamentals of thermal-hydraulics for describing and modelling convective fluid flow as occurring in power engineering components. A major objective is the description of the convective heat transfer for external and internal flows. A key issue is the transfer of analytic models and empirical results into “state of the art” computational tools and their validation by advanced experimental methods. Within the scope of the course, the students learn (a) to develop differential equation for thermal-hydraulic problems and to describe the thermal flow field by means of dimensionless parameters, (b) to transfer a real problem to an experiment or computational model, (c) to develop analogies and correlations for heat transfer processes of forced convection, (d) to select adequate computational methods/models, (e) to evaluate and select experiments including measurement techniques with adequate instrumentation for thermal-hydraulic problems and (f) to know design option for an efficient and effective heat exchange.

Attendance time: 21 h
Preparation/follow-up time of lectures, exam preparation: 90h

Oral exam of about 30 min.

Literature
Literaturlisten und Angabe von Fachliteratur werden jeweils in den Vorlesungen genannt. Unterlagen zur Lehrveranstaltung werden online unter http://ilias.studium.kit.edu zu Verfügung gestellt. Handout mit Übungsaufgaben für ausgewählte Themengebiete in den jeweiligen Vorlesungen.

T 3.335 Course: Thin Film and Small-scale Mechanical Behavior [T-MACH-105554]

Responsible: Dr. Patric Gruber
Dr. Ruth Schwaiger
Dr. Daniel Weygand

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104878 - Specification in Mechanical Engineering
M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2178123	Thin film and small-scale mechanical behavior	2 SWS	Lecture (V)	Weygand, Gruber
Exams					
WS 19/20	76-T-MACH-105554	Thin Film and Small-scale Mechanical Behavior		Prüfung (PR)	Gruber, Weygand
SS 2020	76-T-MACH-105554	Thin Film and Small-scale Mechanical Behavior		Prüfung (PR)	Gruber, Weygand

Competence Certificate
oral exam 30 minutes

Prerequisites
none

Recommendation
preliminary knowlegde in materials science, physics and mathematics

Below you will find excerpts from events related to this course:

V Thin film and small-scale mechanical behavior

2178123, SS 2020, 2 SWS, Language: English, Open in study portal

Lecture (V)

Content
1. Introduction: Application and properties of micro- and nanosystems
2. Physical scaling and size effects
3. Fundamentals: Dislocation plasticity
4. Thin films
5. Strain gradient plasticity
6. Micro- and nanosamples: Nanowires, micropillars, microbeams 7.Nanocrystalline materials

The students know and understand size and scaling effects in micro- and nanosystems. They can describe the mechanical behavior of nano- and microstructured materials and analyze and explain the origin for the differences compared to classical material behavior. They are able to explain suitable processing routes, experimental characterization techniques and adequate modelling schemes for nano- and microstructured materials.

regular attendance: 22,5 hours
self-study: 97,5 hours

oral exam ca. 30 minutes

Literature
1. M. Ohring: „The Materials Science of Thin Films“, Academic Press, 1992
2. L.B. Freund and S. Suresh: „Thin Film Materials

T 3.336 Course: Tires and Wheel Development for Passenger Cars [T-MACH-102207]

Responsible: Hon.-Prof. Dr. Günter Leister
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2114845	Tires and Wheel Development for Passenger Cars	2 SWS	Lecture (V)	Leister
Exams					
WS 19/20	76-T-MACH-102207	Tires and Wheel Development for Passenger Cars		Prüfung (PR)	Leister
SS 2020	76-T-MACH-102207	Tires and Wheel Development for Passenger Cars		Prüfung (PR)	Leister

Competence Certificate
Oral Examination

Duration: 30 up to 40 minutes

Auxiliary means: none

Prerequisites
none

Below you will find excerpts from events related to this course:

V Tires and Wheel Development for Passenger Cars

2114845, SS 2020, 2 SWS, Open in study portal **Lecture (V)**

Content

1. The role of the tires and wheels in a vehicle
2. Geometrie of Wheel and tire, Package, load capacity and endurance, Book of requirement
3. Mobility strategy, Minispare, runflat systems and repair kit.
4. Project management: Costs, weight, planning, documentation
5. Tire testing and tire properties
6. Wheel technology incuding Design and manifacturing methods, Wheeltesting
7. Tire presssure: Indirect and direct measuring systems
8. Tire testing subjective and objective

Learning Objectives:

The students are informed about the interactions of tires, wheels and chassis. They have an overview of the processes regarding the tire and wheel development. They have knowledge of the physical relationships.

Literature
Manuskript zur Vorlesung

Manuscript to the lecture

T 3.337 Course: Tractors [T-MACH-105423]

Responsible: Simon Becker
Prof. Dr.-Ing. Marcus Geimer
Hon.-Prof. Dr. Martin Kremmer

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	1

Events					
WS 19/20	2113080	Tractors	2 SWS		Kremmer, Becker
Exams					
WS 19/20	76-T-MACH-105423	Tractors		Prüfung (PR)	Geimer

Competence Certificate
The assessment consists of an written exam taking place in the recess period (90 min).

Prerequisites
none

Recommendation
Basic knowledge in mechanical engineering.

Annotation
Learning Outcomes
After completion of the course the Students know:

- important problems in agritechnological developments
- Customer requirements and their implementation in tractors
- Tractor technology in width and depth

Content
Tractors are one of the most underestimated vehicles in regard to performance und technics. Almost none vehicle is as multifunctional and fulfilled with high-tech as a tractor. Automatic guidance, special chassis suspension or special concepts of power trains are one of the topics where tractors are in leading position in technologies
During the lecture an overview about the design and construction and application area is given. A close look will be taken on the historical background, legal requirements, ways of development, agricultural organizations and the process of development itself.
In detail the following topics will be dealt with:

- agricultural organization / legal requirements
- history of tractors
- tractor engineering
- tractor mechanics
- chassis suspension
- combustion engine
- transmission
- interfaces
- hydraulics
- wheels and tyres
- cabin
- electrics and electronics

Literature

- K.T. Renius: Traktoren - Technik und ihre Anwendung; DLG Verlag (Frankfurt), 1985
- E. Schilling: Landmaschinen - Lehr- und Handbuch für den Landmaschinenbau; Schilling-Verlag (Köln), 1960

Below you will find excerpts from events related to this course:

V **Tractors**
2113080, WS 19/20, 2 SWS, Language: German, Open in study portal

Content

Tractors are one of the most underestimated vehicles in regard to performance und technics. Almost none vehicle is as multifunctional and fullfilled with high-tec as a tractor. Automatic guidance, special chassis suspension or special concepts of power trains are one of the topics where tractors are in leading position in technologies

During the lecture an overview about the design and construction and application area is given. A close look will be taken on the historical backround, legal requirements, ways of development, agricultural organizations and the proces of development itself.

In detail the following topics will be dealt with:

- agricultural organization / legal requirements
- history of tractors
- tractor engineering
- tractor mechanics
- chassis suspension
- combustion engine
- transmission
- interfaces
- hydraulics
- wheels and tyres
- cabin
- electrics and electronics

basic knowledge in mechanical engineering

- regular attendance: 21 hours
- self-study: 92 hours

Literature

- K.T. Renius: Traktoren - Technik und ihre Anwendung; DLG Verlag (Frankfurt), 1985
- E. Schilling: Landmaschinen - Lehr- und Handbuch für den Landmaschinenbau; Schilling-Verlag (Köln), 1960

T 3.338 Course: Tribology [T-MACH-105531]

Responsible: Prof. Dr. Martin Dienwiebel
Prof. Dr.-Ing. Matthias Scherge

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Oral examination	8	Each winter term	2

Events					
WS 19/20	2181114	Tribology	5 SWS	Lecture / Practice (VÜ)	Dienwiebel, Scherge
Exams					
WS 19/20	76-T-MACH-105531	Tribology		Prüfung (PR)	Dienwiebel

Competence Certificate
oral examination (ca. 40 min)

no tools or reference materials

Prerequisites
admission to the exam only with successful completion of the exercises [T-MACH-109303]

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-109303 - Exercices - Tribology must have been passed.

Recommendation
preliminary knowlegde in mathematics, mechanics and materials science

Below you will find excerpts from events related to this course:

V Tribology

2181114, WS 19/20, 5 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Content

- Chapter 1: Friction
  adhesion, geometrical and real area of contact, Friction experiments, friction powder, tribological stressing, evironmental influences, tribological age, contact models, Simulation of contacts, roughness.
- Chapter 2: Wear
  plastic deformation at the asperity level, dissipation modes, mechanical mixing, Dynamics of the third body, running-in, running- in dynamics, shear stress.
- Chapter 3: Lubrication
  base oils, Stribeck plot, lubrication regimes (HD, EHD, mixed lubrication), additives, oil characterization, solid lubrication.
- Chapter 4: Measurement Techniques
  friction measurement, tribometer, dissipated frictional power, conventional wear measurement, continuous wear measurement(RNT)
- Chapter 5: Roughness
  profilometry, surface roughness parameters, evaluation length and filters, bearing ratio curve, measurement error
- Chapter 6: Accompanying Analysis
  multi-scale topography measurement, chemical surface analysis, structural analysis, mechanical analysis

Exercises are used for complementing and deepening the contents of the lecture as well as for answering more extensive questions raised by the students.

The student can

- describe the fundamental friction and wear mechanisms, which occur in tribologically stressed systems
- evaluate the friction and wear behavior of tribological systems
- explain the effects of lubricants and their most important additives
- identify suitable approaches to optimize tribological systems
- explain the most important experimental methods for the measurement of friction and wear, and is able to use them for the characterisation of tribo pairs
- choose suitable methods for the evaluation of roughness and topography from the nm-scale to the mm-scale and is able to interpret the determined values in respect to their effect on the tribological behavior
- describe the most important surface-analytical methods and their physical principles for the characterization of tribologically stressed sliding surfaces

preliminary knowlegde in mathematics, mechanics and materials science recommended

regular attendance: 45 hours
self-study: 195 hours

oral examination (ca. 40 min)

no tools or reference materials

admission to the exam only with successful completion of the exercises

Literature

1. Fleischer, G. ; Gröger, H. ; Thum: Verschleiß und Zuverlässigkeit. 1. Auflage. Berlin : VEB-Verlag Technik, 1980
2. Persson, B.J.N.: Sliding Friction, Springer Verlag Berlin, 1998
3. M. Dienwiebel, and M. Scherge, Nanotribology in automotive industry, In:Fundamentals of Friction and Wear on the Nanoscale; Editors: E. Meyer and E. Gnecco, Springer, Berlin, 2007.
4. Scherge, M., Shakhvorostov, D., Pöhlmann, K.: Fundamental wear mechanism of metals. Wear 255, 395–400 (2003)
5. Shakhvorostov, D., Pöhlmann, K., Scherge, M.: An energetic approach to friction, wear and temperature. Wear 257, 124–130 (2004)

T 3.339 Course: Turbine and Compressor Design [T-MACH-105365]

Responsible: Prof. Dr.-Ing. Hans-Jörg Bauer
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2169462	Turbine and compressor Design	2 SWS	Lecture (V)	Bauer
Exams					
WS 19/20	76-T-MACH-105365	Turbine and Compressor Design		Prüfung (PR)	Bauer, Schulz
SS 2020	76-T-MACH-105365	Turbine and Compressor Design		Prüfung (PR)	Schulz, Bauer

Competence Certificate
oral exam, duration: 20 min.

Prerequisites
Exams Thermal Turbomachinery I & II successfully passed.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105363 - Thermal Turbomachines I must have been passed.
2. The course T-MACH-105364 - Thermal Turbomachines II must have been passed.

Below you will find excerpts from events related to this course:

V Turbine and compressor Design

2169462, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
The lecture is intended to expand the knowledge from Thermal Turbomachines I+II.

Thermal Turbomaschines, general overview

Design of a turbomachine: Criteria and development

Radial machines

Transonic compressors

Combustion chambers

Multi-spool installations

The students have the ability to:

- describe special types of components, such as e.g. radial machines and transonic compressors
- explain and evaluate the operation of components and machines
- interpret and apply the the physical principles
- design individual components in a practical approach

regular attendance: 21 h
self-study: 42 h

Exam:

oral
Duration: approximately 30 minutes

no tools or reference materials may be used during the exam

Literature
Münzberg, H.G.: Gasturbinen - Betriebsverhalten und Optimierung, Springer Verlag, 1977

Traupel, W.: Thermische Turbomaschinen, Bd. I-II, Springer Verlang, 1977, 1982

T 3.340 Course: Tutorial Mathematical Methods in Strength of Materials [T-MACH-106830]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104847 - Major Field Fundamentals of Engineering

Type	Credits	Recurrence	Version
Completed coursework	1	Each winter term	3

Exams				
WS 19/20	76-T-MACH-106830	Tutorial Mathematical Methods in Strength of Materials	Prüfung (PR)	Böhlke

Competence Certificate
successfully solving the homework sheets. Details are announced in the first lecture.

Prerequisites
None

T 3.341 Course: Tutorial Mathematical Methods in Structural Mechanics [T-MACH-106831]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104847 - Major Field Fundamentals of Engineering

Type	Credits	Recurrence	Version
Completed coursework	1	Each summer term	2

Events					
SS 2020	2162281	Tutorial Mathematical Methods in Micromechanics	1 SWS	Practice (Ü)	Karl, Krause, Böhlke

Competence Certificate
Successfully solving the homework sheets. Details are given in the first lecture.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Tutorial Mathematical Methods in Micromechanics

2162281, SS 2020, 1 SWS, Language: German, Open in study portal

Practice (Ü)

Content
see lecture "Mathematical Methods in Micromechanics"

T 3.342 Course: Two-Phase Flow and Heat Transfer [T-MACH-105406]

Responsible: Prof. Dr.-Ing. Thomas Schulenberg
Dr. Martin Wörner

Organisation: KIT Department of Chemical and Process Engineering
KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Version
Oral examination	4	1

Events					
WS 19/20	2169470	Two-Phase Flow and Heat Transfer	2 SWS	Lecture (V)	Wörner, Schulenberg
Exams					
WS 19/20	76-T-MACH-105406	Two-Phase Flow and Heat Transfer		Prüfung (PR)	Schulenberg

Competence Certificate
oral exam, duration: approximately 30 minutes

no tools or reference materials may be used during the exam

Prerequisites
none

Below you will find excerpts from events related to this course:

V Two-Phase Flow and Heat Transfer

2169470, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
The students can describe two-phase flows with heat transfer as phenomena occuring in steam generators and condensers (e.g. in power stations or refrigerators). They can distinguish different flow regimes and transitions and apply two-phase flow models. The students are qualified to explain the characteristics of different flow examples (e.g. pressure drop of two phase flows, pool boiling, forced convective boiling, condensation) and can analysze two-phase flow instabilities.

- Examples for technical applications
- Definitions and averaging of two-phase flows
- Flow regimes and transitions
- Two-phase models
- Pressure drop of two phase flows
- Pool boiling
- Forced convective boiling
- Condensation
- Two-phase flow instabilities

Literature
Vorlesungsskript

T 3.343 Course: Vacuum and Tritium Technology in Nuclear Fusion [T-MACH-108784]

Responsible: Dr. Beate Bornschein
Dr. Christian Day

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2190499	Vacuum and Tritium Technology in Nuclear Fusion	2 SWS		Day, Größle
Exams					
SS 2020	76-T-MACH-108784	Vacuum and Tritium Technology in Nuclear Fusion		Prüfung (PR)	Day, Bornschein

Competence Certificate
oral examination, 20 Minutes, any time in the year

Prerequisites
none

Recommendation
Knowledge in ´Fusion Technology A´

Below you will find excerpts from events related to this course:

V Vacuum and Tritium Technology in Nuclear Fusion
2190499, SS 2020, 2 SWS, Language: German/English, Open in study portal

Content
Introduction

Tritium Handling

Tritium Plant Technologies

Tritium and Breeding

Fundamentals of Vacuum Science and Technology

Fusion Vacuum systems

Matter Injection into the Plasma Chamber

Fuel Cycle of ITER and DEMO

The students have acquired the necessary understanding in order to design and size facilities for tritium operation. They understand the process steps in the tritium plant of a fusion reactor for tritium removal and tritium recovery from tritiated exhaust gas. Furthermore, the students have understood the fundamentals of vacuum physics and are able to design and choose vacuum pumps properly.

recommended is Knowledge in "Fusion Technology A"

oral exam of about 20 min

T 3.344 Course: Vehicle Comfort and Acoustics I [T-MACH-105154]

Responsible: Prof. Dr. Frank Gauterin
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering
M-MACH-104878 - Specification in Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2113806	Vehicle Comfort and Acoustics I	2 SWS	Lecture (V)	Gauterin
SS 2020	2114856	Vehicle Ride Comfort & Acoustics I	2 SWS	Lecture (V)	Gauterin
Exams					
WS 19/20	76-T-MACH-105154	Vehicle Comfort and Acoustics I		Prüfung (PR)	Gauterin
SS 2020	76-T-MACH-105154	Vehicle Comfort and Acoustics I		Prüfung (PR)	Gauterin

Competence Certificate
Oral Examination

Duration: 30 up to 40 minutes

Auxiliary means: none

Prerequisites
Can not be combined with lecture T-MACH-102206

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-102206 - Vehicle Ride Comfort & Acoustics I must not have been started.

Below you will find excerpts from events related to this course:

V Vehicle Comfort and Acoustics I

Lecture (V)

2113806, WS 19/20, 2 SWS, Language: German, Open in study portal

Content
1. Perception of noise and vibrations
3. Fundamentals of acoustics and vibrations
3. Tools and methods for measurement, computing, simulation and analysis of noise and vibrations
4. The relevance of tire and chasis for the acoustic and mechanical driving comfort:
phenomena, influencing parameters, types of construction, optimization of components and systems, conflict of goals, methods of development

An excursion will give insights in the development practice of a car manufacturer or a system supplier.

Learning Objectives:

The students know what noises and vibrations mean, how they are generated, and how they are perceived by human beings. They have knowledge about the requirements given by users and the public. They know which components of the vehicle are participating in which way on noise and vibration phenomenon and how they could be improved. They are ready to apply different tools and methods to analyze relations and to judge them. They are able to develop the chasis regarding driving comfort and acoustic under consideration of goal conflicts.

Literature
1. Michael Möser, Technische Akustik, Springer, Berlin, 2005

2. Russel C. Hibbeler, Technische Mechanik 3, Dynamik, Pearson Studium, München, 2006

3. Manfred Mitschke, Dynamik der Kraftfahrzeuge, Band B: Schwingungen, Springer, Berlin, 1997

Das Skript wird zu jeder Vorlesung zur Verfügung gestellt

V

Vehicle Ride Comfort & Acoustics I

2114856, SS 2020, 2 SWS, Language: English, Open in study portal

Lecture (V)

Content
1. Perception of noise and vibrations

3. Fundamentals of acoustics and vibrations

3. Tools and methods for measurement, computing, simulation and analysis of noise and vibrations

4. The relevance of tire and chasis for the acoustic and mechanical driving comfort:
phenomena, influencing parameters, types of construction, optimization of components and systems, conflict of goals, methods of development

An excursion will give insights in the development practice of a car manufacturer or a system supplier.

Learning Objectives:

The students know what noises and vibrations mean, how they are generated, and how they are perceived by human beings. They have knowledge about the requirements given by users and the public. They know which components of the vehicle are participating in which way on noise and vibration phenomenon and how they could be improved. They are ready to apply different tools and methods to analyze relations and to judge them. They are able to develop the chasis regarding driving comfort and acoustic under consideration of goal conflicts.

Literature
1. Michael Möser, Technische Akustik, Springer, Berlin, 2005

2. Russel C. Hibbeler, Technische Mechanik 3, Dynamik, Pearson Studium, München, 2006

3. Manfred Mitschke, Dynamik der Kraftfahrzeuge, Band B: Schwingungen, Springer, Berlin, 1997

Das Skript wird zu jeder Vorlesung zur Verfügung gestellt

T 3.345 Course: Vehicle Comfort and Acoustics II [T-MACH-105155]

Responsible: Prof. Dr. Frank Gauterin
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering
M-MACH-104878 - Specification in Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	2114825	Vehicle Comfort and Acoustics II	2 SWS	Lecture (V)	Gauterin
SS 2020	2114857	Vehicle Ride Comfort & Acoustics II	2 SWS	Lecture (V)	Gauterin
Exams					
WS 19/20	76-T-MACH-105155	Vehicle Comfort and Acoustics II		Prüfung (PR)	Gauterin
SS 2020	76-T-MACH-105155	Vehicle Comfort and Acoustics II		Prüfung (PR)	Gauterin

Competence Certificate
Oral Examination

Duration: 30 up to 40 minutes

Auxiliary means: none

Prerequisites
Can not be combined with lecture T-MACH-102205

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-102205 - Vehicle Ride Comfort & Acoustics II must not have been started.

Below you will find excerpts from events related to this course:

V Vehicle Comfort and Acoustics II

Lecture (V)

2114825, SS 2020, 2 SWS, Language: German, Open in study portal

Content
1. Summary of the fundamentals of acoustics and vibrations

2. The relevance of road surface, wheel imperfections, springs, dampers, brakes, bearings and bushings, suspensions, engines and drive train for the acoustic and mechanical driving comfort:
- phenomena
- influencing parameters
- types of construction
- optimization of components and systems
- conflicts of goals
- methods of development

3. Noise emission of motor vehicles
- noise stress
- sound sources and influencing parameters
- legal restraints
- optimization of components and systems
- conflict of goals
- methods of development

Learning Objectives:

The students have knowledge about the noise and vibration properties of the chassis components and the drive train. They know what kind of noise and vibration phenomena do exist, what are the generation mechanisms behind, which components of the vehicle participate in which way and how could they be improved. They have knowledge in the subject area of noise emission of automobiles: Noise impact, legal requirements, sources and influencing parameters, component and system optimization, target conflicts and development methods. They are ready to analyze, to judge and to optimize the vehicle with its single components regarding acoustic and vibration phenomena. They are also able to contribute competently to the development of a vehicle regarding the noise emission.

Literature
Das Skript wird zu jeder Vorlesung zur Verfügung gestellt.

V Vehicle Ride Comfort & Acoustics II

2114857, SS 2020, 2 SWS, Language: English, Open in study portal

Lecture (V)

Content
1. Summary of the fundamentals of acoustics and vibrations

2. The relevance of road surface, wheel imperfections, springs, dampers, brakes, bearings and bushings, suspensions, engines and drive train for the acoustic and mechanical driving comfort:
- phenomena
- influencing parameters
- types of construction
- optimization of components and systems
- conflicts of goals
- methods of development

3. Noise emission of motor vehicles
- noise stress
- sound sources and influencing parameters
- legal restraints
- optimization of components and systems
- conflict of goals
- methods of development

Learning Objectives:

The students have knowledge about the noise and vibration properties of the chassis components and the drive train. They know what kind of noise and vibration phenomena do exist, what are the generation mechanisms behind, which components of the vehicle participate in which way and how could they be improved. They have knowledge in the subject area of noise emission of automobiles: Noise impact, legal requirements, sources and influencing parameters, component and system optimization, target conflicts and development methods. They are ready to analyze, to judge and to optimize the vehicle with its single components regarding acoustic and vibration phenomena. They are also able to contribute competently to the development of a vehicle regarding the noise emission.

Literature
Das Skript wird zu jeder Vorlesung zur Verfügung gestellt.

The script will be supplied in the lectures.

T 3.346 Course: Vehicle Ergonomics [T-MACH-108374]

Responsible: Dr.-Ing. Tobias Kunkel
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	1

Events					
SS 2020	2110050	Vehicle Ergonomics	2 SWS	Lecture (V)	Kunkel
Exams					
SS 2020	76-T-MACH-108374	Vehicle Ergonomics		Prüfung (PR)	Deml

Competence Certificate
written exam, 60 minutes

Prerequisites
none

Below you will find excerpts from events related to this course:

V Vehicle Ergonomics

Lecture (V)

2110050, SS 2020, 2 SWS, Language: German, Open in study portal

Content
- Basics of physical-body related ergonomics
- Basics of cognitive ergonomics
- Theories of driver behaviour
- interface design
- usability testing

Learning objective:

An ergonomic vehicle is best adapted to the requirements, needs and characteristics of its users and thus enables effective, efficient and satisfying interaction. After attending the lecture, students are able to analyse and evaluate the ergonomic quality of various vehicle concepts and derive design recommendations. They can consider aspects of both physical and cognitive ergonomics. Students are familiar with basic ergonomic methods, theories and concepts as well as with theories of human information processing, especially theories of driver behaviour. They are capable of critically reflecting this knowledge and applying it in a flexible way within the user-centered design process.

Literature
Die Literaturliste wird in der Vorlesung ausgegeben. Die Folien zur Vorlesung stehen auf ILIAS zum Download zur Verfügung.

T 3.347 Course: Vehicle Lightweight Design - Strategies, Concepts, Materials [T-MACH-105237]

Responsible: Prof. Dr.-Ing. Frank Henning
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	1

Events					
WS 19/20	2113102	Vehicle Lightweight design – Strategies, Concepts, Materials	2 SWS	Lecture (V)	Henning
Exams					
WS 19/20	76-T-MACH 105236	Vehicle Lightweight Design - Strategies, Concepts, Materials		Prüfung (PR)	Henning
WS 19/20	76-T-MACH-105237	Vehicle Lightweight Design - Strategies, Concepts, Materials		Prüfung (PR)	Henning
SS 2020	762113102	Vehicle Lightweight Design - Strategies, Concepts, Materials		Prüfung (PR)	Henning

Competence Certificate
Written exam, 90 minutes

Prerequisites
none

Recommendation
none

Below you will find excerpts from events related to this course:

V Vehicle Lightweight design – Strategies, Concepts, Materials

2113102, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Literature

[1] E. Moeller, *Handbuch Konstruktionswerkstoffe : Auswahl, Eigenschaften, Anwendung*. München: Hanser, 2008.

[2] H.-J. Bargel, *et al.*, *Werkstoffkunde*, 10., bearb. Aufl. ed. Berlin: Springer, 2008.

[3] C. Kammer, *Aluminium-Taschenbuch : Grundlagen und Werkstoffe*, 16. Aufl. ed. Düsseldorf: Aluminium-Verl., 2002.

[4] K. U. Kainer, "Magnesium - Eigenschaften, Anwendungen, Potentiale ", Weinheim [u.a.], 2000, pp. VIII, 320 S.

[5] A. Beck and H. Altwicker, *Magnesium und seine Legierungen*, 2. Aufl., Nachdr. d. Ausg. 1939 ed. Berlin: Springer, 2001.

[6] M. Peters, *Titan und Titanlegierungen*, [3., völlig neu bearb. Aufl.] ed. Weinheim [u.a.]: Wiley-VCH, 2002.

[7] H. Domininghaus and P. Elsner, *Kunststoffe : Eigenschaften und Anwendungen; 240 Tab*, 7., neu bearb. u. erw. Aufl. ed. Berlin: Springer, 2008.

T 3.348 Course: Vehicle Mechatronics I [T-MACH-105156]

Responsible: Prof. Dr.-Ing. Dieter Ammon
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104849 - Major Field Automotive Engineering

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	1

Exams				
WS 19/20	76-T-MACH-105156	Vehicle Mechatronics I	Prüfung (PR)	Ammon

Competence Certificate
Written examination

Duration: 90 minutes

Auxiliary means: none

Prerequisites
none

T 3.349 Course: Vehicle Ride Comfort & Acoustics I [T-MACH-102206]

Responsible: Prof. Dr. Frank Gauterin
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	3	Each summer term	1

Events					
SS 2020	2114856	Vehicle Ride Comfort & Acoustics I	2 SWS	Lecture (V)	Gauterin
Exams					
WS 19/20	76-T-MACH-102206	Vehicle Ride Comfort & Acoustics I		Prüfung (PR)	Gauterin
SS 2020	76-T-MACH-102206	Vehicle Ride Comfort & Acoustics I		Prüfung (PR)	Gauterin

Competence Certificate
Oral examination

Prerequisites
Can not be combined with lecture Fahrzeugkomfort und -akustik I T-MACH-105154

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105154 - Vehicle Comfort and Acoustics I must not have been started.

Below you will find excerpts from events related to this course:

V Vehicle Ride Comfort & Acoustics I

2114856, SS 2020, 2 SWS, Language: English, Open in study portal

Lecture (V)

Content
1. Perception of noise and vibrations

3. Fundamentals of acoustics and vibrations

3. Tools and methods for measurement, computing, simulation and analysis of noise and vibrations

4. The relevance of tire and chasis for the acoustic and mechanical driving comfort:
phenomena, influencing parameters, types of construction, optimization of components and systems, conflict of goals, methods of development

An excursion will give insights in the development practice of a car manufacturer or a system supplier.

Learning Objectives:

The students know what noises and vibrations mean, how they are generated, and how they are perceived by human beings. They have knowledge about the requirements given by users and the public. They know which components of the vehicle are participating in which way on noise and vibration phenomenon and how they could be improved. They are ready to apply different tools and methods to analyze relations and to judge them. They are able to develop the chasis regarding driving comfort and acoustic under consideration of goal conflicts.

Literature

1. Michael Möser, Technische Akustik, Springer, Berlin, 2005

2. Russel C. Hibbeler, Technische Mechanik 3, Dynamik, Pearson Studium, München, 2006

3. Manfred Mitschke, Dynamik der Kraftfahrzeuge, Band B: Schwingungen, Springer, Berlin, 1997

Das Skript wird zu jeder Vorlesung zur Verfügung gestellt

T 3.350 Course: Vehicle Ride Comfort & Acoustics II [T-MACH-102205]

Responsible: Prof. Dr. Frank Gauterin
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	3	Each summer term	1

Events					
SS 2020	2114857	Vehicle Ride Comfort & Acoustics II	2 SWS	Lecture (V)	Gauterin
Exams					
SS 2020	76-T-MACH-102205	Vehicle Ride Comfort & Acoustics II		Prüfung (PR)	Gauterin

Competence Certificate
Oral examination

Prerequisites
Can not be combined with lecture Fahrzeugkomfort und -akustik II T-MACH-105155

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-105155 - Vehicle Comfort and Acoustics II must not have been started.

Below you will find excerpts from events related to this course:

V Vehicle Ride Comfort & Acoustics II

2114857, SS 2020, 2 SWS, Language: English, Open in study portal

Lecture (V)

Content
1. Summary of the fundamentals of acoustics and vibrations

2. The relevance of road surface, wheel imperfections, springs, dampers, brakes, bearings and bushings, suspensions, engines and drive train for the acoustic and mechanical driving comfort:
- phenomena
- influencing parameters
- types of construction
- optimization of components and systems
- conflicts of goals
- methods of development

3. Noise emission of motor vehicles
- noise stress
- sound sources and influencing parameters
- legal restraints
- optimization of components and systems
- conflict of goals
- methods of development

Learning Objectives:

The students have knowledge about the noise and vibration properties of the chassis components and the drive train. They know what kind of noise and vibration phenomena do exist, what are the generation mechanisms behind, which components of the vehicle participate in which way and how could they be improved. They have knowledge in the subject area of noise emission of automobiles: Noise impact, legal requirements, sources and influencing parameters, component and system optimization, target conflicts and development methods. They are ready to analyze, to judge and to optimize the vehicle with its single components regarding acoustic and vibration phenomena. They are also able to contribute competently to the development of a vehicle regarding the noise emission.

Literature
Das Skript wird zu jeder Vorlesung zur Verfügung gestellt.

The script will be supplied in the lectures.

T 3.351 Course: Vibration Theory [T-MACH-105290]

Responsible: Prof. Dr.-Ing. Alexander Fidlin
Prof. Dr.-Ing. Wolfgang Seemann

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104853 - Major Field Theoretical Foundations of Mechanical Engineering

Type	Credits	Recurrence	Version
Written examination	5	Each winter term	2

Events					
WS 19/20	2161212	Vibration Theory	2 SWS	Lecture (V)	Fidlin, Römer
WS 19/20	2161213	Übungen zu Technische Schwingungslehre	2 SWS	Practice (Ü)	Fidlin, Römer, Burgert
Exams					
WS 19/20	76-T-MACH-105290	Vibration Theory		Prüfung (PR)	Fidlin
SS 2020	76-T-MACH-105290	Vibration Theory		Prüfung (PR)	Fidlin

Competence Certificate
written exam, 180 min.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Vibration Theory

2161212, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
Concept of vibration, superposition of vibration with equal and with different frequencies, complex frequency response.

Vibration of systems with one dof: Free undamped and damped vibration, forced vibration for harmonic, periodic and arbitrary excitation. Excitation of undamped vibration in resonance.

Systems with many degrees of freedom: Eigenvalue problem for undamped vibration, orthogonality of eigenvectors, modal decoupling, approximation methods, eigenvalue problem for damped vibration. Forced vibration for harmonic excitation, modal decomposition for arbitrary forced vibration, vibration absorber.

Vibration of systems with distributed parameters: Partial differential equations as equations of motion, wave propagation, d'Alembert's solution, Ansatz for separation of time and space, eigenvalue problem, infinite number of eigenvalues and eigenfunctions.

Introduction to rotor dynamics: Laval rotor in rigid and elastic bearings, inner damping, Laval rotor in anisotropic bearings, synchronous and asynchronous whirl, rotors with asymmetric shaft.

Literature
Klotter: Technische Schwingungslehre, Bd. 1 Teil A, Heidelberg, 1978

Hagedorn, Otterbein: Technische Schwingungslehre, Bd. 1 und Bd. 2, Berlin, 1987

Wittenburg: Schwingungslehre, Springer-Verlag, Berlin, 1995

V Übungen zu Technische Schwingungslehre

2161213, WS 19/20, 2 SWS, Language: German, Open in study portal

Practice (Ü)

Content
Exercises related to the lecture

T 3.352 Course: Virtual Engineering (Specific Topics) [T-MACH-105381]

Responsible: Prof. Dr.-Ing. Jivka Ovtcharova
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104878 - Specification in Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each summer term	1

Events					
SS 2020	3122031	Virtual Engineering (Specific Topics)	2 SWS	Lecture (V)	Ovtcharova, Maier

Competence Certificate
oral exam, 20 min.

Prerequisites
none

Below you will find excerpts from events related to this course:

V Virtual Engineering (Specific Topics)

3122031, SS 2020, 2 SWS, Language: English, Open in study portal

Lecture (V)

Content
Students can

- explain the basics of virtual engineering and name exemplary modeling tools and assign them to the corresponding methods and processes
- Formulate validation questions in the product development process and name obvious solution methods
- explain the basics of systems engineering and establish the connection to the product development process
- explain individual methods of the digital factory and present the functions of the digital factory in the context of the product creation process
  explain the theoretical and technical basics of Virtual Reality technology and show the connection to Virtual Engineering

Literature
Lecture slides / Vorlesungsfolien

T 3.353 Course: Virtual Engineering I [T-MACH-102123]

Responsible: Prof. Dr.-Ing. Jivka Ovtcharova
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104851 - Major Field Product Development and Construction
M-MACH-104878 - Specification in Mechanical Engineering
M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	2

Events					
WS 19/20	2121352	Virtual Engineering I	2 SWS	Lecture (V)	Ovtcharova
WS 19/20	2121353	Exercises Virtual Engineering I	2 SWS	Practice (Ü)	Ovtcharova, Mitarbeiter
Exams					
WS 19/20	76-T-MACH-102123	Virtual Engineering I		Prüfung (PR)	Ovtcharova

Competence Certificate
Writen examination 90 min.

Prerequisites
None

Below you will find excerpts from events related to this course:

V Virtual Engineering I
2121352, WS 19/20, 2 SWS, Language: English, Open in study portal

Lecture (V)

Content
The course includes:

- Conception of the product (system approaches, requirements, definitions, structure)
- Generation of domain-specific product data (CAD, ECAD, software, ...) and AI methods
- Validation of product properties and production processes through simulation
- Digital twin for optimization of products and processes using AI methods

After successful attendance of the course, students can:

- conceptualize complex systems with the methods of virtual engineering and continue the product development in different domains
- model the digital product with regard to planning, design, manufacturing, assembly and maintenance.
- use validation systems to validate product and production in an exemplary manner.
- Describe AI methods along the product creation process.

Literature
Vorlesungsfolien / Lecture slides

V Exercises Virtual Engineering I
2121353, WS 19/20, 2 SWS, Language: English, Open in study portal

Practice (Ü)

Content
The theoretical Konzepts and contents of the lecture will be trained within practical relevance by basic functionalities of VE System solutions.

Literature
Exercise script / Übungsskript

T 3.354 Course: Virtual Engineering II [T-MACH-102124]

Responsible: Prof. Dr.-Ing. Jivka Ovtcharova
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104851 - Major Field Product Development and Construction
M-MACH-104878 - Specification in Mechanical Engineering
M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Written examination	4	Each summer term	2

Events					
SS 2020	2122378	Virtual Engineering II	2/1 SWS	Lecture / Practice (VÜ)	Ovtcharova, Mitarbeiter
Exams					
WS 19/20	76-T-MACH-102124	Virtual Engineering II		Prüfung (PR)	Ovtcharova

Competence Certificate
Writen examination 90 min.

Prerequisites
None

Below you will find excerpts from events related to this course:

V Virtual Engineering II
2122378, SS 2020, 2/1 SWS, Language: English, Open in study portal

Lecture / Practice (VÜ)

Content
The course includes:

- Fundamentals (Computer Graphics, VR, AR, MR)
- Hardware and Software Solutions
- Virtual Twin, Validation and application

After successful attendance of the course, students can:

- describe Virtual Reality concepts, as well as explaining and comparing the underlying technologies
- discuss the modeling and computer-internal picture of a VR scene and explain the operation of the pipeline to visualize the scene
- designate different systems to interact with a VR scene and assess the pros and cons of manipulation and tracking devices
- differentiate between static, dynamic and functional Virtual Twins
- describe applications and validation studies with Virtual Twins in the area of building and production

Literature
Vorlesungsfolien / Lecture slides

T 3.355 Course: Virtual Reality Practical Course [T-MACH-102149]

Responsible: Prof. Dr.-Ing. Jivka Ovtcharova
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104850 - Major Field Mechatronics and Microsystem Technology

Type	Credits	Recurrence	Version
Examination of another type	4	Each term	2

Events					
WS 19/20	2123375	Virtual Reality Practical Course	3 SWS	Project (PRO)	Ovtcharova, Mitarbeiter
Exams					
WS 19/20	76-T-MACH-102149	Virtual Reality Practical Course		Prüfung (PR)	Ovtcharova

Competence Certificate
Assessment of another type (graded)

Prerequisites
None

Annotation
Number of participants is limited

Below you will find excerpts from events related to this course:

V Virtual Reality Practical Course

2123375, WS 19/20, 3 SWS, Language: German/English, Open in study portal

Project (PRO)

Content

- Introduction in Virtual Reality (hardware, software, applications)
- Exercises in the task specific software systems
- Autonomous project work in the area of Virtual Reality in small groups

Literature
Keine / None

T 3.356 Course: Warehousing and Distribution Systems [T-MACH-105174]

Responsible: Prof. Dr.-Ing. Kai Furmans
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104852 - Major Field Production Technology

Type	Credits	Recurrence	Version
Written examination	3	Each summer term	2

Events					
SS 2020	2118097	Warehousing and distribution systems	2 SWS	Lecture (V)	Furmans

Competence Certificate
The assessment consists of a 60 minutes written examination (according to §4(2), 1 of the examination regulation).

Prerequisites
none

Below you will find excerpts from events related to this course:

V Warehousing and distribution systems — Lecture (V)
2118097, SS 2020, 2 SWS, Language: German, Open in study portal

Literature

ARNOLD, Dieter, FURMANS, Kai (2005)
Materialfluss in Logistiksystemen, 5. Auflage, Berlin: Springer-Verlag

ARNOLD, Dieter (Hrsg.) et al. (2008)
Handbuch Logistik, 3. Auflage, Berlin: Springer-Verlag

BARTHOLDI III, John J., HACKMAN, Steven T. (2008)
Warehouse Science

GUDEHUS, Timm (2005)
Logistik, 3. Auflage, Berlin: Springer-Verlag

FRAZELLE, Edward (2002)
World-class warehousing and material handling, McGraw-Hill

MARTIN, Heinrich (1999)
Praxiswissen Materialflußplanung: Transport, Hanshaben, Lagern, Kommissionieren, Braunschweig, Wiesbaden: Vieweg

WISSER, Jens (2009)
Der Prozess Lagern und Kommissionieren im Rahmen des Distribution Center Reference Model (DCRM); Karlsruhe : Universitätsverlag

Eine ausführliche Übersicht wissenschaftlicher Paper findet sich bei:

ROODBERGEN, Kees Jan (2007)
Warehouse Literature

T 3.357 Course: Wave Propagation [T-MACH-105443]

Responsible: Prof. Dr.-Ing. Wolfgang Seemann
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104853 - Major Field Theoretical Foundations of Mechanical Engineering

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	2

Events					
WS 19/20	2161219	Wave Propagation	2 SWS	Lecture (V)	Seemann
Exams					
WS 19/20	76-T-MACH-105443	Wave Propagation		Prüfung (PR)	Seemann
SS 2020	76-T-MACH-105443	Wave Propagation		Prüfung (PR)	Seemann

Competence Certificate
oral exam, 30 min.

Below you will find excerpts from events related to this course:

V Wave Propagation

2161219, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content
The course gives an introduction into wave propagation phenomena. This contains both one-dimensional continua (beams, rods, strings) as well as two- and three-dimensional continua. Initial condition problems are treated. Fundamental effects like velocity, group velocity or dispersion are explained. Wave propagation is used to show the limits of structural models like beams. In addition surface waves and acoustic waves are covered.

Literature
P. Hagedorn and A. Dasgupta: Vibration and waves in continuous mechanical systems. Wiley, 2007.

T 3.358 Course: Welding Technology [T-MACH-105170]

Responsible: Dr. Majid Farajian
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Oral examination	4	Each winter term	1

Events					
WS 19/20	2173571	Welding Technology	2 SWS	Lecture (V)	Farajian
Exams					
WS 19/20	76-T-MACH-105170	Welding Technology		Prüfung (PR)	Farajian

Competence Certificate
Oral exam, about 20 minutes

Prerequisites
none

Recommendation
Basics of material science (iron- and non-iron alloys), materials, processes and production, design.

All the relevant books of the German Welding Institute (DVS: Deutscher Verband für Schweißen und verwandte Verfahren) in the field of welding and joining is recommended.

Below you will find excerpts from events related to this course:

V Welding Technology
2173571, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture (V)

Content

definition, application and differentiation: welding,

welding processes, alternative connecting technologies.

history of welding technology

sources of energy for welding processes

Survey: Fusion welding,

pressure welding.

weld seam preparation/design

welding positions

weldability

gas welding, thermal cutting, manual metal-arc welding

submerged arc welding

gas-shielded metal-arc welding, friction stir welding, laser beam and electron beam welding, other fusion and pressure welding processes

static and cyclic behavior of welded joints,

fatigue life improvement techniques

learning objectives:

The students have knowledge and understanding of the most important welding processes and its industrial application.

They are able to recognize, understand and handle problems occurring during the application of different welding processes relating to design, material and production.

They know the classification and the importance of welding technology within the scope of connecting processes (advantages/ disadvantages, alternatives).

The students will understand the influence of weld quality on the performance and behavior of welded joints under static and cyclic load.

How the fatigue life of welded joints could be increased, will be part of the course.

requirements:

basics of material science (iron- and non-iron alloys), of electrical engineering, of production processes.

workload:

The workload for the lecture Welding Technology is 120 h per semester and consists of the presence during the lecture (18 h) as well as preparation and rework time at home (102 h).

exam:

oral, ca. 20 minutes, no auxiliary material

Literature

Für ergänzende, vertiefende Studien gibt das

Handbuch der Schweißtechnik von J. Ruge, Springer Verlag Berlin, mit seinen vier Bänden

Band I: Werkstoffe

Band II: Verfahren und Fertigung

Band III: Konstruktive Gestaltung der Bauteile

Band IV: Berechnung der Verbindungen

einen umfassenden Überblick. Der Stoff der Vorlesung Schweißtechnik findet sich in den Bänden I und II. Einen kompakten Einblick in die Lichtbogenschweißverfahren bietet das Bändchen

Nies: Lichtbogenschweißtechnik, Bibliothek der Technik Band 57, Verlag moderne Industrie AG und Co., Landsberg / Lech

Im Übrigen sei auf die zahlreichen Fachbücher des DVS Verlages, Düsseldorf, zu allen Einzelgebieten der Fügetechnik verwiesen.

T 3.359 Course: Windpower [T-MACH-105234]

Responsible: Dr. Norbert Lewald
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

Type	Credits	Recurrence	Version
Written examination	4	Each winter term	2

Exams				
WS 19/20	7600008	Windpower	Prüfung (PR)	Lewald

Competence Certificate
written exam, 120 minutes

Prerequisites
none

T 3.360 Course: Working Methods in Materials Science and Technology [T-MACH-100288]

Responsible: Prof. Dr.-Ing. Martin Heilmaier
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

Type	Credits	Recurrence	Version
Completed coursework (practical)	2	Each term	1

T 3.361 Course: Workshop on Computer-based Flow Measurement Techniques [T-MACH-106707]

Responsible: Prof. Dr.-Ing. Hans-Jörg Bauer
Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-105134 - Elective Module Mechanical Engineering

Type	Credits	Recurrence	Version
Completed coursework	4	Each term	1

Events					
WS 19/20	2171488	Workshop on computer-based flow measurement techniques	3 SWS	Practical course (P)	Bauer, Mitarbeiter
SS 2020	2171488	Workshop on computer-based flow measurement techniques	3 SWS	Practical course (P)	Bauer, Mitarbeiter
Exams					
WS 19/20	76-T-MACH-106707	Workshop on computer-based flow measurement techniques		Prüfung (PR)	Bauer
SS 2020	76-T-MACH-106707	Workshop on computer-based flow measurement techniques		Prüfung (PR)	Bauer

Competence Certificate
Group colloquia for each topic

Duration: approximately 10 minutes

no tools or reference materials may be used

Prerequisites
none

Below you will find excerpts from events related to this course:

V Workshop on computer-based flow measurement techniques

2171488, WS 19/20, 3 SWS, Language: German, Open in study portal

Practical course (P)

Content
Registration during the lecture period via the website.

The laboratory course offers an introduction into the acquisition of basic test data in fluid mechanics applications as well as a basic hands-on training for the application of modern PC based data acquisition methods. The combination of lectures about measurement techniques, sensors, signal converters, I/O systems, bus systems, data acquisition, handling and control routines and tutorials for typical fluid mechanics applications allows the participant to get a comprehensive insight and a sound knowledge in this field. The graphical programming environment LabVIEW from National Instruments is used in this course as it is one of the standard software tools for data acquisition worldwide.

Basic design of measurements systems

- Logging devices and sensors
- Analog to digital conversion
- Program design and programming methods using LabView
- Data handling
- Bus systems
- Design of a computer aided data acquisition system for pressure, temperature and derived parameters
- frequency analysis

regular attendance: 52,5
self-study: 67,5

Lernziele:

Die Studenten können:

- die wesentlichen Grundlagen der rechnergestützen Messwerterfassung theoretisch beschreiben und praktisch anwenden
- nach jedem Lernabschnitt den vorgestellten Stoff anhand eines Beispiels am PC in die Praxis umsetzen

The students are able to:

- theoretically describe and explain the fundamentals of computer aided measurements and and adopt them practically
- apply the basics learned during the lecture to a practical problem in the form of a PC excercise

Group colloquia for each topic

Duration: approximately 10 minutes

no tools or reference materials may be used

Literature
Germer, H.; Wefers, N.: Meßelektronik, Bd. 1, 1985

LabView User Manual

Hoffmann, Jörg: Taschenbuch der Messtechnik, 6., aktualisierte. Aufl. , 2011

V **Workshop on computer-based flow measurement techniques** **Practical course (P)**
2171488, SS 2020, 3 SWS, Language: German, Open in study portal

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