Modules of Mechanical Engineering for Exchange Students

Valid from Summer Term 2020
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<td>Tires and Wheel Development for Passenger Cars</td>
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<td>Welding Technology - T-MACH-105170</td>
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<td>Windpower - T-MACH-105234</td>
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<td>3.360.</td>
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<tr>
<td>Courses of Other Faculties and Soft Skills</td>
<td>90 CR</td>
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### 1.1 KIT-Department of Mechanical Engineering Courses

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### 1.2 Courses of Other Faculties and Soft Skills

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<td>M-MACH-104883</td>
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<td>M-MACH-105405</td>
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2 Modules

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

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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.

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<th>Election block: Exchange Students_CIW (between 0 and 90 credits)</th>
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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
2.2 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:  10
Recurrence:  Each term
Language:  German/English
Level:  4
Version:  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 ()

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<td>T-BGU-110842</td>
<td>Modeling of Turbulent Flows - RANS and LES</td>
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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
2.3 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:** 20  
**Recurrence:** Each term  
**Language:** German/English  
**Level:** 4  
**Version:** 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)**

| Course Code       | Course Title                                                   | Credits | Teacher(s)                      |
|-------------------|----------------------------------------------------------------|
| 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
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: 90
Recurrence: Each term
Language: German/English
Level: 4
Version: 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)

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<td>T-ETIT-101931</td>
<td>Medical Imaging Techniques II</td>
<td>3 CR</td>
<td>Dössel</td>
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<td>T-ETIT-101956</td>
<td>Bioelectric Signals</td>
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<td>T-ETIT-106492</td>
<td>Biomedical Measurement Techniques I</td>
<td>3 CR</td>
<td>Nahm</td>
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<td>Digital Technology</td>
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<td>T-ETIT-100807</td>
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<td>Electrical Machines and Power Electronics</td>
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<td>Electronic Devices and Circuits</td>
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<td>T-ETIT-109313</td>
<td>Signals and Systems</td>
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<td>Solar Energy</td>
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<td>System Dynamics and Control Engineering</td>
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<td>Theory of Probability</td>
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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
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

<table>
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**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)

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<td>Information Processing in Sensor Networks</td>
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<td>T-INFO-101356</td>
<td>Cognitive Systems</td>
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<td>T-INFO-101377</td>
<td>Localization of Mobile Agents</td>
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<td>Human-Machine-Interaction</td>
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**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
2.6 Module: Courses of the Department of Mathematics [M-MACH-104885]

**Responsible:** Prof. Dr.-Ing. Martin Heilmayer  
Prof. Dr.-Ing. Carsten Proppe

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** Courses of Other Faculties and Soft Skills

<table>
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**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)

<table>
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<tr>
<th>Module Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>T-MATH-102242</td>
<td>Numerical Mathematics for Students of Computer Science</td>
<td>6 CR</td>
<td>Rieder, Weiß, Wieners</td>
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<tr>
<td>T-MATH-109620</td>
<td>Probability Theory and Statistics</td>
<td>5 CR</td>
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**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

<table>
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**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

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<td>Atomistic Simulations and Molecular Dynamics</td>
<td>4 CR</td>
<td>Brandl, Gumbsch, Schneider</td>
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<td>T-MACH-105407</td>
<td>CFD in Power Engineering</td>
<td>4 CR</td>
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<td>T-MACH-109302</td>
<td>Computational Homogenization on Digital Image Data</td>
<td>6 CR</td>
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<td>T-MACH-106698</td>
<td>A holistic approach to power plant management</td>
<td>4 CR</td>
<td>Seidl, Stiegitz</td>
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<td>T-MACH-108407</td>
<td>NMR micro probe hardware conception and construction</td>
<td>4 CR</td>
<td>Korvink</td>
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<tr>
<td>T-MACH-110431</td>
<td>Digital microstructure characterization and modeling</td>
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<td>Combined Cycle Power Plants</td>
<td>4 CR</td>
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<td>T-MACH-105182</td>
<td>Introduction to Microsystem Technology I</td>
<td>4 CR</td>
<td>Badilita, Jouda, Korvink</td>
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<tr>
<td>T-MACH-105183</td>
<td>Introduction to Microsystem Technology II</td>
<td>4 CR</td>
<td>Jouda, Korvink</td>
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<td>Fundamentals of reactor safety for the operation and dismantling of nuclear power plants</td>
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<td>T-MACH-105163</td>
<td>Fundamentals of Automobile Development II</td>
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<td>High Temperature Materials</td>
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<td>Innovative Project</td>
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<td>Introduction to Neutron Cross Section Theory and Nuclear Data Generation</td>
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<td>T-MACH-105402</td>
<td>Nuclear Power Plant Technology</td>
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<td>Badea, Cheng, Schulenberg</td>
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<td>Coal Fired Power Plants</td>
<td>4 CR</td>
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<td>Machine Dynamics II</td>
<td>4 CR</td>
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<td>6 CR</td>
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<td>4 CR</td>
<td>Korvink, MacKinnon</td>
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<td>T-MACH-105557</td>
<td>Microenergy Technologies</td>
<td>4 CR</td>
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<td>T-MACH-108383</td>
<td>Microsystem Simulation</td>
<td>4 CR</td>
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<td>T-MACH-105532</td>
<td>Nonlinear Continuum Mechanics</td>
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<td>T-MACH-102191</td>
<td>Polymers in MEMS B: Physics, Microstructuring and Applications</td>
<td>4 CR</td>
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<td>T-MACH-102192</td>
<td>Polymers in MEMS A: Chemistry, Synthesis and Applications</td>
<td>4 CR</td>
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<td>T-MACH-102200</td>
<td>Polymers in MEMS C: Biopolymers and Bioplastics</td>
<td>4 CR</td>
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<td>Simulator Exercises Combined Cycle Power Plants</td>
<td>2 CR</td>
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<td>T-MACH-105456</td>
<td>Ten Lectures on Turbulence</td>
<td>4 CR</td>
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<td>T-MACH-105363</td>
<td>Thermal Turbomachines I</td>
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<td>T-MACH-105364</td>
<td>Thermal Turbomachines II</td>
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<td>Bauer</td>
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### Modules of Mechanical Engineering for Exchange Students

#### Module Handbook as of 15/02/2020

<table>
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<tr>
<td>T-MACH-105554</td>
<td>Thin Film and Small-scale Mechanical Behavior</td>
<td>4 CR</td>
<td>Gruber, Schwaiger, Weygand</td>
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<td>Virtual Engineering II</td>
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<td>Heat Transfer in Nuclear Reactors</td>
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**Election block: Elective Area B ()**

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<td>T-MACH-102141</td>
<td>Constitution and Properties of Wearresistant Materials</td>
<td>4 CR</td>
<td>Ulrich</td>
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<td>T-MACH-105528</td>
<td>Aerodynamics</td>
<td>4 CR</td>
<td>Frohnapfel, Ohle</td>
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<td>T-MACH-105451</td>
<td>Drive Systems and Possibilities to Increase Efficiency</td>
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<td>Fundamentals of reactor safety for the operation and dismantling of nuclear power plants</td>
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<td>Hands-on BioMEMS</td>
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<td>Principles of Medicine for Engineers</td>
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<td>Solar Thermal Energy Systems</td>
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<td>Mechatronical Systems and Products</td>
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<td>Workshop on Computer-based Flow Measurement Techniques</td>
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<td>5 CR</td>
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**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
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:** 90  
**Recurrence:** Each term  
**Language:** German/English  
**Level:** 4  
**Version:** 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 ()**

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<td>T-MACH-105655</td>
<td>Alternative Powertrain for Automobiles</td>
<td>4 CR</td>
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<td>T-MACH-105307</td>
<td>Drive Train of Mobile Machines</td>
<td>4 CR</td>
<td>Geimer, Wydra</td>
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<td>T-MACH-105311</td>
<td>Design and Development of Mobile Machines</td>
<td>4 CR</td>
<td>Geimer, Siebert</td>
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<td>T-MACH-108887</td>
<td>Design and Development of Mobile Machines - Advance</td>
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<td>Rail System Technology</td>
<td>4 CR</td>
<td>Gratzfeld</td>
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<td>T-MACH-105184</td>
<td>Fuels and Lubricants for Combustion Engines</td>
<td>4 CR</td>
<td>Kehrwald, Kubach</td>
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<td>BUS-Controls</td>
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<td>Dynamics of the Automotive Drive Train</td>
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<td>Electric Rail Vehicles</td>
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<td>Handling Characteristics of Motor Vehicles I</td>
<td>4 CR</td>
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<td>Fundamentals for Design of Motor-Vehicle Bodies I</td>
<td>2 CR</td>
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<td>T-MACH-102119</td>
<td>Fundamentals for Design of Motor-Vehicle Bodies II</td>
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<td>Industrial Aerodynamics</td>
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<td>Breitling, Frohnapfel</td>
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<td>T-MACH-105188</td>
<td>Integrative Strategies in Production and Development of High Performance Cars</td>
<td>4 CR</td>
<td>Schlichtenmayer</td>
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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
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: 90
Recurrence: Each term
Language: German/English
Level: 4
Version: 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.

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<td>T-MACH-105428 Selected Chapters of the Combustion Fundamentals 4 CR Maas</td>
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<tr>
<td>T-MACH-105462 Selected Problems of Applied Reactor Physics and Exercises 4 CR Dagan</td>
</tr>
<tr>
<td>T-MACH-105313 CFD-Lab Using OpenFOAM 4 CR Koch</td>
</tr>
<tr>
<td>T-MACH-105391 Finite Difference Methods for Numerical Solution of Thermal and Fluid Dynamical Problems 4 CR Günther</td>
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<tr>
<td>T-MACH-105525 Introduction to Nuclear Energy 4 CR Cheng</td>
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<tr>
<td>T-MACH-102211 Energy and Process Technology I 9 CR Bauer, Schwitzke, Velji, Wirbser</td>
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<tr>
<td>T-MACH-102212 Energy and Process Technology II 9 CR Schwitzke, Wirbser</td>
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<td>T-MACH-105715 Energy demand of buildings – fundamentals and applications, with building simulation exercises 6 CR Schmidt</td>
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<td>T-MACH-105952 Energy Storage and Network Integration 4 CR Jäger, Stieglitz</td>
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<td>T-MACH-105550 Energy systems II: Reactor Physics 4 CR Badea</td>
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**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
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

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**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.

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**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
Module: Major Field Materials and Structures for High Performance Systems

**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:** 90

**Recurrence:** Each term

**Language:** German/English

**Level:** 4

**Version:** 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.

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**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
### 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

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**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.

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<td>4 CR</td>
<td>Lorch, Seemann, Stiller</td>
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<td>T-MACH-105335</td>
<td>Measurement II</td>
<td>4 CR</td>
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<td>T-MACH-105300</td>
<td>Measurement Instrumentation Lab</td>
<td>4 CR</td>
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<td>T-MACH-101910</td>
<td>Microactuators</td>
<td>4 CR</td>
<td>Kohl</td>
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<td>T-MACH-105539</td>
<td>Modern Control Concepts I</td>
<td>4 CR</td>
<td>Groell, Matthes</td>
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<td>T-MACH-105180</td>
<td>Nanotechnology for Engineers and Natural Scientists</td>
<td>4 CR</td>
<td>Dienwiebel, Hölscher, Walheim</td>
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<td>T-MACH-102152</td>
<td>Novel Actuators and Sensors</td>
<td>4 CR</td>
<td>Kohl, Sommer</td>
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<td>Polymers in MEMS A: Chemistry, Synthesis and Applications</td>
<td>4 CR</td>
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<td>T-MACH-102191</td>
<td>Polymers in MEMS B: Physics, Microstructuring and Applications</td>
<td>4 CR</td>
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<td>T-MACH-102200</td>
<td>Polymers in MEMS C: Biopolymers and Bioplastics</td>
<td>4 CR</td>
<td>Rapp, Worgull</td>
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<td>T-MACH-105341</td>
<td>Lab Computer-Aided Methods for Measurement and Control</td>
<td>4 CR</td>
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<td>T-MACH-105555</td>
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<td>Virtual Reality Practical Course</td>
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**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
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:** 90
**Recurrence:** Each term
**Language:** German/English
**Level:** 4
**Version:** 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 ()**

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<td>T-MACH-105215</td>
<td>Applied Tribology in Industrial Product Development</td>
<td>4 CR</td>
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<td>T-MACH-102185</td>
<td>CATIA CAD Training Course</td>
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<td>Powertrain Systems Technology B: Stationary Machinery</td>
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<td>CAD-NX Training Course</td>
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<td>CAE-Workshop</td>
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**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
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

<table>
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**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.

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<td>T-MACH-105519 Human Factors Engineering II</td>
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<td>T-MACH-105830 Human Factors Engineering III: Empirical research methods</td>
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<td>T-MACH-108844 Automated Manufacturing Systems</td>
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<td>T-MACH-102105 Manufacturing Technology</td>
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<td>T-MACH-105159 Global Production and Logistics - Part 2: Global Logistics</td>
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<td>T-MACH-109919 Basics of Technical Logistics I</td>
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<td>T-MACH-105388 Introduction to Industrial Production Economics</td>
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<td>T-MACH-105386 Occupational Safety and Environmental Protection</td>
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<td>T-MACH-105457 Project Mikromanufacturing: Development and Manufacturing of Microsystems</td>
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<td>T-MACH-105171 Safety Engineering</td>
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<td>T-MACH-105177 Metal Forming</td>
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<td>T-MACH-109055 Machine Tools and Industrial Handling</td>
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**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
# 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

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## 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 ()

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<td>T-MACH-108718</td>
<td>Introduction to numerical mechanics</td>
<td>4 CR</td>
<td>Schnack</td>
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<td>T-MACH-108808</td>
<td>Introduction to Engineering Mechanics I: Statics</td>
<td>3 CR</td>
<td>Fidlin</td>
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<tr>
<td>T-MACH-102208</td>
<td>Introduction to Engineering Mechanics I: Statics and Strength of Materials</td>
<td>5 CR</td>
<td>Fidlin</td>
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<td>T-MACH-105439</td>
<td>Introduction to Nonlinear Vibrations</td>
<td>7 CR</td>
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<td>T-MACH-105514</td>
<td>Experimental Dynamics</td>
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<td>T-MACH-105324</td>
<td>Foundations of Nonlinear Continuum Mechanics</td>
<td>4 CR</td>
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<td>Numerical Mechanics for Industrial Applications</td>
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<td>T-MACH-105348</td>
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<td>4 CR</td>
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<td>Computational Dynamics</td>
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<td>T-MACH-105352</td>
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<td>T-MACH-105458</td>
<td>Flow Simulations</td>
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<td>T-MACH-105290</td>
<td>Vibration Theory</td>
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<td>Wave Propagation</td>
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### 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
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: 60
Recurrence: Each term
Language: German/English
Level: 4
Version: 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.

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<tr>
<td>T-MACH-105308 Atomic Simulations and Molecular Dynamics 4 CR Brandl, Gumbsch, Schneider</td>
</tr>
<tr>
<td>T-MACH-105381 Virtual Engineering (Specific Topics) 4 CR Ovtcharova</td>
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<td>T-MACH-105407 CFD in Power Engineering 4 CR Otic</td>
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<td>T-MACH-106698 A holistic approach to power plant management 4 CR Seidl, Stieglitz</td>
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<td>T-ETIT-100807 Electrical Machines 4 CR Becker</td>
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<td>T-MACH-105154 Vehicle Comfort and Acoustics I 4 CR Gauterin</td>
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<td>T-MACH-105155 Vehicle Comfort and Acoustics II 4 CR Gauterin</td>
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<td>T-MACH-105444 Combined Cycle Power Plants 4 CR Schünberg</td>
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<td>T-MACH-105220 Fundamentals of Energy Technology 8 CR Badea, Cheng</td>
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<td>T-MACH-100909 Automotive Engineering I 8 CR Gauterin, Unrau</td>
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<td>T-MACH-102117 Automotive Engineering II 4 CR Gauterin, Unrau</td>
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<td>T-MACH-105379 Global Logistics 4 CR Furmans</td>
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<td>T-MACH-105182 Introduction to Microsystem Technology I 4 CR Badilita, Jouda, Korvink</td>
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<td>T-MACH-105183 Introduction to Microsystem Technology II 4 CR Jouda, Korvink</td>
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<td>T-MACH-105162 Fundamentals of Automobile Development I 2 CR Frech</td>
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<td>T-MACH-105163 Fundamentals of Automobile Development II 2 CR Frech</td>
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<td>T-MACH-105466 Introduction to Neutron Cross Section Theory and Nuclear Data Generation 4 CR Dagan</td>
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<td>T-MACH-105402 Nuclear Power Plant Technology 4 CR Badea, Cheng, Schünberg</td>
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<td>T-MACH-105410 Coal Fired Power Plants 4 CR Schünberg</td>
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<td>T-MACH-105223 Machine Vision 8 CR Lauer, Stiller</td>
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<td>T-MACH-105434 Magnet Technology of Fusion Reactors 4 CR Fietz, Weiss</td>
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<td>T-MACH-105210 Machine Dynamics 5 CR Proppe</td>
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<td>T-MACH-105224 Machine Dynamics II 4 CR Proppe</td>
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<td>T-MACH-105189 Mathematical Models and Methods for Production Systems 6 CR Baumann, Furmans</td>
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<td>T-MACH-105557 Microenergy Technologies 4 CR Kohl</td>
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<td>T-MACH-105782 Micro Magnetic Resonance 4 CR Korvink, MacKinnon</td>
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<td>T-MACH-105532 Nonlinear Continuum Mechanics 5 CR Böhlke</td>
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<td>T-WIWI-100806 Renewable Energy-Resources, Technologies and Economics 4 CR Jochem, McKenna</td>
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<td>T-MACH-105445 Simulator Exercises Combined Cycle Power Plants 2 CR Schünberg</td>
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<td>T-MACH-105456 Ten Lectures on Turbulence 4 CR Otic</td>
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<td>T-MACH-105363 Thermal Turbomachines I 6 CR Bauer</td>
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<td>T-MACH-105364 Thermal Turbomachines II 6 CR Bauer</td>
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### 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

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

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**Competence Certificate**
oral exam of about 30 minutes

**Prerequisites**
none

**Annotation**
none
### 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

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**Competence Certificate**  
oral exam

**Prerequisites**  
none
### 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

<table>
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<tr>
<td>Oral examination</td>
<td>4</td>
<td>Each summer term</td>
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**Events**

<table>
<thead>
<tr>
<th>SS 2020</th>
<th>2194660</th>
<th>Advanced Materials Thermodynamics: Experiments and Modelling</th>
<th>2 SWS</th>
<th>Lecture (V)</th>
<th>Seifert, Franke</th>
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</thead>
</table>

**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:*

**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

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

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<td>Oral examination</td>
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<td>Each summer term</td>
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</table>

**Events**

| SS 2020 | 2154420 | Aerodynamics | 2 SWS | Ohle |

**Competence Certificate**
oral exam 30 minutes

**Prerequisites**
none

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

**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


Schlichting, Gersten. Grenzschichttheorie, Springer
3.5 Course: Agile Product Innovation Management - Value-driven Planning of New Products [T-MACH-106744]

**Responsible:** Dr.-Ing. Roland Kläger

**Organisation:** KIT Department of Mechanical Engineering

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

**Competence Certificate**
Oral examination, 20 min.

**Prerequisites**
None

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<td>Each summer term</td>
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Modules of Mechanical Engineering for Exchange Students
Module Handbook as of 15/02/2020

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

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<thead>
<tr>
<th>Responsible</th>
<th>Prof. Dipl.-Ing. Karl Ernst Noreikat</th>
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<tbody>
<tr>
<td>Organisation</td>
<td>KIT Department of Mechanical Engineering</td>
</tr>
<tr>
<td>Part of</td>
<td>M-MACH-104849 - Major Field Automotive Engineering</td>
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<tr>
<td>SS 2020</td>
<td>76-T-MACH-105655</td>
<td>Alternative Powertrain for Automobiles</td>
<td>Prüfung (PR)</td>
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</table>

**Competence Certificate**
written exam
3 COURSES  
Course: Analysis of Exhaust Gas and Lubricating Oil in Combustion Engines [T-MACH-105173]  

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  

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Events  
SS 2020  2134150  Analysis of Exhaust Gas und Lubricating Oil in Combustion Engines  2 SWS  Lecture (V)  Gohl  

Exams  
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 auxiliary means)  

Prerequisites  
none  

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

**Analysis of Exhaust Gas und Lubricating Oil in Combustion Engines**  
2134150, SS 2020, 2 SWS, Language: German, Open in study portal  

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

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**Events**

<table>
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<th>2134134</th>
<th>Analysis tools for combustion diagnostics</th>
<th>2 SWS</th>
<th>Lecture (V)</th>
<th>Pfeil</th>
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**Exams**

<table>
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<th>SS 2020</th>
<th>76-T-MACH-105167</th>
<th>Analysis Tools for Combustion Diagnostics</th>
<th>Prüfung (PR)</th>
<th>Koch</th>
</tr>
</thead>
</table>

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

Prerequisites
none

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

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

Literature
Skript, erhältlich in der Vorlesung
### 3.9 Course: Applied Materials Modelling [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

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**Events**

<table>
<thead>
<tr>
<th>SS 2020</th>
<th>2182614</th>
<th>Applied Materials Modelling</th>
<th>4 SWS</th>
<th>Lecture / Practice (VÜ)</th>
<th>Schulz, Gumbsch</th>
</tr>
</thead>
</table>

**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:**

**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 knowledge 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

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[43](#)
Literature

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

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<td>Oral examination</td>
<td>4</td>
<td>Each winter term</td>
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</table>

**Competence Certificate**
oral exam (20 min)

**Prerequisites**
None
3 COURSES

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

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

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Events

<table>
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<th>SS 2020</th>
<th>2181740</th>
<th>Atomistic simulations and molecular dynamics</th>
<th>2 SWS</th>
<th>Lecture (V)</th>
<th>Gumbsch, Weygand</th>
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<tr>
<td>SS 2020</td>
<td>2181741</td>
<td>Lab for 'Atomistic simulations and molecular dynamics'</td>
<td>2 SWS</td>
<td>Practice (Ü)</td>
<td>Gumbsch, Weygand</td>
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</table>

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:

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 knowledge 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


Lab for 'Atomistic simulations and molecular dynamics'
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 dynamics software package.

Literature
siehe Voprlesung
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

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**Events**

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<th>Type</th>
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<tr>
<td>SS 2020 2150904</td>
<td>6 SWS</td>
<td>Automated Manufacturing Systems</td>
<td>Lecture / Practice (VÜ)</td>
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</table>

**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:_

- **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 automatic 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/).
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

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**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.
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

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**Events**

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<tr>
<td>SS 2020</td>
<td>2114835</td>
<td>Automotive Engineering II</td>
<td>2 SWS</td>
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<td>SS 2020</td>
<td>2114855</td>
<td>Automotive Engineering II</td>
<td>2 SWS</td>
<td>Lecture (V)</td>
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</table>

**Competence Certificate**

Written Examination

Duration: 90 minutes

Auxiliary means: none

**Prerequisites**

none

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

**Automotive Engineering II**

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

**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**


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:

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

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<td>Each summer term</td>
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Events

| SS 2020 | 2138340 | Automotive Vision | 3 SWS | Lecture (V) | 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:

Automotive Vision
2138340, SS 2020, 3 SWS, Language: German, 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 seeing 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.
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

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<td>Written exam</td>
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<td>Each winter term</td>
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**Competence Certificate**

written exam
2.5 hours

**Prerequisites**
none
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

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<td>Each winter term</td>
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</table>

**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.
### 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

<table>
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<tbody>
<tr>
<td>Written exam</td>
<td>5</td>
<td>Each winter term</td>
<td>1</td>
</tr>
</tbody>
</table>

**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 Logistics I" (T-MACH-109919) preconditioned.
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

<table>
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**Events**

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<th>Course Title</th>
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<th>Lecture Type (V)</th>
<th>Instructor(s)</th>
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<tbody>
<tr>
<td>SS 2020</td>
<td>2138336</td>
<td>Behaviour Generation for Vehicles</td>
<td>2</td>
<td>Werling, Stiller</td>
<td></td>
</tr>
</tbody>
</table>

**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:*

**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.
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

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<tr>
<td>Written examination</td>
<td>3</td>
<td>Each summer term</td>
<td>2</td>
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</table>

**Events**

| SS 2020 | 2305264 | Bioelectric Signals | 2 SWS | Lecture (V) | Loewe |

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

**Prerequisites**
none
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

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<td>Each winter term</td>
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</table>

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

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<tbody>
<tr>
<td>Written exam</td>
<td>4</td>
<td>Each winter term</td>
<td>2</td>
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</table>

Competence Certificate
written exam (75 Min.)

Prerequisites
none
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

<table>
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<td>SS 2020 2142883</td>
<td>4</td>
<td>Each summer term</td>
<td>Written exam</td>
<td>2</td>
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</tbody>
</table>

**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

**Content**
Examples of use in Life-Sciences and biomedicine: Microfluidic Systems:
- LabCD, Protein Crystallisation
- Microarrays
- 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
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

<table>
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<tbody>
<tr>
<td>Written examination</td>
<td>4</td>
<td>Each summer term</td>
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Events
SS 2020 2142879 BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III 2 SWS Lecture (V) Guber

Competence Certificate
Written exam (75 Min.)

Prerequisites
none

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

BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III
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
3.25 Course: Bionics for Engineers and Natural Scientists [T-MACH-102172]

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

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

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<tbody>
<tr>
<td>Oral exam</td>
<td>4</td>
<td>Each summer term</td>
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Events

SS 2020 2142140 Bionics for Engineers and Natural Scientists 2 SWS Lecture (V) Hölscher, Greiner

Competence Certificate
written or oral exam

Prerequisites
none

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

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

lectures 30 h
self study 30 h
preparation for examination 30 h

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

Literature
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

<table>
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**Events**

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<td>SS 2020</td>
<td>2114092</td>
<td>BUS-Controls</td>
<td>2 SWS</td>
<td>Lecture (V)</td>
<td>Geimer, Daiß</td>
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**Exams**

<table>
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<tr>
<th>Semester</th>
<th>Code</th>
<th>Course</th>
<th>Type</th>
<th>Lecturer(s)</th>
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<tr>
<td>SS 2020</td>
<td>76T-MACH-102150</td>
<td>BUS-Controls</td>
<td>Prüfung (PR)</td>
<td>Geimer</td>
</tr>
</tbody>
</table>

**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:**


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

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

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<td>Each summer term</td>
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Exams

| SS 2020 | 76-T-MACH-108889 | BUS-Controls - Advance | Prüfung (PR) | Geimer |

Competence Certificate
Creation of control program

Prerequisites
none
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

<table>
<thead>
<tr>
<th>Type</th>
<th>Completed coursework (practical)</th>
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<td><strong>Each term</strong></td>
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Events

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<th>2123357</th>
<th>CAD-NX training course</th>
<th>2 SWS</th>
<th>Practical course (P)</th>
<th>Ovtcharova, Mitarbeiter</th>
</tr>
</thead>
</table>

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:

**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
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

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<td>Examination of another type</td>
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<td>Each term</td>
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</table>

**Events**

| SS 2020 | 2147175 | CAE-Workshop | 3 SWS | Block (B) | Albers, Mitarbeiter |

**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:*

**Content**

Content:

- Introduction to the finite element analysis (FEA)
- Stress 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.
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**  
Examination of another type

**Credits**  
4

**Recurrence**  
Each term

**Version**  
1

<table>
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<th>Events</th>
<th>2123380</th>
<th>CATIA advanced</th>
<th>3 SWS</th>
<th>Project (PRO)</th>
<th>Ovtcharova, Mitarbeiter</th>
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<tbody>
<tr>
<td>SS 2020</td>
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</table>

**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:*

**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
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

<table>
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<tbody>
<tr>
<td>SS 2020</td>
<td>2123358</td>
<td>CATIA CAD training course</td>
<td>3 SWS</td>
<td>Practical course (P)</td>
</tr>
</tbody>
</table>

**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:**

**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
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

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<th>Type</th>
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</thead>
<tbody>
<tr>
<td>Oral examination</td>
<td>4</td>
<td>Each winter term</td>
<td>1</td>
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</table>

Competence Certificate
oral exam
## 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

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<tbody>
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<td>Oral examination</td>
<td>4</td>
<td>Each summer term</td>
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</table>

### Events

| SS 2020 | 2130910 | CFD for Power Engineering | 2 SWS | Lecture (V) | Otic |

### Competence Certificate

Oral exam, 30 min

### Prerequisites

none

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

### CFD for Power Engineering

2130910, SS 2020, 2 SWS, Language: English, [Open in study portal](#)
The course is aimed at 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 the form of a technical report.

Literature
Vorlesungsskript
Projektskript und Unterlagen
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

Competence Certificate
Successful solution of problems

Prerequisites
none
### 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  

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<tbody>
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<td>Oral examination</td>
<td>6</td>
<td>Each summer term</td>
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</tbody>
</table>

#### 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:

#### Chemical Fuels (ENTECH)

22331, SS 2020, 2 SWS, Language: English, [Open in study portal](#)  
Lecture (V)
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

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

Prerequisites
none
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

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<td>Each winter term</td>
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</tbody>
</table>

Competence Certificate
Oral examination, Duration approximately 30 Minutes
no tools or reference materials may be used during the exam

Prerequisites
none
### 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

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<td>6</td>
<td>Each summer term</td>
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</tbody>
</table>

**Events**

| SS 2020 | 2138341 | Cognitive 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:**

### Cognitive 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.
### 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

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**Events**

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<tr>
<td>SS 2020</td>
<td>24572</td>
<td>Kognitive Systeme</td>
<td>4</td>
<td>Lecture / Practice (VÜ)</td>
<td>Waibel, Stüker, Meißner, Neumann</td>
</tr>
</tbody>
</table>
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

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<tbody>
<tr>
<td>SS 2020</td>
<td>2170490</td>
<td>Combined Cycle Power Plants</td>
<td>2 SWS</td>
</tr>
</tbody>
</table>

**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:**

**Combined Cycle Power Plants**
2170490, 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. 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 challenging 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:
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

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<td>4</td>
<td>Each winter term</td>
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</table>

Exams

| 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
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

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**Exams**

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<td>76-T-MACH-104609</td>
<td>Combustion Engines II</td>
<td>Koch, Kubach</td>
</tr>
</tbody>
</table>

**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:*
**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**  
Written examination

**Credits**  
4

**Recurrence**  
Each summer term

**Version**  
2

**Events**

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<th>Event</th>
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<td>SS 2020</td>
<td>2114053</td>
<td>Composite Manufacturing – Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies</td>
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<td>Henning</td>
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**Exams**

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<td>Composite Manufacturing - Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies</td>
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<td>Henning</td>
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</table>

**Competence Certificate**  
written exam 90 minutes

**Prerequisites**  
none

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

**Composite Manufacturing – Polymers, Fibers, Semi-Finished Products, Manufacturing Technologies**  
2114053, SS 2020, 2 SWS, Language: German, Open in study portal

**Literature**

**Literatur Leichtbau II**

[1-7]


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

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<tbody>
<tr>
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<td>Each summer term</td>
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</table>

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:

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!
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:** Oral examination

**Credits:** 6

**Recurrence:** Each winter term

**Expansion:** 1 terms

**Version:** 1

**Competence Certificate**
oral exam, 30 min

**Prerequisites**
nein
### 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

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<tr>
<td>Written examination</td>
<td>4</td>
<td>Each winter term</td>
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</table>

**Competence Certificate**  
Written exam (Duration: 1h)

**Prerequisites**  
none
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

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<td>Oral examination</td>
<td>6</td>
<td>Each winter term</td>
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**Competition 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.
## 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

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**Events**

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<th>Type</th>
<th>Lecturer(s)</th>
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<td>SS 2020</td>
<td>2162206</td>
<td>Consultation hour Computational Mechanics II</td>
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<td>Consultation-hour (Sprechst.)</td>
<td>Erdle, Krause</td>
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<tr>
<td>SS 2020</td>
<td>2162296</td>
<td>Computational Mechanics II</td>
<td>2</td>
<td>Lecture (V)</td>
<td>Böhlke, Langhoff</td>
</tr>
<tr>
<td>SS 2020</td>
<td>2162297</td>
<td>Tutorial Computational Mechanics II</td>
<td>2</td>
<td>Practice (Ü)</td>
<td>Erdle, Krause, Langhoff</td>
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</tbody>
</table>

**Competence Certificate**
oral examination, 30 min.

**Prerequisites**
none

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

### Lecture (V)

**Computational Mechanics II**
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 plasticity
- linear and geometrically nonlinear thermoelasticity

**Literature**
- Belytschko, T.; Liu, W.K.; Moran, B.: Nonlinear FE for Continua and Structures. JWS 2000

### Practice (Ü)

**Tutorial Computational Mechanics II**
2162297, SS 2020, 2 SWS, Language: German, [Open in study portal](#)

**Content**
see lecture "Computational Mechanics II"

**Literature**
siehe Vorlesung "Rechnerunterstützte Mechanik II"
Course: Computational Vehicle Dynamics [T-MACH-105350]

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

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Events

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<td>SS 2020</td>
<td>2162256</td>
<td>Computational Vehicle Dynamics</td>
<td>2</td>
<td>German</td>
<td>Open in study portal</td>
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</table>

Competence Certificate
oral exam, 30 min.

Prerequisites
none

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

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

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
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

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Events

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<th>SS 2020</th>
<th>2106002</th>
<th>Computer Engineering</th>
<th>2 SWS</th>
<th>Lecture (V)</th>
<th>Keller</th>
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</table>

Competence Certificate
written exam (Duration: 2 hours)

Prerequisites
none

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

**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 exercise 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)


### 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

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<td>4</td>
<td>Each summer term</td>
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</table>

**Competence Certificate**  
Oral exam, 30 min.

**Prerequisites**  
none

**Recommendation**  
Knowledge of EM III/IV
### 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

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<tbody>
<tr>
<td>Oral exam</td>
<td>4</td>
<td>Each winter term</td>
<td>1</td>
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</table>

**Competence Certificate**  
oral examination (about 30 min)

- no tools or reference materials

**Prerequisites**  
none
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

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<td>4</td>
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</table>

**Events**

| SS 2020 | 2194643 | Constitution and Properties of Wear resistant materials | 2 SWS | Lecture (V) | Ulrich |

**Competence Certificate**  
oral examination (about 30 min)

**Prerequisites**  
none

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

**Constitution and Properties of Wear resistant materials**  
2194643, SS 2020, 2 SWS, Language: German, Open in study portal  

**Lecture (V)**  

**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


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
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

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<td>4</td>
<td>Each summer term</td>
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</tbody>
</table>

**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:

### 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 be 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
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)
### 3.55 Course: Control Technology [T-MACH-105185]

**Responsible:** Christoph Gönnheimer

**Organisation:** KIT Department of Mechanical Engineering

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

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</table>

**Events**

| SS 2020 | 2150683 | Control Technology       | 2 SWS   | Lecture (V) | Gönnheimer |

**Competence Certificate**

Written Exam (60 min)

**Prerequisites**

none

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

**Control Technology**

2150683, SS 2020, 2 SWS, Language: German, [Open in study portal](#)
**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/](https://ilias.studium.kit.edu/)) bereitgestellt.

**Media:**

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

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Events

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<td>Lecture (V) Bauer, Elfner</td>
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Exams

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<td>Prüfung (PR) Bauer, Schulz</td>
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Competence Certificate
oral exam, 30 min.

Prerequisites
none

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

Cooling of thermally high loaded gas turbine components
2170463, SS 2020, 2 SWS, Language: German, Open in study portal

**Lecture (V)**

**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 will 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 between 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 convective heat transfer and film cooling
- design cooled 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
# 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

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**Events**

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<td>Data Analytics for Engineers</td>
<td>3 SWS</td>
<td>Lecture / Practice (VÜ)</td>
<td>Mikut, Reischl, Ludwig</td>
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</table>

**Competence Certificate**

Written exam (Duration: 1h)

**Prerequisites**

none

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

## Data Analytics for Engineers

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

**Contents**

- 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)
**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

### Exams

| 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 interesting 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, students 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 successfully
- analyse a mobile machines and break its structure down from a complex system to subsystems with reduced complexity
- identify and describe interactions and links between subsystems of a mobile machine
- present and document solutions of a technical problem according to R&D standards

The number of participants is limited.

**Content:**

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 criteria 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 addressed. To do so, an exemplary mobile machine will be discussed and designed in the lecture as a semester project.

**Literature:**

See German recommendations

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Modules of Mechanical Engineering for Exchange Students  
Module Handbook as of 15/02/2020
### 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

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<td>76-T-MACH-108887</td>
<td>Design and Development of Mobile Machines - Advance</td>
<td>Prüfung (PR)</td>
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**Prerequisites**  
none

**Competence Certificate**  
Preparation of semester report
3.60 Course: Design of Highly Stresses Components [T-MACH-105310]

Responsibility: 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

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<td>Each winter term</td>
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Competence Certificate
oral exam
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

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<td>4</td>
<td>Each summer term</td>
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**Events**

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

**Competence Certificate**

Oral exam, about 20 minutes

**Prerequisites**

none

**Recommendation**

Poly 1

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

**Design with Plastics**

2174571, SS 2020, 2 SWS, Language: German, [Open in study portal](#)
**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.
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

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

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

**Organisation:** KIT Department of Mechanical Engineering

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

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**Competence Certificate**
oral exam (20 min)

**Prerequisites**
none
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

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**Competence Certificate**
written exam
60 min.

**Prerequisites**
none
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

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Competence Certificate
oral examination
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:** Written examination
- **Credits:** 6
- **Recurrence:** Each winter term
- **Version:** 1

**Prerequisites**

none
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** Oral examination  
**Credits** 4  
**Recurrence** Each summer term  
**Version** 1

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<td>Lecture (V)</td>
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<td>Design &amp; Optimization of Conventional &amp; Electrified Automotive Transmissions</td>
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</table>

**Competence Certificate**  
oral exam (20 min)

**Prerequisites**  
none

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

Design & Optimization of Conventional & Electrified Automotive Transmissions  
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-axes
- 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)
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

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**Competence Certificate**
Active and regular participation (compulsory attendance) in all appointments; no marking.

**Prerequisites**
Timely enrollment in ILIAS; limited number of participants.
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

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<td>2</td>
<td>Each winter term</td>
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**Competence Certificate**
Oral examination, time duration 30 min., no aids

**Prerequisites**
none
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

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Exams

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 every 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.
### 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

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#### Exams

| 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
### 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

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<td>1 SWS</td>
<td>Practice (Ü)</td>
<td>Vivekanathan</td>
</tr>
</tbody>
</table>

**Prerequisites**  
none
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

<table>
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Events

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<tbody>
<tr>
<td>SS 2020 2114346 Electric Rail Vehicles</td>
<td>2 SWS Lecture (V) Gratzfeld</td>
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Exams

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<tr>
<td>SS 2020 76-T-MACH-102121 Electrical Railway Traction Systems</td>
<td>Prüfung (PR) Gratzfeld</td>
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</table>

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:

**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).
<table>
<thead>
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<tr>
<td>Written examination</td>
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<td>Each winter term</td>
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</table>

**Competence Certificate**
Written exam, duration 3 hours.

**Prerequisites**
none

**Annotation**
Exam will be held in english language.
### 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

<table>
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**Annotation**  
Exam will be held in german language
# 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

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</table>
### 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 |

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#### Events

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<td>WS 20/21</td>
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#### 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

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<td>Electronic Devices and Circuits</td>
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<td>Übungen zu 2312655 Elektronische Schaltungen</td>
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Prerequisites
none
**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

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**Exams**

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<td>Energy and Process Technology I</td>
<td>Prüfung (PR)</td>
<td>Bauer, Wirbser, Schwitzke</td>
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</table>

**Competence Certificate**

The assessment consists of a written exam (120 minutes) (following §4(2), 1 of the examination regulation).

**Prerequisites**

none
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

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Events

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<td>SS 2020 2170832 Energy and Process Technology II</td>
<td>6 SWS</td>
<td>Lecture / Practice (VÜ)</td>
<td>Schwitzke, Wirbser, Pritz</td>
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Exams

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<th>Events</th>
<th>Credits</th>
<th>Recurrence</th>
<th>Version</th>
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</table>

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:

Energy and Process Technology II

Content

Thermal Turbomachinery - 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 fossil 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, risks 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
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

<table>
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**Exams**

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<th>Energy Conversion and Increased Efficiency in Internal Combustion Engines</th>
<th>Prüfung (PR)</th>
<th>Koch, Kubach</th>
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</thead>
</table>

**Competence Certificate**

oral exam, 25 minutes, no auxiliary means

**Prerequisites**

none
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

<table>
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**Events**

| SS 2020 | 2158203 | Energy demand of buildings – fundamentals and applications, with building simulation exercises | 4 SWS | Lecture / Practice (VÜ) | Schmidt |

**Exams**

| 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:

**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](#)
Course: Energy demand of buildings – fundamentals and applications, with building simulation exercises [T-MACH-105715]

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

3.83 Course: Energy Market Engineering [T-WIWI-107501]

Responsibel: Prof. Dr. Christof Weinhardt
Organisation: KIT Department of Economics and Management
Part of: M-MACH-104884 - Courses of the Department of Economics and Management

Events

<table>
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<td>SS 2020 2540465</td>
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<td>Practice (Ü)</td>
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</table>

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:

Energy Market Engineering
2540464, SS 2020, 2 SWS, Language: German, Open in study portal

Lecture (V)

Literature

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

<table>
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</table>

**Exams**

| 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.

Responsible: Dr. Ron Dagan
Organisation: KIT Department of Mechanical Engineering

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

<table>
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Exams


Competence Certificate
oral exam, 1/2 hour

Prerequisites
none
### 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

<table>
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#### Events

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</table>

**Competence Certificate**

oral exam, 20 min

**Prerequisites**

none

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

### 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

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

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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:

Engine Laboratory

2134001, SS 2020, 2 SWS, Language: German, Open in study portal

Practical course (P)

Literature

Versuchsbeschreibungen
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

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Events

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<td>Engine measurement techniques</td>
<td>2 SWS</td>
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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:

Engine measurement techniques
2134137, SS 2020, 2 SWS, Language: German, Open in study portal

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
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

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<td>Each term</td>
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**Events**

| SS 2020 | 2545001 | Entrepreneurship | 2 SWS | Lecture (V) | 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:

**Entrepreneurship**

2545001, SS 2020, 2 SWS, Language: English, [Open in study portal]

**Literature**

Füglistaller, Urs, Müller, Christoph und Volery, Thierry (2008): Entrepreneurship
Ries, Eric (2011): The Lean Startup
3 COURSES

Course: Exercises - Fatigue of Welded Components and Structures [T-MACH-109304]

3.90 Course: Exercises - 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

Competence Certificate
successful solving of all exercises

Prerequisites
none
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

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<td>Each winter term</td>
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**Competence Certificate**
Homework is mandatory.
3 COURSES

Course: Exercises in Technical Thermodynamics and Heat Transfer II [T-MACH-105288]

3.92 Course: Exercises 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

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Events

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<th>Technical Thermodynamics and Heat Transfer II (Tutorial)</th>
<th>2 SWS</th>
<th>Practice (Ü)</th>
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<tr>
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<td>2166556</td>
<td>Technical Thermodynamics and Heat Transfer II (Tutorial)</td>
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<td>Technical Thermodynamics and Heat Transfer II (Tutorial)</td>
<td>2 SWS</td>
<td>Practice (Ü)</td>
<td>Schießl, Maas</td>
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</table>

Competence Certificate
Homework is mandatory.

Prerequisites
none

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

Technical Thermodynamics and Heat Transfer II (Tutorial)
2166556, SS 2020, 2 SWS, Language: German, Open in study portal

Content
Calculation of thermodynamical problems

Literature
Vorlesungsskriptum
**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

<table>
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<th>Each winter term</th>
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<th>1 terms</th>
<th>Version</th>
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</thead>
</table>

**Competence Certificate**  
successful solving of all exercises

**Prerequisites**  
none
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**  
Completed coursework

**Credits**  
2

**Recurrence**  
Each summer term

**Version**  
2

### Events

<table>
<thead>
<tr>
<th>SS 2020</th>
<th>2182614</th>
<th>Applied Materials Modelling</th>
<th>4 SWS</th>
<th>Lecture / Practice (VÜ)</th>
<th>Schulz, Gumbsch</th>
</tr>
</thead>
</table>

**Competence Certificate**

successful solving of all exercises

**Prerequisites**

none

---

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

**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 knowledge 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**

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

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</table>

**Exams**

| SS 2020 | 76-T-MACH-107685 | Exercises for Materials Characterization | Prüfung (PR) | Heilmaier, Gibmeier |

**Competence Certificate**

Regular attendance

**Prerequisites**

none
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

Competence Certificate  
successful processing of exercises

Prerequisites  
none

<table>
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<th>Type</th>
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<th>Recurrence</th>
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<td>Each winter term</td>
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</table>
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

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<tr>
<td>SS 2020 2162225</td>
<td>3 SWS</td>
<td>Lecture (V)</td>
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<td>SS 2020 2162228</td>
<td>2 SWS</td>
<td>Practice (Ü)</td>
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<table>
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<tr>
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<th>Prüfung (PR)</th>
<th>Fidlin</th>
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<tbody>
<tr>
<td>SS 2020 76-T-MACH-105514</td>
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</tbody>
</table>

**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](#)

**Content**

1. Introduction
2. Measurement principles
3. Sensors as coupled 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
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

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<tbody>
<tr>
<td>Oral examination</td>
<td>4</td>
<td>Each summer term</td>
<td>1</td>
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</tbody>
</table>

Events

| SS 2020 | 2154446 | Experimental Fluid Mechanics | 2 SWS | Lecture (V) | Kriegseis |

Competence Certificate
oral exam - 30 minutes

Prerequisites
none

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

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
**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

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<td>Completed coursework</td>
<td>4</td>
<td>Each winter term</td>
<td>2</td>
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</tbody>
</table>

**Competence Certificate**  
Certificate to be issued after evaluation of the lab class report.

**Prerequisites**  
Certificate 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!
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

<table>
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<th>Events</th>
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<tr>
<td>SS 2020 2143882</td>
<td>2 SWS</td>
<td>Lecture (V)</td>
<td>Bade</td>
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</table>

Competence Certificate
Oral examination, 20 minutes

Prerequisites
none

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

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
### 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

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<td>Each winter term</td>
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#### Exams

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<th>76-T-MACH-105724</th>
<th>Failure Analysis</th>
<th>Prüfung (PR)</th>
<th>Schneider</th>
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</table>

**Competence Certificate**

oral examination, ca. 30 min

**Prerequisites**

none

**Recommendation**

basic knowledge in materials science (e.g. lecture materials science I and II)
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

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<td>Each winter term</td>
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</table>

**Exams**

| 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 knowledge in mathematics, mechanics and materials science
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

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<td>Oral examination</td>
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<td>Each winter term</td>
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**Competence Certificate**
oral exam ca. 30 minutes
no tools or reference materials

**Prerequisites**
none

**Recommendation**
preliminary knowledge in mathematics, mechanics and materials science
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

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**Exams**

| 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.
### 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

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<td>Each winter term</td>
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**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 - Exercises - Fatigue of Welded Components and Structures must have been passed.

**Recommendation**
preliminary knowledge materials science and mechanics
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

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Events

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<th>Version</th>
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<tr>
<td>SS 2020</td>
<td>2183716</td>
<td>FEM Workshop -- Constitutive Laws</td>
<td>2 SWS</td>
<td>Block (B)</td>
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</table>

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:

FEM Workshop -- Constitutive Laws
2183716, SS 2020, 2 SWS, Language: German, [Open in study portal]

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

**Responsible:** Dr. Torsten Luedecke

**Organisation:** KIT Department of Economics and Management

**Part of:** M-MACH-104884 - Courses of the Department of Economics and Management

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<td>SS 2020</td>
<td>2530205</td>
<td>Financial Analysis</td>
<td>2 SWS</td>
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<tr>
<td>SS 2020</td>
<td>2530206</td>
<td>Übungen zu Financial Analysis</td>
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</tr>
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</table>

**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:*

**Financial Analysis**
2530205, SS 2020, 2 SWS, Language: English, [Open in study portal](#)

**Literature**
Course: Finite Difference Methods for Numerical 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

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<th>Version</th>
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<tbody>
<tr>
<td>Oral examination</td>
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<td>Each winter term</td>
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</table>

Competence Certificate
oral exam, Duration: 30 minutes
no auxiliary means

Prerequisites
none
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

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Events

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<th>Version</th>
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<tbody>
<tr>
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<td>Finite Element Workshop</td>
<td>2 SWS</td>
<td>Block (B)</td>
<td>Weygand, Mattheck, Tesari</td>
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</tbody>
</table>

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:

Content
The students will learn the foundations of the FEM stress analysis and the optimization method '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
### 3.110 Course: Flow Simulations [T-MACH-105458]

<table>
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<tr>
<th>Responsible</th>
<th>Prof. Dr.-Ing. Bettina Frohnapfel</th>
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<td>Organisation</td>
<td>KIT Department of Mechanical Engineering</td>
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<td>Part of</td>
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<td><strong>Recurrence</strong></td>
<td>Each winter term</td>
</tr>
<tr>
<td><strong>Version</strong></td>
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</table>

**Competence Certificate**
ungraded homework and colloquium

**Prerequisites**
none
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

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<tbody>
<tr>
<td>Oral examination</td>
<td>4</td>
<td>Each winter term</td>
<td>1</td>
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</tbody>
</table>

**Competence Certificate**
oral exam, 20 min

**Prerequisites**
none
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

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<tr>
<td>Oral examination</td>
<td>4</td>
<td>Each winter term</td>
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**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)
# 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

<table>
<thead>
<tr>
<th>Events</th>
<th>SS 2020</th>
<th>2154512</th>
<th>Fluid Mechanics I</th>
<th>3 SWS</th>
<th>Lecture / Practice (VÜ)</th>
<th>Frohnapfel</th>
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<tbody>
<tr>
<td>SS 2020</td>
<td>3154510</td>
<td>Fluid Mechanics I</td>
<td>3 SWS</td>
<td>Lecture / Practice (VÜ)</td>
<td>Frohnapfel</td>
<td></td>
</tr>
</tbody>
</table>

**Competence Certificate**  
written exam 3 hours

**Prerequisites**  
none

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

## Fluid Mechanics I

**2154512, SS 2020, 3 SWS, Language: German, Open in study portal**

**Lecture / Practice (VÜ)**

### 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


## Fluid Mechanics I

**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
### 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

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<tr>
<td>SS 2020</td>
<td>6221806</td>
<td>Fluid Mechanics of Turbulent Flows</td>
<td>4 SWS</td>
<td>Oral examination</td>
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<td></td>
<td></td>
<td>Uhlmann</td>
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</table>

**Competence Certificate**  
oral exam, appr. 30 min.

**Prerequisites**  
none

**Recommendation**  
none

**Annotation**  
none
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

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<tr>
<td>Written examination</td>
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<td>Each winter term</td>
<td>2</td>
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</tbody>
</table>

**Exams**
| SS 2020 | 76-T-MACH-102093 | Fluid Power Systems | Prüfung (PR) | Geimer |

**Competence Certificate**
The assessment consists of a written 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
### 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

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<td>Oral examination</td>
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<td>Each summer term</td>
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**Events**

<table>
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<tr>
<th>SS 2020</th>
<th>2154453</th>
<th>Fluid-Structure-Interaction with Python</th>
<th>2 SWS</th>
<th>Mühlhausen</th>
</tr>
</thead>
</table>

**Competence Certificate**  
oral exam 30 minutes

**Prerequisites**  
one

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

### 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
3.117 Course: Foundations of Nonlinear Continuum Mechanics [T-MACH-105324]

Responsible: Prof. Dr. Marc Kamlah
Organisation: KIT Department of Mechanical Engineering

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

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<tr>
<td>Oral exam</td>
<td>4</td>
<td>Each winter term</td>
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</table>

Competence Certificate
oral exam
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

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<th>Version</th>
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<tr>
<td>SS 2020 2174575 Foundry Technology</td>
<td>2 SWS</td>
<td>Lecture (V)</td>
<td>Wilhelm</td>
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</tbody>
</table>

**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:

**Foundry Technology**  
2174575, SS 2020, 2 SWS, Language: German, Open in study portal

**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 detailed 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 detailed.

**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
Reference to literature, documentation and partial lecture notes given in lecture
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
Oral examination

Credits
4

Recurrence
Each winter term

Version
1

Exams

| 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
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  

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<tr>
<td>Oral examination</td>
<td>4</td>
<td>Each winter term</td>
<td>1</td>
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</table>

**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**  
one
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

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<th>Recurrence</th>
<th>Version</th>
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<tbody>
<tr>
<td>Oral exam.</td>
<td>2</td>
<td>Each winter term</td>
<td>1</td>
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</table>

Competence Certificate
Oral group examination

Duration: 30 minutes
Auxiliary means: none

Prerequisites
none
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

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<td>Each summer term</td>
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**Events**

<table>
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<tr>
<th>SS 2020</th>
<th>2114840</th>
<th>Fundamentals for Design of Motor-Vehicles Bodies II</th>
<th>1 SWS</th>
<th>Lecture (V)</th>
<th>Bardehle</th>
</tr>
</thead>
</table>

**Competence Certificate**

Oral group examination

**Duration:** 30 minutes

**Auxiliary means:** none

**Prerequisites**

none

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

**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
3.123 Course: Fundamentals in the Development of Commercial Vehicles I [T-MACH-105160]

Responsible: Prof. Dr. Jörg Zürn
Organisation: KIT Department of Mechanical Engineering

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

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<tbody>
<tr>
<td>Oral examination</td>
<td>2</td>
<td>Each winter term</td>
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</tbody>
</table>

Competence Certificate
Oral group examination

Duration: 30 minutes
Auxiliary means: none

Prerequisites
none
3.124 Course: Fundamentals in the Development of Commercial Vehicles II [T-MACH-105161]

Responsible: Prof. Dr. Jörg Zürn
 Organisation: KIT Department of Mechanical Engineering

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

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<tr>
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<td>2</td>
<td>Each summer term</td>
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Events

| SS 2020 | 2114844 | Fundamentals in the Development of Commercial Vehicles II | 1 SWS | Lecture (V) | 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:

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 front axle 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

3.125 Course: Fundamentals of Automobile Development I [T-MACH-105162]

**Responsible:** 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

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<tbody>
<tr>
<td>Written exam</td>
<td>2</td>
<td>Each winter term</td>
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</table>

**Competence Certificate**
Written examination

**Duration:** 90 minutes

**Auxiliary means:** none

**Prerequisites**
none
3.126 Course: Fundamentals of Automobile Development II [T-MACH-105163]

Responsible: 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

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<td>Fundamentals of Automobile Development II</td>
<td>1 SWS</td>
<td>Lecture (V)</td>
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<tr>
<td>SS 2020 2114860</td>
<td>Principles of Whole Vehicle Engineering II</td>
<td>1 SWS</td>
<td>Frech</td>
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Competence Certificate
Written examination
Duration: 90 minutes
Auxiliary means: none

Prerequisites
none

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

Fundamentals of Automobile Development II
2114842, SS 2020, 1 SWS, Language: German, 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
Skript zur Vorlesung ist über ILIAS verfügbar.

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.
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

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<td>Each summer term</td>
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**Events**

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<tr>
<th>SS 2020</th>
<th>2134138</th>
<th>Fundamentals of catalytic exhaust gas aftertreatment</th>
<th>2 SWS</th>
<th>Lecture (V)</th>
<th>Lox, Grunwaldt, Deutschmann</th>
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**Exams**

<table>
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<tr>
<th>SS 2020</th>
<th>76-T-MACH-105044</th>
<th>Fundamentals of Catalytic Exhaust Gas Aftertreatment</th>
<th>Prüfung (PR)</th>
<th>Lox</th>
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</thead>
</table>

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

**Prerequisites**
none

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

**Fundamentals of catalytic exhaust gas aftertreatment**
2134138, SS 2020, 2 SWS, Language: German, Open in study portal

**Literature**
Skript, erhältlich in der Vorlesung

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

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<td>Oral examination</td>
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**Exams**

| SS 2020 | 76-T-MACH-105652 | Fundamentals of Combustion Engine Technology | Prüfung (PR) | Kubach |

**Competence Certificate**
oral exam, 30 min

**Prerequisites**
none
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

<table>
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<tbody>
<tr>
<td>SS 2020</td>
<td>2130927</td>
<td>Fundamentals of Energy Technology</td>
<td>3 SWS</td>
</tr>
<tr>
<td>SS 2020</td>
<td>3190923</td>
<td>Fundamentals of Energy Technology</td>
<td>3 SWS</td>
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Exams:

| 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:

Fundamentals of Energy Technology
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 storage
- Transport of energy
- Power generation and environment. Future of the energy industry
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
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

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<tr>
<td>Oral examination</td>
<td>4</td>
<td>Each winter term</td>
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Competence Certificate
oral exam about 30 minutes

Prerequisites
none
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

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**Exams**

| 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 knowledge in heat and mass transfer as well as in electrical engineering, basic knowledge in fluid mechanics, material sciences and physics
3 COURSES

Course: Fusion Technology B [T-MACH-105433]

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

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<th>Type</th>
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<tbody>
<tr>
<td>SS 2020</td>
<td>2190492</td>
<td>Fusion Technology B</td>
<td>Lecture (V)</td>
<td>2 SWS</td>
<td>Stieglitz</td>
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<tr>
<td>SS 2020</td>
<td>2190493</td>
<td>Übungen zu Fusionstechnologie B</td>
<td>Practice (Ü)</td>
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Exams

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<th>Course Name</th>
<th>Type</th>
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<td>SS 2020</td>
<td>76-T-MACH-105433</td>
<td>Fusion Technology B</td>
<td>Prüfung (PR)</td>
</tr>
</tbody>
</table>

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:

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
### 3.133 Course: Gasdynamics [T-MACH-105533]

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<tr>
<th>Responsible</th>
<th>Dr.-Ing. Franco Magagnato</th>
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<tr>
<td>Organisation</td>
<td>KIT Department of Mechanical Engineering</td>
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<tr>
<td>Part of</td>
<td>M-MACH-104848 - Major Field Energy and Environmental Engineering</td>
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</table>

| Type       | Oral examination |
| Credits    | 4                |
| Recurrence | Each winter term |
| Version    | 1                |

**Competence Certificate**
oral exam - 30 minutes

**Prerequisites**
none
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

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**Competence Certificate**

Oral Exam (20 min)

**Prerequisites**

none
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

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<td>Oral examination</td>
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**Events**

| SS 2020 | 3118095 | Global Logistics | 2 SWS | Furmans, Fleischer-Dörr, Mittwollen, Jacobi |

**Competence Certificate**
oral exam (20 min)

**Prerequisites**
none

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

**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
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**

| 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:**

**Global Production and Logistics - Part 2: Global Logistics**

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 appropriate 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, Oldenbourg Verlag, 1996
- Gudehus. Logistik, Springer Verlag, 2007
- Tempelmeier. Bestandsmanagement in SupplyChains, Books on Demand 2006
### 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

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<td>Each winter term</td>
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**Competence Certificate**  
Verbally  
Duration: 30 up to 40 minutes  
Auxiliary means: none

**Prerequisites**  
none
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: Oral examination
Credits: 4
Recurrence: Each summer term
Version: 1

Events

| SS 2020 | 2114838 | Handling Characteristics of Motor Vehicles II | 2 SWS | Lecture (V) | 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:

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

### 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

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<td>Examination of another type</td>
<td>4</td>
<td>Each term</td>
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**Events**

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<th>2143874</th>
<th>Hands-on BioMEMS</th>
<th>2 SWS</th>
<th>Lecture (V)</th>
<th>Guber</th>
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</table>

**Competence Certificate**  
Oral presentation and discussion (30 Min.)

**Prerequisites**
none
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

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<td>Written examination</td>
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**Events**

| SS 2020 | 3122512 | Heat and Mass Transfer | 2 SWS | Lecture (V) | Bockhorn |

**Competence Certificate**

Written exam, 3 h

**Prerequisites**

none
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

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**Competence Certificate**
oral exam, 20 min

**Prerequisites**
none
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

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Events

| SS 2020 | 2166534 | Heatpumps | 2 SWS | Lecture (V) | Wirbser |

Competence Certificate
Oral exam (20 min)

Prerequisites
none

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

Content
The aim of this lecture is to promote heat pumps as heating systems for small and 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
### 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

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**Competence Certificate**  
At the end of the semester, there will be a written exam (90 min).

**Prerequisites**  
none

**Recommendation**  
preliminary knowledge in mathematics, physics and materials science  
regular participation in the additionally offered computer exercises
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

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**Events**

| SS 2020 | 2126749 | Advanced powder metals | 2 SWS | Lecture (V) | Schell |

**Competence Certificate**
oral exam, 20-30 min

**Prerequisites**
none

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

**Advanced powder metals**
2126749, SS 2020, 2 SWS, Language: German, Open in study portal

**Literature**

- R.M. German. "Powder metallurgy and particulate materials processing. Metal Powder Industries Federation, 2005
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

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Exams

| SS 2020 | 76-T-MACH-105459 | High Temperature Materials | Prüfung (PR) | Heilmaier, Lang |

Competence Certificate
Oral exam, about 25 minutes

Prerequisites
none

**Responsible:** Prof. Dr.-Ing. Rüdiger Dillmann  
Dr. Uwe Spetzger

**Organisation:** KIT Department of Informatics

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

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#### Events

| SS 2020 | 24678 | Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy | 2 SWS | Lecture (V) | Spetzger |

#### Exams

### 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

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<td>SS 2020</td>
<td>76-T-MACH-105518</td>
<td>Human Factors Engineering I</td>
<td>Prüfung (PR)</td>
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</tbody>
</table>

**Competence Certificate**  
written exam, 60 minutes  
The exams are only offered in German!

**Prerequisites**  
none
### 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

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**Exams**

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<th>SS 2020</th>
<th>76-T-MACH-105519</th>
<th>Human Factors Engineering II</th>
<th>Prüfung (PR)</th>
<th>Deml</th>
</tr>
</thead>
</table>

**Competence Certificate**

written exam, 60 minutes  
The exams are only offered in German!

**Prerequisites**

none
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

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<td>4</td>
<td>Each summer term</td>
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**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:*

**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
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

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<td>Written exam</td>
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<td>Each summer term</td>
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**Events**

| SS 2020 | 24659 | Human-Computer-Interaction | 2 SWS | Lecture (V) | Exler, Beigl |

**Exams**

| SS 2020 | 7500048 | Human-Machine-Interaction | Prüfung (PR) | Beigl |

**Prerequisites**

none
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

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<td>Each winter term</td>
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Prerequisites
none
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

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Events

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<tr>
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<td>Lecture (V)</td>
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Exams

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<th>Version</th>
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<tr>
<td>SS 2020</td>
<td>7600004</td>
<td>Prüfung (PR)</td>
<td>Pritz</td>
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</table>

Competence Certificate
oral exam, 40 min.

Prerequisites
None.

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

Hydraulic Fluid Machinery
2157432, SS 2020, 4 SWS, Language: German, Open in study portal

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 announcement)
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
5. Carolus, T.: Ventilatoren, Teubner-Verlag
6. Kreiselpumpenlexikon, KSB Aktiengesellschaft
7. Zierep, J., Bühler, K.: Grundzüge der Strömungslehre, Teubner-Verlag
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

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<tbody>
<tr>
<td>Oral exam</td>
<td>4</td>
<td>Each summer term</td>
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</table>

Events

SS 2020 2170495 Hydrogen Technologies 2 SWS Lecture (V) 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:

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
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

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<td>Oral examination</td>
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<td>Each winter term</td>
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**Competence Certificate**

oral exam - 30 minutes

**Prerequisites**

none
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

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<tr>
<td>SS 2020</td>
<td>7500011</td>
<td>Information Processing in Sensor Networks</td>
<td>Prüfung (PR)</td>
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</table>
### 3.156 Course: Information Systems and Supply Chain Management [T-MACH-102128]

**Responsible:** Dr. Christoph Kilger  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-104852 - Major Field Production Technology

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<td>SS 2020 2118094 Information Systems in Logistics and Supply Chain Management</td>
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<tr>
<td>SS 2020 76-T-MACH-102128 Information Systems and Supply Chain Management</td>
<td>Prüfung (PR)</td>
<td>Mittwollen</td>
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**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:**

**Information Systems in Logistics and Supply Chain Management**  
2118094, SS 2020, 2 SWS, Language: German, [Open in study portal](#)

**Literature**  
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

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<tbody>
<tr>
<td>Oral examination</td>
<td>4</td>
<td>Each summer term</td>
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**Events**

| SS 2020 | 2130973 | Innovative Nuclear Systems | 2 SWS | Cheng |

**Competence Certificate**

oral exam, 20 min

**Prerequisites**

none

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

**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 today's 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
3.158 Course: Innovative 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

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<td>Examination of another type</td>
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<td>Each winter term</td>
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**Competence Certificate**
Students have to deliver pitch-talk supported by slides to convince a committee about their results. A fictive project proposal of 10 to 15 pages.

**Prerequisites**
none

**Recommendation**
Participates need to bring their own laptop with Skype installed.

Recommended English proficiency equivalent 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.
### 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

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**Events**

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<tr>
<th>SS 2020</th>
<th>2121001</th>
<th>Integrated Information Systems for engineers</th>
<th>3 SWS</th>
<th>Lecture / Practice (VÜ)</th>
<th>Ovtcharova, Elstermann</th>
</tr>
</thead>
</table>

**Competence Certificate**

Oral examination 20 min.

**Prerequisites**

None

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

### 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
### 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

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<tbody>
<tr>
<td>Oral examination</td>
<td>8</td>
<td>Each summer term</td>
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**Events**

| SS 2020 | 2150660 | Integrated Production Planning in the Age of Industry 4.0 | 6 SWS | Lecture / Practice (VÜ) | 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:**

**Integrated Production Planning in the Age of Industry 4.0**

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/).
3 COURSES
Course: Integrative Strategies in Production and Development of High Performance Cars [T-MACH-105188]

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

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**Events**

| SS 2020 | 2150601 | Integrative Strategies in Production and Development of High Performance Cars | 2 SWS | Lecture (V) | Schlichtenmayer |

**Competence Certificate**

Written Exam (60 min)

**Prerequisites**

none

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

**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/).
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
Frank Zacharias

**Organisation:** KIT Department of Mechanical Engineering

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

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**Events**

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<tr>
<td>SS 2020</td>
<td>Patents and Patentstrategies in innovative companies</td>
<td>2 SWS</td>
<td>Zacharias</td>
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**Competence Certificate**
oral exam (20 min)

**Prerequisites**
none

**Recommendation**
None

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

**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
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

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<tbody>
<tr>
<td>Written examination</td>
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<td>Each winter term</td>
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**Competence Certificate**  
Oral exam (Duration: 2h)

**Prerequisites**  
none
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

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<tr>
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<td>5</td>
<td>Each summer term</td>
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**Events**

| SS 2020 | 2162235 | Introduction into the multi-body dynamics | 3 SWS | Lecture (V) | Seemann |

**Exams**

| 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:

**Introduction into the multi-body dynamics**  
2162235, SS 2020, 3 SWS, Language: German, Open in study portal  

**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 virtual 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  
de Ja'lon, J. G., Bayo, E.: Kinematik and Dynamic Simulation of Multibody Systems.  
Kane, T.: Dynamics of rigid bodies.
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

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<tbody>
<tr>
<td>Oral examination</td>
<td>6</td>
<td>Each winter term</td>
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</table>

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
### 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

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</table>

- **Type:** Written examination  
- **Credits:** 3  
- **Recurrence:** Each summer term  
- **Version:** 1

#### 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 every ordinary examination date.

- **Permitted utilities:** none

#### Prerequisites
None

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

**Introduction to Engineering Mechanics I: Statics and Strength of Materials**

2162238, SS 2020, 2 SWS, Language: German, Open in study portal

<table>
<thead>
<tr>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statics: force · moment · general equilibrium conditions · center of mass · inner force in structure · plane frameworks · theory of adhesion</td>
</tr>
</tbody>
</table>

**Responsible:** Prof. Dr.-Ing. Alexander Fidlin  
**Organisation:** KIT Department of Mechanical Engineering

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

<table>
<thead>
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<th>Type</th>
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<th>Recurrence</th>
<th>Version</th>
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<tbody>
<tr>
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<td>Each summer term</td>
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**Events**

<table>
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<th>Module</th>
<th>Title</th>
<th>Type</th>
<th>Credits</th>
<th>Recurrence</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>SS 2020</td>
<td>2162238</td>
<td>Introduction to Engineering Mechanics I: Statics and Strength of Materials</td>
<td>Lecture (V)</td>
<td>2 SWS</td>
<td>Fidlin</td>
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<tr>
<td>SS 2020</td>
<td>2162239</td>
<td>Introduction to Engineering Mechanics I: Statics and Strength of Materials (Tutorial)</td>
<td>Practice (Ü)</td>
<td>1 SWS</td>
<td>Fidlin, Altoé</td>
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**Exams**

<table>
<thead>
<tr>
<th>Semester</th>
<th>Module</th>
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<th>Recurrence</th>
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<tbody>
<tr>
<td>SS 2020</td>
<td>76-T-MACH-102208-1</td>
<td>Introduction to Engineering Mechanics I: Statics (75 Min)</td>
<td>Prüfung (PR)</td>
<td>75 Min</td>
<td>Fidlin</td>
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<tr>
<td>SS 2020</td>
<td>76-T-MACH-102208-2</td>
<td>Introduction to Engineering Mechanics I: Statics and Strength of Materials (120 Min)</td>
<td>Prüfung (PR)</td>
<td>120 Min</td>
<td>Fidlin</td>
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**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 every ordinary examination date.

For students of economics the assessment 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:

**Introduction to Engineering Mechanics I: Statics and Strength of Materials**
2162238, SS 2020, 2 SWS, Language: German, Open in study portal

**Lecture (V)**

**Content**
Statics: force · moment · general equilibrium conditions · center of mass · inner force in structure · plane frameworks · theory of adhesion
### Course: Introduction to Industrial Production Economics [T-MACH-105388]

<table>
<thead>
<tr>
<th>Responsible:</th>
<th>Simone Dürrschnabel</th>
</tr>
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<tr>
<td>Organisation:</td>
<td>KIT Department of Mechanical Engineering</td>
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<tr>
<td>Part of:</td>
<td>M-MACH-104852 - Major Field Production Technology</td>
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<tr>
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<tr>
<td>Credits</td>
<td>4</td>
</tr>
<tr>
<td>Recurrence</td>
<td>Each summer term</td>
</tr>
<tr>
<td>Version</td>
<td>1</td>
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</tbody>
</table>

**Competence Certificate**
- oral exam (approx. 30 min)
- The exam is offered in German only!

**Prerequisites**
- none
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

<table>
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<td>Written examination</td>
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<td>Each winter term</td>
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</table>

**Competence Certificate**
written examination (60 min)

**Prerequisites**
none
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:** Written examination  
**Credits:** 4  
**Recurrence:** Each summer term  
**Version:** 1

### Events

<table>
<thead>
<tr>
<th>SS 2020</th>
<th>2142874</th>
<th>Introduction to Microsystem Technology II</th>
<th>2 SWS</th>
<th>Lecture (V)</th>
<th>Korvink, Badilita</th>
</tr>
</thead>
</table>

**Competence Certificate**  
written examination (60 min)

**Prerequisites**  
none

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

**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
3.171 Course: Introduction to Neutron Cross Section Theory and Nuclear Data Generation [T-MACH-105466]

Responsible: 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

<table>
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<tr>
<td>SS 2020 2190490</td>
<td>2 SWS</td>
<td>Lecture (V) Dagan</td>
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<tbody>
<tr>
<td>SS 2020 76-T-MACH-105466</td>
<td>Prüfung (PR) Dagan</td>
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</tbody>
</table>

Competence Certificate
oral exam of about 30 minutes

Prerequisites
none

Annotation
none

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

Introduction to Neutron Cross Section Theory and Nuclear Data Generation
2190490, SS 2020, 2 SWS, Language: English, Open in study portal

Lecture (V)

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)
P. Tippler, R. Llewellyn Modern Physics 2008 (in English)
### 3.172 Course: Introduction to Nonlinear Vibrations [T-MACH-105439]

<table>
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<th>Prof. Dr.-Ing. Alexander Fidlin</th>
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<td>KIT Department of Mechanical Engineering</td>
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<tr>
<td>Part of:</td>
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<td>Credits</td>
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<tbody>
<tr>
<td>SS 2020</td>
<td>76-T-MACH-105439 Introduction to Nonlinear Vibrations Prüfung (PR) Fidlin</td>
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</table>

**Competence Certificate**  
oral exam, 30 min.

**Prerequisites**  
none

**Recommendation**  
Vibration theory, Mathematical Methods of Vibration Theory, Dynamic Stability
### 3.173 Course: Introduction to Nuclear Energy [T-MACH-105525]

<table>
<thead>
<tr>
<th>Responsible</th>
<th>Prof. Dr.-Ing. Xu Cheng</th>
</tr>
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<td>Organisation</td>
<td>KIT Department of Mechanical Engineering</td>
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<tr>
<td>Part of</td>
<td>M-MACH-104848 - Major Field Energy and Environmental Engineering</td>
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<th>Type</th>
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<th>Recurrence</th>
<th>Version</th>
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<tbody>
<tr>
<td>Oral examination</td>
<td>4</td>
<td>Each winter term</td>
<td>1</td>
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</table>

**Competence Certificate**
oral exam, 30 min

**Prerequisites**
none
### 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

<table>
<thead>
<tr>
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<th>Recurrence</th>
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<tbody>
<tr>
<td>Oral exam</td>
<td>4</td>
<td>Each winter term</td>
<td>1</td>
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</table>

**Exams**

| 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.
**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**
- Written examination

**Credits**
- 9

**Recurrence**
- see Annotations

**Version**
- 1

**Events**

<table>
<thead>
<tr>
<th>Events</th>
<th>SS 2020</th>
<th>2550040</th>
<th>Introduction to Operations Research I</th>
<th>2 SWS</th>
<th>Lecture (V)</th>
<th>Rebennack</th>
</tr>
</thead>
</table>

**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:*

**Introduction to Operations Research I**

2550040, SS 2020, 2 SWS, Language: German, Open in study portal

**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**

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**  
Written examination

**Credits**  
4

**Recurrence**  
Each summer term

**Version**  
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:*

**Introduction to the Finite Element Method**  
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
3.177 Course: Introduction to Theory of Materials [T-MACH-105321]

Responsible: Prof. Dr. Marc Kamlah  
Organisation: KIT Department of Mechanical Engineering

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

<table>
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<tr>
<th>Events</th>
<th>Type</th>
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<th>Recurrence</th>
<th>Version</th>
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<tbody>
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<td>SS 2020</td>
<td>Oral exam</td>
<td>4</td>
<td>Each summer term</td>
<td>1</td>
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</tbody>
</table>

Competence Certificate  
oral exam

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

Introduction to Theory of Materials  
2182732, SS 2020, 2 SWS, Language: German, Open in study portal

Content  
Following a brief introduction into continuum mechanics at small deformations, the classification into elastic, viscoelastic, plastic and viscoplastic constitutive models of solids is discussed. Then, one after the other, the four groups of elastic, viscoelastic, plastic and viscoplastic constitutive models are motivated and mathematically formulated. Their properties are demonstrated by means of elementary analytical solutions and examples.

The student can judge for a problem to be computed, which constitutive model should be selected depending on choice of material and loading. For computation tools such as commercial finite element codes, the students can understand the documentation with respect to the implemented constitutive models, and they can make their choice based on their knowledge.

The students have basic knowledge for the development of constitutive laws.

Qualification: Engineering Mechanics; Advanced Mathematics

regular attendance: 22.5 hours  
self-study: 97.5 hours  
oral exam ca. 30 minutes

Literature  
[2] Skript
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

<table>
<thead>
<tr>
<th>Type</th>
<th>Credits</th>
<th>Recurrence</th>
<th>Version</th>
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</thead>
<tbody>
<tr>
<td>Examination of another type</td>
<td>4</td>
<td>Each term</td>
<td>1</td>
</tr>
</tbody>
</table>

Events

| SS 2020 | 2123352 | IoT platform for engineering | 3 SWS | Project (PRO) | Ovtcharova, Maier |

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:

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

<table>
<thead>
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<th>Type</th>
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</thead>
<tbody>
<tr>
<td>Completed coursework</td>
<td>4</td>
<td>Each winter term</td>
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</table>

**Competence Certificate**
- Colloquia

**Prerequisites**
- none
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

<table>
<thead>
<tr>
<th>Type</th>
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<th>Credits</th>
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<th>Version</th>
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<td>Completed coursework</td>
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<td>4</td>
<td>Each term</td>
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</table>

**Events**

| SS 2020 | 2171487 | Laboratory Exercise in Energy Technology | 3 SWS | Practical course (P) | Bauer, Maas, Bykov |

**Exams**

| 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 assistants

**Prerequisites**

none

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

**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 period 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 assistants

Duration: 30 minutes

no tools or reference materials may be used
3.181 Course: Laboratory Laser Materials Processing [T-MACH-102154]

Responsibility: Dr.-Ing. Johannes Schneider
Organization: KIT Department of Mechanical Engineering

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

<table>
<thead>
<tr>
<th>Type</th>
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<th>Credits</th>
<th>Recurrence</th>
<th>Version</th>
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<tr>
<td>Completed coursework</td>
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<td>Each term</td>
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**Events**

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<thead>
<tr>
<th>Term</th>
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<th>Course Name</th>
<th>SWS</th>
<th>Type</th>
<th>Lecturers</th>
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<tbody>
<tr>
<td>SS 2020</td>
<td>2183640</td>
<td>Laboratory &quot;Laser Materials Processing&quot;</td>
<td>3</td>
<td>Practical course (P)</td>
<td>Schneider, Pfleging</td>
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**Exams**

<table>
<thead>
<tr>
<th>Term</th>
<th>Course Code</th>
<th>Course Name</th>
<th>SWS</th>
<th>Type</th>
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<tbody>
<tr>
<td>SS 2020</td>
<td>76-T-MACH-102154</td>
<td>Laboratory Laser Materials Processing</td>
<td>3</td>
<td>Prüfung (PR)</td>
<td>Schneider</td>
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</tbody>
</table>

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:

**Laboratory "Laser Materials Processing"**

2183640, SS 2020, 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
R. Poprawe: Lasertechnik für die Fertigung, 2005, Springer
3.182 Course: Laboratory Mechatronics [T-MACH-105370]

**Responsible:**
Dr.-Ing. Maik Lorch
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

<table>
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<tbody>
<tr>
<td>Completed coursework</td>
<td>4</td>
<td>Each winter term</td>
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</tr>
</tbody>
</table>

**Competence Certificate**
certificate of successful attendance

**Prerequisites**
None
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

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<td>Each summer term</td>
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**Events**

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<tr>
<td>SS 2020</td>
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<td>Lecture (V)</td>
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**Exams**

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<td>SS 2020</td>
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<td>Prüfung (PR)</td>
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<tr>
<td></td>
<td></td>
<td>Schneider</td>
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</tbody>
</table>

**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 knowledge in mathematics, physics and materials science

*Below you will find excerpts from events related to this course:*
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
- safety 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
R. Poprawe: Lasertechnik für die Fertigung, 2005, Springer
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

**Events**

<table>
<thead>
<tr>
<th>Events</th>
<th>Credits</th>
<th>Type</th>
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<td>SS 2020 2110017</td>
<td>2 SWS</td>
<td>Lecture (V)</td>
<td>Each summer term</td>
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**Exams**

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<th>Version</th>
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<tbody>
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<td>SS 2020 76-T-MACH-105440</td>
<td></td>
<td>Prüfung (PR)</td>
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</tbody>
</table>

**Competence Certificate**
oral exam (approx. 30 min)

**Prerequisites**
none

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

Leadership and Conflict Management (in German)

2110017, SS 2020, 2 SWS, Language: German, Open in study portal

**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.
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**  Oral examination

**Credits**  4

**Recurrence**  Each winter term

**Version**  1

**Competence Certificate**  
oral exam (20 min)

**Prerequisites**  
none
### 3.186 Course: Lightweight Engineering Design [T-MACH-105221]

**Responsible:** Prof. Dr.-Ing. Albert Albers  
Norbert Burkardt

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
<thead>
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<th>Recurrence</th>
<th>Version</th>
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<tbody>
<tr>
<td>Written exam.</td>
<td>4</td>
<td>Each summer term</td>
<td>2</td>
</tr>
</tbody>
</table>

**Events**

| SS 2020 | 2146190 | Lightweight Engineering Design | 2 SWS | Lecture (V) | Albers, Burkardt |

**Competence Certificate**  
Written examination (90 min)

**Prerequisites**  
None

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

**Lightweight Engineering Design**  
2146190, SS 2020, 2 SWS, Language: German, Open in study portal

**Lecture (V)**

**Content**  
General aspects of lightweight 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 a practical point of view.

The students are able to ...

- evaluate the potential of central lightweight strategies and their application in design processes.
- apply different stiffening 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  
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

<table>
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Events

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<th>SS 2020</th>
<th>24613</th>
<th>Localization of Mobile Agents</th>
<th>3 SWS</th>
<th>Lecture (V)</th>
<th>Noack, Li</th>
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Exams

<table>
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<tr>
<th>SS 2020</th>
<th>7500004</th>
<th>Localization of Mobile Agents</th>
<th>Prüfung (PR)</th>
<th>Hanebeck, Noack</th>
</tr>
</thead>
</table>

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

Localization of Mobile Agents 24613, SS 2020, 3 SWS, Language: German, Open in study portal

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.
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

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<td>SS 2020 2581996 Logistics and Supply Chain Management</td>
<td>2 SWS</td>
<td>Lecture (V)</td>
<td>Wiens, Schultmann</td>
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<tr>
<td>SS 2020 2581997 Übung zu Logistics and Supply Chain Management</td>
<td>1 SWS</td>
<td>Practice (Ü)</td>
<td>Diehlmann, Lüttenberg</td>
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</table>

**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:*

**Logistics and Supply Chain Management**
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 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.
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

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<tr>
<th>Events</th>
<th>SS 2020</th>
<th>2161224</th>
<th>Machine Dynamics</th>
<th>2 SWS</th>
<th>Lecture (V)</th>
<th>Proppe</th>
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<td>2161225</td>
<td>Machine Dynamics (Tutorial)</td>
<td>1 SWS</td>
<td>Practice (Ü)</td>
<td>Proppe, Fischer</td>
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<td>Exams</td>
<td>SS 2020</td>
<td>76-T-MACH-105210</td>
<td>Machine Dynamics</td>
<td>Prüfung (PR)</td>
<td>Proppe</td>
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</table>

**Competence Certificate**
written exam, 180 min.

**Prerequisites**
none

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

**Machine Dynamics**
2161224, SS 2020, 2 SWS, Language: English, [Open in study portal](#)

**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

**Machine Dynamics (Tutorial)**
2161225, SS 2020, 1 SWS, Language: English, [Open in study portal](#)

**Content**
Exercises related to the lecture
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

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<td>Each winter term</td>
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</table>

**Exams**

| SS 2020 | 76-T-MACH-105224 | Machine Dynamics II | Prüfung (PR) | Proppe |

**Competence Certificate**

oral exam, 30 min.

**Prerequisites**

none

**Recommendation**

Machine Dynamics
3 COURSES
Course: Machine Tools and Industrial Handling [T-MACH-109055]

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
Oral examination

Credits
8

Recurrence
Each winter term

Version
1

Competence Certificate
Oral exam (40 minutes)

Prerequisites
"T-MACH-102158 - Werkzeugmaschinen und Handhabungstechnik" must not be commenced.
### 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

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<tbody>
<tr>
<td>Written exam</td>
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<td>Each winter term</td>
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**Competence Certificate**  
Type of Examination: written exam  
Duration of Examination: 60 minutes

**Prerequisites**  
None
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

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<td>SS 2020</td>
<td>Machines and Processes</td>
<td>4 SWS</td>
<td>Lecture / Practice (VÜ)</td>
<td>Bauer, Maas, Kubach, Pritz</td>
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<td>SS 2020</td>
<td>Machines and Processes, Prerequisite</td>
<td>Prüfung (PR)</td>
<td>Kubach, Gabi, Bauer, Maas</td>
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**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.
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

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**Events**

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<tr>
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<td>Bauer, Kubach, Maas, Pritz</td>
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**Exams**

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<th>Recurrence</th>
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<tbody>
<tr>
<td>SS 2020</td>
<td>Machines and Processes, Prerequisite</td>
<td>Prüfung (PR)</td>
<td>Kubach, Gabi, Bauer, Maas</td>
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</tbody>
</table>

**Competence Certificate**

Successful completed training course

**Prerequisites**

none

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

**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 turbines
  • gas turbines
  • combined-cycle plants
  • turbines and compressors
  • aircraft engines
hydraulic fluid machines
  • operating 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.
### 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

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<td>Oral examination</td>
<td>4</td>
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</table>

**Events**

| SS 2020 | 2190496 | Magnet Technology of Fusion Reactors | 2 SWS | Lecture (V) | Fietz, Weiss |

**Exam**

| 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:

**Magnet Technology of Fusion Reactors**

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
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

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<tr>
<td>Oral examination</td>
<td>4</td>
<td>Each winter term</td>
<td>1</td>
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</table>

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)
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**  
Written examination  

**Credits**  
4.5

**Recurrence**  
Each summer term  

**Version**  
2

### Events

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<th>Type</th>
<th>Lecturer</th>
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<tr>
<td>SS 2020</td>
<td>2579900</td>
<td>Management Accounting 1</td>
<td>2</td>
<td>Lecture (V)</td>
<td>Wouters</td>
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<tr>
<td>SS 2020</td>
<td>2579901</td>
<td>Übung zu Management Accounting 1 (Bachelor)</td>
<td>2</td>
<td>Practice (Ü)</td>
<td>Riar</td>
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<tr>
<td>SS 2020</td>
<td>2579902</td>
<td></td>
<td>2</td>
<td>Practice (Ü)</td>
<td>Riar</td>
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</tbody>
</table>

### 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 tutorial and examination.

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

**Management Accounting 1**  
2579900, SS 2020, 2 SWS, Language: English, Open in study portal  
Lecture (V)

**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**

- In addition, several papers that will be available on ILIAS.
Übung zu Management Accounting 1 (Bachelor)
2579901, SS 2020, 2 SWS, Language: English, [Open in study portal]

**Content**
see Module Handbook

Practice (Ü)

Übung zu Management Accounting 1 (Bachelor)
2579902, SS 2020, 2 SWS, Language: English, [Open in study portal]

**Content**
see Module Handbook

Practice (Ü)
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

<table>
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<td>Each summer term</td>
<td>1</td>
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**Events**

| SS 2020 | 2577900 | Management and Strategy | 2 SWS | Lecture (V) | Lindstädt |

**Competence Certificate**
The assessment consists of a written exam (60 min) taking place at the beginning 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:

**Management and Strategy**  
2577900, SS 2020, 2 SWS, Language: German, Open in study portal  
Lecture (V)

**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


Die relevanten Auszüge und zusätzliche Quellen werden in der Veranstaltung bekannt gegeben.
### 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

<table>
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<td>Each winter term</td>
<td>3</td>
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</table>

**Competence Certificate**
Written Exam (180 min)

**Prerequisites**
none

Responsible: Prof. Dr.-Ing. Kai Hermans
Organisation: KIT Department of Mechanical Engineering

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

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<tr>
<td>Examination of another type</td>
<td>9</td>
<td>Each winter term</td>
<td>3</td>
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</table>

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).
### 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

<table>
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<tr>
<td>Oral examination</td>
<td>4</td>
<td>Each winter term</td>
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</table>

#### Exams

| 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.
3.202 Course: Materials Modelling: Dislocation Based Plasticity [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

<table>
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<td>2 SWS</td>
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<tr>
<td>SS 2020 76-T-MACH-105369</td>
<td>2 SWS</td>
<td>Prüfung (PR)</td>
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**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:

**Materials modelling: dislocation based plasticity**
2182740, SS 2020, 2 SWS, Language: German, Open in study portal

**Lecture (V)**

**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 knowledge in mathematics, physics and materials science recommended

regular attendance: 22.5 hours
self-study: 97.5 hours
oral exam ca. 30 minutes
Literature

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

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**Events**

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<tr>
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<td>2174574</td>
<td>Materials for Lightweight Construction</td>
<td>2</td>
<td>Lecture (V)</td>
<td>Liebig, Elsner</td>
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**Exams**

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<tr>
<td>SS 2020</td>
<td>76-T-MACH-105211</td>
<td>Materials of Lightweight Construction</td>
<td>Prüfung (PR)</td>
<td>Liebig</td>
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</table>

**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:

Materials for Lightweight Construction

2174574, SS 2020, 2 SWS, Language: German, Open in study portal
Content
Introduction
Constructive, production-oriented 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
3 COURSES

Course: Materials Physics and Metals [T-MACH-100285]

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

<table>
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<tr>
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<td>2174598</td>
<td>Metals</td>
<td>3</td>
<td>V</td>
<td>Heilmaier, Kauffmann</td>
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<tr>
<td>SS 2020</td>
<td>2174599</td>
<td>Übungen zur Vorlesung &quot;Metalle&quot;</td>
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<td>Heilmaier, Pundt, Kauffmann</td>
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Exams

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<th>Semester</th>
<th>ID</th>
<th>Event Description</th>
<th>Type</th>
<th>Organisers</th>
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<td>SS 2020</td>
<td>76-T-MACH-100285</td>
<td>Materials Physics and Metals</td>
<td>Prüfung (PR)</td>
<td>Heilmaier, Gruber, Pundt</td>
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</table>

Competence Certificate

Oral exam, about 45 minutes

Prerequisites

none

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

Metals

2174598, SS 2020, 3 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 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 mechanical 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

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. Freudenberger: http://www.ifw-dresden.de/institutes/imw/lectures/lectures/pwe

Modules of Mechanical Engineering for Exchange Students
Module Handbook as of 15/02/2020

269
Übungen zur Vorlesung "Metalle"
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 mechanical 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
http://dx.doi.org/10.1007/978-3-642-36603-1 (frei über die KIT-Lizenz abrufbar)
http://www.ifw-dresden.de/institutes/imw/lectures/pwe
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC309606810
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC052463656
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC27759961X
http://dx.doi.org/10.1007/978-3-662-47952-0 (frei über die KIT-Lizenz abrufbar)
http://dx.doi.org/10.1007/978-3-642-22561-1 (frei über die KIT-Lizenz abrufbar)
http://dx.doi.org/10.1007/978-3-642-17717-0 (frei über die KIT-Lizenz abrufbar)
http://dx.doi.org/10.1007/978-3-658-13795-3 (frei über die KIT-Lizenz abrufbar)
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

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Exams

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
### 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

<table>
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<td>Each winter term</td>
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**Exams**

| SS 2020 | 76-T-MACH-105301 | Materials Science III | Prüfung (PR) | Heilmaier, Lang |

**Competence Certificate**  
Oral exam, about 35 minutes

**Prerequisites**  
none
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

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Exams

| SS 2020 | 76-T-MACH-105293 | Mathematical Methods in Dynamics | Prüfung (PR) | Proppe |

Competence Certificate

written examination, 180 min.

Prerequisites

none
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

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**Events**

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<tr>
<td>SS 2020</td>
<td>2154432</td>
<td>Mathematical Methods in Fluid Mechanics</td>
<td>2 SWS</td>
<td>Lecture (V)</td>
<td>Frohnapfel, Gatti</td>
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<td>SS 2020</td>
<td>2154433</td>
<td>Tutorial in Mathematical Methods of Fluid Mechanics</td>
<td>1 SWS</td>
<td>Practice (Ü)</td>
<td>Frohnapfel, Gatti, Magagnato</td>
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<td>SS 2020</td>
<td>2154540</td>
<td>Mathematical Methods in Fluid Mechanics</td>
<td>SWS</td>
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<td>Magagnato</td>
</tr>
</tbody>
</table>

**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:**

### Lecture (V) Mathematical Methods in Fluid Mechanics

**2154432, SS 2020, 2 SWS, Language: German/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.
3 COURSES

Course: Mathematical Methods in Fluid Mechanics [T-MACH-105295]

Literature

Tutorial in Mathematical Methods of Fluid Mechanics
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

Mathematical Methods in Fluid Mechanics
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.
### 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

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<th>SS 2020</th>
<th>2162204</th>
<th>Consultation hour Mathematical Methods in Micromechanics</th>
<th>2 SWS</th>
<th>Consultation-hour (Sprechst.)</th>
<th>Karl, Krause</th>
</tr>
</thead>
</table>

**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.
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

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<tr>
<td>Written examination</td>
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<td>Each summer term</td>
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**Events**

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<th>Content</th>
<th>Recurrence</th>
<th>Instructor</th>
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<tr>
<td>SS 2020 2162241</td>
<td>2 SWS</td>
<td>Mathematical methods of vibration theory</td>
<td>Lecture (V)</td>
<td>Seemann</td>
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<tr>
<td>SS 2020 2162242</td>
<td>2 SWS</td>
<td>Mathematical methods of vibration theory (Tutorial)</td>
<td>Practice (Ü)</td>
<td>Seemann, Burgert</td>
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**Exams**

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<td>SS 2020 76-T-MACH-105294</td>
<td></td>
<td>Mathematical Methods of Vibration Theory</td>
<td>Prüfung (PR)</td>
<td>Seemann</td>
</tr>
</tbody>
</table>

**Competence Certificate**
written examination, 180 min.

**Prerequisites**
none

**Recommendation**
Engineering Mechanics III/IV

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

**Mathematical methods of vibration theory**
2162241, SS 2020, 2 SWS, Language: German, Open in study portal

**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

**Mathematical methods of vibration theory (Tutorial)**
2162242, SS 2020, 2 SWS, Language: German, Open in study portal

**Content**
Seven tutorials with examples of the contents of the course

**Literature**
Riemer, Wedig, Wauer: Mathematische Methoden der Technischen Mechanik
3.211 Course: Mathematical Models and Methods for Production Systems [T-MACH-105189]

Responsible: 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
Oral examination

Credits
6

Recurrence
Each winter term

Version
1

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
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

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<tbody>
<tr>
<td>Oral examination</td>
<td>4</td>
<td>Each winter term</td>
<td>1</td>
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</tbody>
</table>

Competence Certificate
oral exam (20 min)

Prerequisites
none
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

---

### Events

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<thead>
<tr>
<th>Events</th>
<th>SS 2020</th>
<th>2138326</th>
<th>Measurement II</th>
<th>2 SWS</th>
<th>Lecture (V)</th>
<th>Stiller, Wirth</th>
</tr>
</thead>
</table>

**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](#)

**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.
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

### Events

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<tr>
<td>SS 2020</td>
<td>2 SWS</td>
<td>Practical course (P)</td>
<td>Stiller, Richter</td>
<td></td>
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<tr>
<td>SS 2020</td>
<td>Prüfung (PR)</td>
<td>Stiller</td>
<td></td>
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</tr>
</tbody>
</table>

**Prerequisites**

none

**Competence Certificate**

Non graded colloquia

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

### Measurement Instrumentation Lab

2138328, SS 2020, 2 SWS, Language: German, [Open in study portal](#)

### Content

Please consider the bulletin on our website!

**A Signal recording**

- measurement of temperature
- measurement of lengths

**B Signal pre-processing**

- 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 experiments are available on the institute’s website
### 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

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<td>Oral examination</td>
<td>4</td>
<td>Each winter term</td>
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</table>

**Competence Certificate**  
Oral exam, about 25 minutes

**Prerequisites**  
none

**Recommendation**  
Basic knowledge in materials science (e.g. lecture materials science I and II)
**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

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<tbody>
<tr>
<td>Oral examination</td>
<td>4</td>
<td>Each winter term</td>
<td>1</td>
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</table>

**Competence Certificate**  
Oral examination, ca. 30 min

**Prerequisites**  
none
3.217 Course: Mechatronical Systems and Products [T-MACH-105574]

<table>
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<tr>
<th>Responsible:</th>
<th>Prof. Dr.-Ing. Sören Hohmann</th>
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<td></td>
<td>Prof. Dr.-Ing. Sven Matthiesen</td>
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<td>Organisation:</td>
<td>KIT Department of Mechanical Engineering</td>
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Part of: M-MACH-105134 - Elective Module Mechanical Engineering

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<tr>
<td>Written examination</td>
<td>3</td>
<td>Each winter term</td>
<td>3</td>
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</table>

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.
### 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

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<tr>
<td>Written examination</td>
<td>3</td>
<td>Each winter term</td>
<td>1</td>
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</table>

**Competence Certificate**
Success control is carried out in the form of a written test of 120 minutes.

**Prerequisites**
none
### 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

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<td>SS 2020 2305262</td>
<td>2 SWS</td>
<td>Lecture (V)</td>
<td>Dössel</td>
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<tbody>
<tr>
<td>SS 2020 7305262</td>
<td>Prüfung (PR)</td>
<td>Dössel</td>
<td></td>
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</tbody>
</table>

**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.
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

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**Events**

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<tr>
<td>SS 2020</td>
<td>2 SWS</td>
<td>Lecture (V)</td>
<td>Mathis-Ullrich</td>
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</table>
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

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<td>Oral examination</td>
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</table>

**Events**

| SS 2020 | 2150681 | Metal Forming | 2 SWS | Lecture (V) | Herlan |

**Competence Certificate**

Oral Exam (20 min)

**Prerequisites**

none

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

**Metal Forming**

2150681, SS 2020, 2 SWS, Language: German, [Open in study portal](#)

**Lecture (V)**

**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/)
3.222 Course: Metallographic Lab Class [T-MACH-105447]

**Responsible:** Ulla Hauf  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

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</table>

**Events**

| SS 2020 | 2175590 | Metallographic Lab Class | 3 SWS | Practical course (P) | Mühl |

**Competence Certificate**

Colloquium for every experiment, about 60 minutes, protocol

**Prerequisites**

none

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

**Metallographic Lab Class**

2175590, SS 2020, 3 SWS, Language: German, [Open in study portal]

**Content**

**learning objectives:**

**requirements:**

**workload:**

**Literature**

Macherauch, E.: Praktikum in Werkstoffkunde, 10. Aufl., 1992


Literaturliste wird zu jedem Versuch ausgegeben
**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

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### Type
Oral examination  

### Credits
6  

### Recurrence
Each summer term  

### Version
1  

#### Events
<table>
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<th>SS 2020</th>
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<th>Metals</th>
<th>3 SWS</th>
<th>Lecture (V)</th>
<th>Pundt, Heilmaier, Kauffmann</th>
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<tr>
<td>SS 2020</td>
<td>2174599</td>
<td>Übungen zur Vorlesung &quot;Metalle&quot;</td>
<td>1 SWS</td>
<td>Practice (Ü)</td>
<td>Heilmaier, Pundt, Kauffmann</td>
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#### Exams
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<th>Prüfung (PR)</th>
<th>Heilmaier</th>
</tr>
</thead>
</table>

**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, 3 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 mechanical 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**
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. Freudenberger: [http://www.ifw-dresden.de/institutes/imw/lectures/lectures/pwe](http://www.ifw-dresden.de/institutes/imw/lectures/lectures/pwe)
Übungen zur Vorlesung "Metalle"
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 mechanical 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
http://dx.doi.org/10.1007/978-3-642-36603-1 (frei über die KIT-Lizenz abrufbar)
http://www.ifw-dresden.de/institutes/imw/lectures/pwe
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC309606810
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC052463656
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC27759961X
http://dx.doi.org/10.1007/978-3-662-47952-0 (frei über die KIT-Lizenz abrufbar)
http://dx.doi.org/10.1007/978-3-642-22561-1 (frei über die KIT-Lizenz abrufbar)
http://dx.doi.org/10.1007/978-3-642-17717-0 (frei über die KIT-Lizenz abrufbar)
http://dx.doi.org/10.1007/978-3-658-13795-3 (frei über die KIT-Lizenz abrufbar)
3.224 Course: Methods and Processes of PGE - Product Generation Development [T-MACH-109192]

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

Organisation: KIT Department of Mechanical Engineering

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

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<tr>
<td>Written examination</td>
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<td>Each summer term</td>
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</table>

Events

SS 2020 2146176 Methods and processes of PGE - Product Generation Development 4 SWS Lecture (V) 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:

Methods and processes of PGE - Product Generation Development
2146176, SS 2020, 4 SWS, Language: German, Open in study portal Lecture (V)
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
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 different 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
3.225 Course: Methods of Signal Processing [T-ETIT-100694]

Responsible:  Prof. Dr.-Ing. Fernando Puente León
Organisation:  KIT Department of Electrical Engineering and Information Technology
Part of:  M-MACH-104882 - Courses of the Department of Electrical Engineering and Information Technology

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<th>Recurrence</th>
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<tbody>
<tr>
<td>Written examination</td>
<td>6</td>
<td>Each winter term</td>
<td>1</td>
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</table>

Prerequisites
none
3.226 Course: Micro- and Nanosystem Integration for Medical, Fluidic and Optical Applications [T-MACH-108809]

**Responsible:** Dr. Ulrich Gengenbach  
Prof. Dr. Veit Hagenmeyer  
Dr. Liane Koker  
PD Dr.-Ing. Ingo Sieber

**Organisation:** KIT Department of Mechanical Engineering

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

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<th>Recurrence</th>
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<tbody>
<tr>
<td>Oral examination</td>
<td>4</td>
<td>Each winter term</td>
<td>1</td>
</tr>
</tbody>
</table>

**Competence Certificate**  
Oral exam (Duration: 30min)

**Prerequisites**  
T-MACH-105695 "Selected topics of system integration for micro- and nanotechnology" must not be started.
3.227 Course: Micro Magnetic Resonance [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

<table>
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<th>Type</th>
<th>Completed coursework</th>
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<tr>
<td>Version</td>
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</table>

**Competence Certificate**
Own Presentation, participation at the course discussions, result is passed or failed.

**Prerequisites**
none
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

Events

<table>
<thead>
<tr>
<th>Events</th>
<th>Credits</th>
<th>Recurrence</th>
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</tr>
</thead>
<tbody>
<tr>
<td>SS 2020 2142881 Microactuators</td>
<td>4</td>
<td>Each summer term</td>
<td>2</td>
</tr>
</tbody>
</table>

Competence Certificate
written exam, 60 min.

Prerequisites
none

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

Microactuators
2142881, SS 2020, 2 SWS, Language: German, Open in study portal

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:
- Microelectromechanical 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"
- M. Kohl, Shape Memory Microactuators, M. Kohl, Springer-Verlag Berlin, 2004
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

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<tbody>
<tr>
<td>Oral examination</td>
<td>4</td>
<td>Each summer term</td>
<td>1</td>
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</table>

**Events**

| SS 2020 | 2142897 | Microenergy Technologies | 2 SWS | Lecture (V) | Kohl |

**Competence Certificate**

Oral examination (30 Min.)

**Prerequisites**

none

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

**Microenergy Technologies**

2142897, SS 2020, 2 SWS, Language: English, [Open in study portal]

**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"
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

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<th>Type</th>
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<tbody>
<tr>
<td>Written exam</td>
<td>4</td>
<td>Each summer term</td>
<td>1</td>
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</table>

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:

Microsystem Simulation
2142875, SS 2020, 3 SWS, Language: English, Open in study portal

Lecture / Practice (VÜ)
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 microsystem components are very small (in the micrometre range), often the operational modalities will be described better by statistical mechanics or even quantum mechanics, so that we have to take caution to use the right models.

In many cases, commercial tools are unavailable, so that engineers are forced to build 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 attendance 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 used by 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)
- Bengt Fornberg, Calculation of Weights in Finite Difference Formulas, SIAM Rev. 40(3) 1998
- Mathematica Help Documentation
- Rick Beatson and Leslie Greengard, A short course on fast multipole methods
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

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<td>8</td>
<td>Each summer term</td>
<td>Oral examination</td>
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Events
- SS 2020 2114073 Mobile Machines 4 SWS Lecture (V) Geimer, Geiger
- SS 2020 76-T-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 important 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:

Mobile Machines 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
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

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<td>Each winter term</td>
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**Competence Certificate**
The assessment consists of a 180 minutes written examination.

**Prerequisites**
none
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

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<tr>
<td>Oral examination</td>
<td>6</td>
<td>Each term</td>
<td>1</td>
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</table>

**Events**

| SS 2020 | 2167523 | Modeling of Thermodynamical Processes | 3 SWS | Lecture (V) | Maas, Schießl |

**Competence Certificate**

Oral exam (30 min)

**Prerequisites**

none

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

**Modeling of Thermodynamical Processes**

2167523, SS 2020, 3 SWS, Language: German, [Open in study portal](#)

**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
- J. Kopitz, W. Polifke; Wärmeübertragung; Pearson Studium; 1. Auflage
### 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

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<td>Oral examination</td>
<td>6</td>
<td>Each term</td>
<td>1 terms</td>
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</table>

**Competence Certificate**  
oral exam, appr. 45 min.

**Prerequisites**  
none

**Recommendation**  
none

**Annotation**  
none
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**
- Written examination

**Credits**
- 5

**Recurrence**
- Each term

**Version**
- 2

**Events**

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<th>SS 2020</th>
<th>2183703</th>
<th>Modelling and Simulation</th>
<th>2+1 SWS</th>
<th>Lecture / Practice (VÜ)</th>
<th>Nestler</th>
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</table>

**Competence Certificate**
Written exam, 90 min

**Prerequisites**
none

**Recommendation**
preliminary knowledge in mathematics, physics and materials science

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

**Modelling and Simulation**
2183703, SS 2020, 2+1 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 knowledge 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**
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

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<tr>
<td>Oral exam</td>
<td>5</td>
<td>Each winter term</td>
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**Competence Certificate**
oral exam 30 min

**Prerequisites**
none

**Recommendation**
materials science  
fundamental mathematics
3.237 Course: Modern Control Concepts I [T-MACH-105539]

**Responsible:** 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

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<td>Written examination</td>
<td>4</td>
<td>Each summer term</td>
<td>1</td>
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</table>

**Events**

| SS 2020 | 2105024 | Modern Control Concepts I | 2 SWS | Lecture (V) | Matthes, Groell |

**Competence Certificate**

Written exam (Duration: 1 h)

**Prerequisites**

none

_Below you will find excerpts from events related to this course:_

**Modern Control Concepts I**

2105024, SS 2020, 2 SWS, Language: German, [Open in study portal](#)

**Literature**

**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

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<tbody>
<tr>
<td>Written examination</td>
<td>4</td>
<td>Each term</td>
<td>3</td>
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</table>

**Events**

| SS 2020 | 2115808 | Motor Vehicle Laboratory | 2 SWS | Practical course (P) | Frey |

**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:*

**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**


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

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<tr>
<td>Examination of another type</td>
<td>4</td>
<td>Each winter term</td>
<td>2</td>
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</table>

**Competence Certificate**  
presentation (40%) und colloquium (30 min, 60%)

**Prerequisites**  
none

**Recommendation**  
preliminary knowledge in mathematics, physics, mechanics and materials science

**Annotation**
- limited number of participants
- mandatory registration
- mandatory attendance
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

Events

| SS 2020 | 2142861 | Nanotechnology for Engineers and Natural Scientists | 2 SWS | Lecture (V) | Hölscher, Dienwiebel |

Competence Certificate
written exam 90 min

Prerequisites
none

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

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 especially scanning probe methods and is able to use them for the characterisation of chemical and physical properties of surfaces
• describe 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 knowledge in mathematics and physics

lectures 30 h
self study 30 h
preparation for examination 30 h

The successful attendance of the lecture is controlled by a 30 minutes written examination, and a subsequent oral examination (20 min). Passing the written exam is mandatory for the participation of the oral examination. The grade result is the result of the oral exam.

Literature
1. Tafelbilder, Folien, Skript
### 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

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<td>Oral examination</td>
<td>4</td>
<td>Each winter term</td>
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**Competence Certificate**
oral exam (30 Min.)

**Prerequisites**
none
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

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<tbody>
<tr>
<td>SS 2020</td>
<td>76-T-MACH-105435 Neutron Physics of Fusion Reactors Prüfung (PR) Stieglitz, Fischer</td>
</tr>
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</table>

**Competence Certificate**  
oral exam of about 30 minutes

**Prerequisites**  
none

**Annotation**  
none
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

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<tr>
<th>Type</th>
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<td>Completed coursework</td>
<td></td>
<td>4</td>
<td>Each summer term</td>
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Events

<table>
<thead>
<tr>
<th>Events</th>
<th>SS 2020</th>
<th>2142551</th>
<th>NMR micro probe hardware conception and construction</th>
<th>2 SWS</th>
<th>Practical course (P)</th>
<th>Korvink, Jouda</th>
</tr>
</thead>
</table>

Competence Certificate
Successful participation.

Prerequisites
none

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

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.
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

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<tr>
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<td>5</td>
<td>Each summer term</td>
<td>2</td>
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</tbody>
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Events

| SS 2020 | 2162344 | Nonlinear Continuum Mechanics | 2 SWS | Lecture (V) | Böhlke |

Competence Certificate
oral examination (approx. 25 min)

Prerequisites
none

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

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 of infinitesimal plasticity
- finite elasto(visco)plasticity
- infinitesimal and finite crystal(visco)plasticity
- hardening and failure
- strain localization

Literature

- Vorlesungsskript
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

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<tbody>
<tr>
<td>Written examination</td>
<td>4</td>
<td>Each winter term</td>
<td>3</td>
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</table>

**Competence Certificate**
written exam, 60 minutes

**Prerequisites**
none
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

<table>
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</table>

**Competence Certificate**  
oral exam, approx. 20 min.

**Prerequisites**  
none
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**  
Oral examination

**Credits**  
4

**Expansion**  
1 terms

**Version**  
1

**Competence Certificate**  
oral exam, approx. 20 min.

**Prerequisites**  
None
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

<table>
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<tbody>
<tr>
<td>Oral examination</td>
<td>4</td>
<td>Each summer term</td>
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</tbody>
</table>

**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:*

**Nuclear Power Plant Technology**

2170460, 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 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
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

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<tbody>
<tr>
<td>Oral examination</td>
<td>4</td>
<td>Each winter term</td>
<td>2</td>
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</table>

Competence Certificate
oral exam - 30 minutes

Prerequisites
none
3 COURSES

Course: Numerical Fluid Mechanics with PYTHON [T-MACH-110838]

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

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Events

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<tr>
<th>SS 2020</th>
<th>2154405</th>
<th>Numerical Fluid Mechanics with Python</th>
<th>2 SWS</th>
<th>Practical course (P)</th>
<th>Stroh, Gatti, Frohnapfel</th>
</tr>
</thead>
</table>

Exams

<table>
<thead>
<tr>
<th>SS 2020</th>
<th>76-T-MACH-110838</th>
<th>Numerical Fluid Mechanics with Python</th>
<th>Prüfung (PR)</th>
<th>Frohnapfel, Gatti</th>
</tr>
</thead>
</table>

Competence Certificate
ungraded homework

Prerequisites
none

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

Numerical Fluid Mechanics with Python
2154405, SS 2020, 2 SWS, Language: German, Open in study portal

Practical course (P)

Content
Numerical Fluid Mechanics with Matlab

- Introduction to Numerics and Matlab
- Finite-Difference-Method
- Finite-Volume-Method
- boundary conditions and initial conditions
- explicit and implicit schemes
- pressure correction
- Solving the Navier-Stokes equation numerically for 2D flow problems

Literature
### 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

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<td>Each term</td>
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#### Events

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<th>Instructor</th>
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<tr>
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<td>Numerische Mathematik für die Fachrichtungen Informatik und Ingenieurwesen</td>
<td>2</td>
<td>Lecture (V)</td>
<td>Weiß</td>
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<td>SS 2020</td>
<td>0187500</td>
<td>Übungen zu 0187400</td>
<td>1</td>
<td>Practice (Ü)</td>
<td>Weiß</td>
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</tbody>
</table>

**Prerequisites**

None
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

<table>
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<th>Recurrence</th>
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<td>Each summer term</td>
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Events

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<tr>
<td>SS 2020</td>
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<td>Numerical mechanics for industrial applications</td>
<td>3</td>
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Exams

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<tbody>
<tr>
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<td>76-T-MACH-108720</td>
<td>Numerical Mechanics for Industrial Applications</td>
<td>Prüfung (PR)</td>
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</tbody>
</table>

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

Content


Literature


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

<table>
<thead>
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<th>Credits</th>
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<th>Version</th>
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<tbody>
<tr>
<td>SS 2020 2130934</td>
<td>4</td>
<td>Each summer term</td>
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</table>

Numerical Modeling of Multiphase Flows

Competence Certificate
oral exam 30 minutes

Prerequisites
none

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

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

Die Powerpoint-Folien werden nach jeder Vorlesung im ILIAS-System zum Herunterladen bereitgestellt.

Eine Liste mit Buchempfehlungen wird in der ersten Vorlesungsstunde ausgegeben.
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

<table>
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<th><strong>Recurrence</strong></th>
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<tbody>
<tr>
<td>Oral examination</td>
<td>4</td>
<td>Each winter term</td>
<td>1</td>
</tr>
</tbody>
</table>

**Competence Certificate**
oral

Duration: 30 minutes
no auxiliary means

**Prerequisites**
none

**Recommendation**
Basics in fluid mechanics
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

<table>
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<th>Credits</th>
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<th>Version</th>
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<td>SS 2020 2110037 Occupational Safety and Environmental Protection 2 SWS von Kiparski</td>
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<td>SS 2020 76-T-MACH-105386 Occupational Safety and Environmental Protection Prüfung (PR) Deml, von Kiparski</td>
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</tbody>
</table>

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:

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 Study within a Small Group

Literature
Das Skript und Literaturhinweise stehen auf ILIAS zum Download zur Verfügung.
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

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<th>Recurrence</th>
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<td>Each summer term</td>
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</tbody>
</table>

Events

| SS 2020 | 2106008 | Organ support systems | 2 SWS | Lecture (V) | Pylatiuk |

Competence Certificate
Written examination (Duration: 45min)

Prerequisites
none

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

Organ support systems
2106008, SS 2020, 2 SWS, Language: German, Open in study portal

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.
• E. Wintermantel, Suk-Woo Ha: Medizintechnik. Springer Verlag.
### 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

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**Events**

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<tr>
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<th>Name</th>
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<th>Lecturer</th>
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**Exams**

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<tr>
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<th>Name</th>
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<td>Patent Law</td>
<td>Prüfung (PR)</td>
<td>Dreier, Matz</td>
</tr>
</tbody>
</table>
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

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<tr>
<td>Written examination</td>
<td>6</td>
<td>Each summer term</td>
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</tbody>
</table>

Events

SS 2020 2313737 Photovoltaics 4 SWS Lecture (V) 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.

**Responsible:** Dr. Ron Dagan  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-105134 - Elective Module Mechanical Engineering

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<td>Each winter term</td>
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<tr>
<th>Exams</th>
<th>Credits</th>
<th>Prüfung (PR)</th>
<th>Dagan</th>
</tr>
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</table>

**Competence Certificate**  
oral exam, 30 min.

**Prerequisites**  
one

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Modules of Mechanical Engineering for Exchange Students  
Module Handbook as of 15/02/2020  
332
### 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

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<tbody>
<tr>
<td>Oral examination</td>
<td>5</td>
<td>Each winter term</td>
<td>3</td>
</tr>
</tbody>
</table>

**Exams**

| 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
### 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

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<td>4</td>
<td>Each winter term</td>
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</table>

**Exams**

| SS 2020 | 76-T-MACH-102137 | Polymer Engineering I | Prüfung (PR) | Elsner, Liebig |

**Competence Certificate**

Oral exam, about 25 minutes

**Prerequisites**

none
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

<table>
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<tbody>
<tr>
<td>Oral exam</td>
<td>4</td>
<td>Each summer term</td>
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</table>

**Events**

| SS 2020  | 2174596 | Polymer Engineering II | 2 SWS | Lecture (V) | Elsner, Liebig |

**Exams**

| 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:

### Polymer Engineering II

2174596, SS 2020, 2 SWS, Language: German, Open in study portal

**Lecture (V)**

**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.
### 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

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<td>Each winter term</td>
<td>1</td>
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</table>

**Competence Certificate**  
Oral examination

**Prerequisites**  
none
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
- Oral examination

### Credits
- 4

### Recurrence
- Each winter term

### Version
- 1

**Competence Certificate**
- Oral examination

**Prerequisites**
- none
Below you will find excerpts from events related to this course:

**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.
Literatur
Zusätzliche vorlesungsbegleitende Literatur ist nicht notwendig.
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

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<tr>
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<td>Each winter term</td>
<td>2</td>
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</table>

Competence Certificate
written examination: 60 min duration

Prerequisites
None
## 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

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<th>Type</th>
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<tbody>
<tr>
<td>Completed coursework</td>
<td>1</td>
<td>Each winter term</td>
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**Competence Certificate**  
Colloquium and laboratory report for the respective experiments.

**Prerequisites**  
none
### Course: Practical Training in Basics of Microsystem Technology [T-MACH-102164]

**Responsible:** Dr. Arndt Last  
**Organisation:** KIT Department of Mechanical Engineering

#### Events

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<tr>
<th>Events</th>
<th>Type</th>
<th>Credits</th>
<th>Recurrence</th>
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<td>Introduction to Microsystem Technology - Practical Course</td>
<td>2 SWS</td>
<td>Practical course (P)</td>
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<td>Introduction to Microsystem Technology - Practical Course</td>
<td>2 SWS</td>
<td>Practical course (P)</td>
<td>Last</td>
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#### Exams

| 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:

#### Introduction to Microsystem Technology - Practical Course

| 2143875, SS 2020, 2 SWS, Language: German, Open in study portal |

### 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'
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'
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

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<th>2162208</th>
<th>Schwingungstechnisches Praktikum</th>
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**Exams**

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<th>76-T-MACH-105373</th>
<th>Practical Training in Measurement of Vibrations</th>
<th>Prüfung (PR)</th>
<th>Fidlin</th>
</tr>
</thead>
</table>

**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
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

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<tbody>
<tr>
<td>Oral examination</td>
<td>4</td>
<td>Each winter term</td>
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**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
### 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

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<td>Written examination</td>
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<td>Each winter term</td>
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</table>

**Competence Certificate**  
Written examination (Duration: 45min)

**Prerequisites**  
none
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

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<td>Each term</td>
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**Competence Certificate**
Written exam (90 min.)

**Prerequisites**
None
3.273 Course: Process Simulation in Forming Operations [T-MACH-105348]

Responsibility: Dr.-Ing. Dirk Helm
Organisation: KIT Department of Mechanical Engineering

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

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<tbody>
<tr>
<td>Oral examination</td>
<td>4</td>
<td>Each winter term</td>
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</table>

Competence Certificate
oral exam, 20 min.

Prerequisites
none
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

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**Type**

Written examination

**Credits**

3

**Recurrence**

Each summer term

**Version**

1

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**Events**

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<tr>
<th>SS 2020</th>
<th>2571154</th>
<th>Product and Innovation Management</th>
<th>2 SWS</th>
<th>Lecture (V)</th>
<th>Feurer</th>
</tr>
</thead>
</table>

**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).

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

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**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, Fout/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**


Responsible: Dr. Stefan Kienzle
Dr. Dieter Steegmüller

Organisation: KIT Department of Mechanical Engineering

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

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</table>

Competence Certificate
Oral Exam (20 min)

Prerequisites
T-MACH-105166 - Materials and Processes for Body Lightweight Construction in the Automotive Industry must not have been started.
# 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

**Type**  
*Written examination*  

**Credits**  
*7*  

**Recurrence**  
*Each summer term*  

**Version**  
*1*  

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<th>Credits</th>
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<tr>
<td>SS 2020</td>
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<td>Written examination</td>
<td>Each summer term</td>
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</table>

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

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**Competence Certificate**  
*written exam (2 hours)*

**Prerequisites**  
*none*

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

---

**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*
3.277 Course: Product, Process and Resource Integration in the Automotive Industry [T-MACH-102155]

Responsibility: Dr.-Ing. Sama Mbang
Organisation: KIT Department of Mechanical Engineering

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

Type: Oral examination
Credits: 4
Recurrence: Each summer term
Version: 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:

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
### 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

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<tr>
<td>Written exam</td>
<td>3</td>
<td>Each winter term</td>
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</table>

#### 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
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

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<tr>
<td>Written exam</td>
<td>4</td>
<td>Each winter term</td>
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</table>

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.
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

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<tr>
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<td>Each summer term</td>
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**Events**

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<td>4</td>
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**Exams**

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<th>Course Name</th>
<th>Type</th>
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<td>Production Techniques Laboratory</td>
<td>Prüfung (PR)</td>
<td>Deml, Furmans, Ovtcharova, Schulze</td>
</tr>
</tbody>
</table>

**Competence Certificate**

**Advanced Internship:** Participate in practical exercise courses and complete the colloquia successfully.

**Elective Subject:** Participate in practical 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:_

**Production Techniques Laboratory**

2110678, SS 2020, 4 SWS, Language: German, _Open in study portal_
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.
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

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<td>Each summer term</td>
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Events

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Exams

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<tr>
<td>SS 2020</td>
<td>4 SWS</td>
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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:

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 effectively 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.
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

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<tbody>
<tr>
<td>Oral examination</td>
<td>4</td>
<td>Each winter term</td>
<td>1</td>
</tr>
</tbody>
</table>

**Competence Certificate**  
oral exam (20 min)  
Aids: None

**Prerequisites**  
none
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

<table>
<thead>
<tr>
<th>Type</th>
<th>Credits</th>
<th>Recurrence</th>
<th>Version</th>
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</thead>
<tbody>
<tr>
<td>Oral examination</td>
<td>4</td>
<td>Each winter term</td>
<td>1</td>
</tr>
</tbody>
</table>

Exams

| 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
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

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<thead>
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<tbody>
<tr>
<td>Examination of another type</td>
<td>5</td>
<td>Each winter term</td>
<td>2</td>
</tr>
</tbody>
</table>

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
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

<table>
<thead>
<tr>
<th>Events</th>
<th>Type</th>
<th>Credits</th>
<th>Recurrence</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>SS 2020 2115817</td>
<td>Oral exam</td>
<td>6</td>
<td>Each term</td>
<td>1</td>
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<tr>
<td>Project Workshop: Automotive Engineering</td>
<td>Lecture (V)</td>
<td>Gauterin, Gießler, Frey</td>
<td></td>
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</tr>
</tbody>
</table>

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:

Project Workshop: Automotive Engineering
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

Skripte werden beim Start-up Meeting ausgegeben.
### 3.286 Course: Quality Management [T-MACH-102107]

<table>
<thead>
<tr>
<th>Responsible</th>
<th>Prof. Dr.-Ing. Gisela Lanza</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organisation</td>
<td>KIT Department of Mechanical Engineering</td>
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<tr>
<td>Part of</td>
<td>M-MACH-104852 - Major Field Production Technology</td>
</tr>
</tbody>
</table>

#### Type
- Written examination

#### Credits
- 4

#### Recurrence
- Each winter term

#### Version
- 1

#### Competence Certificate
Written Exam (60 min)

#### Prerequisites
none
3.287 Course: Rail System Technology [T-MACH-106424]

Responsibility: Prof. Dr.-Ing. Peter Gratzfeld
Organisation: KIT Department of Mechanical Engineering

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

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<th>Type</th>
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<td>Each term</td>
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Events

<table>
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<tr>
<th>SS 2020</th>
<th>2115919</th>
<th>Rail System Technology</th>
<th>2 SWS</th>
<th>Lecture (V)</th>
<th>Gratzfeld</th>
</tr>
</thead>
</table>

Exams

<table>
<thead>
<tr>
<th>SS 2020</th>
<th>76-T-MACH-106424</th>
<th>Rail System Technology</th>
<th>Prüfung (PR)</th>
<th>Gratzfeld</th>
</tr>
</thead>
</table>

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:

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).
3.288 Course: Rail Vehicle Technology [T-MACH-105353]

Responsibility: Prof. Dr.-Ing. Peter Gratzfeld
Organisation: KIT Department of Mechanical Engineering

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

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<tr>
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<tr>
<td>SS 2020 2115996</td>
<td>4</td>
<td>Each term</td>
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<tbody>
<tr>
<td>SS 2020 76-T-MACH-105353</td>
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</tbody>
</table>

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:

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).
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

Events

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<tr>
<th>Events</th>
<th>Credits</th>
<th>Recurrence</th>
<th>Version</th>
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<tbody>
<tr>
<td>SS 2020</td>
<td>4</td>
<td>Each summer term</td>
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Exams

<table>
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<tr>
<th>Exams</th>
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<th>Recurrence</th>
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<tr>
<td>SS 2020 76-T-MACH-105540</td>
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</table>

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:

Railways in the Transportation Market
2114914, SS 2020, 2 SWS, Language: German, Open in study portal

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 environment
- 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
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

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<tr>
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<tbody>
<tr>
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<td>Each summer term</td>
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**Events**

<table>
<thead>
<tr>
<th>SS 2020</th>
<th>2189465</th>
<th>Reactor Safety I: Fundamentals</th>
<th>2 SWS</th>
<th>Lecture (V)</th>
<th>Sanchez-Espinoza</th>
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</table>

**Exams**

<table>
<thead>
<tr>
<th>SS 2020</th>
<th>76-T-MACH-105405</th>
<th>Reactor Safety I: Fundamentals</th>
<th>Prüfung (PR)</th>
<th>Sanchez-Espinoza</th>
</tr>
</thead>
</table>

**Competence Certificate**
oral exam about 30 minutes

**Prerequisites**
none

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

**Reactor Safety I: Fundamentals**  
2189465, SS 2020, 2 SWS, Language: German/English, Open in study portal  
Lecture (V)
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 methodologies 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
3.291 Course: Reduction Methods for the Modeling and the Simulation of Vom bustion 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

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<th>Type</th>
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<tbody>
<tr>
<td>Oral exam</td>
<td>4</td>
<td>Each summer term</td>
<td>1</td>
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</table>

Events

| Events | SS 2020 | 2166543 | Reduction methods for the modeling and the simulation of combustion processes | 2 SWS | Lecture (V) | Bykov |

Competence Certificate
oral exam (20 min)

Prerequisites
none

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

Reduction methods for the modeling and the simulation of combustion processes
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
### 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

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<tbody>
<tr>
<td>Written exam</td>
<td>3</td>
<td>Each winter term</td>
<td>1</td>
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</table>

**Competence Certificate**  
written exam

**Prerequisites**  
one

**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

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<th>Version</th>
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<tr>
<td>Written examination</td>
<td>4</td>
<td>Each winter term</td>
<td>3</td>
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**Competition Certificate**  
The assessment consists of a written exam (60 min., in English, answers in English or German).

**Prerequisites**  
None.
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

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<tr>
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<td>Each winter term</td>
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**Exams**

<table>
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<tr>
<th>SS 2020</th>
<th>7500218</th>
<th>Robotik I - Einführung in die Robotik</th>
<th>Prüfung (PR)</th>
<th>Asfour</th>
</tr>
</thead>
</table>
### 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

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<tbody>
<tr>
<td>Written exam</td>
<td>3</td>
<td>Each summer term</td>
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</table>

**Events**

| SS 2020 | 2400074 | Robotics II: Humanoid Robotics | 2 SWS | Lecture (V) | Asfour |

**Exams**

| SS 2020 | 7500086 | Robotics II: Humanoid Robotics | Prüfung (PR) | Asfour |

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

**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.
### 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

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<tr>
<td>SS 2020 2400067 Robotics III - Sensors and Perception in Robotics</td>
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<tr>
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<tbody>
<tr>
<td>SS 2020 7500242 Robotics III - Sensors and Perception in Robotics</td>
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</table>

**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 Objectives:**  
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.
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

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<th>Recurrence</th>
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<tbody>
<tr>
<td>Oral examination</td>
<td>4</td>
<td>Each winter term</td>
<td>2</td>
</tr>
</tbody>
</table>

**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
### 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

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<tr>
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<th>Type</th>
<th>Recurrence</th>
<th>Version</th>
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</thead>
<tbody>
<tr>
<td>SS 2020, 2154044, Scaling in fluid dynamics, 2 SWS</td>
<td>4</td>
<td>Lecture (V)</td>
<td>Bühler</td>
<td></td>
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</table>

**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:

**Scaling in fluid dynamics**  
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
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

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<tr>
<td>Oral examination</td>
<td>4</td>
<td>Each term</td>
<td>1</td>
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</table>

Events

| 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:

**Selected chapters of the combustion fundamentals**

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
3.300 Course: Selected Problems of Applied Reactor Physics and Exercises [T-MACH-105462]

Responsible: Dr. Ron Dagan
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

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<th>Events</th>
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<tbody>
<tr>
<td>SS 2020 2190411</td>
<td>2 SWS</td>
<td>Lecture (V)</td>
<td>Dagan</td>
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<th>Exams</th>
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</thead>
<tbody>
<tr>
<td>SS 2020 76-T-MACH-105462</td>
<td>Prüfung (PR)</td>
<td>Dagan</td>
<td></td>
</tr>
</tbody>
</table>

Competence Certificate
oral exam, 1/2 hour

Prerequisites
none

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

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
J. Duderstadt and L. Hamilton, Nuclear reactor Analysis, J. Wiley $ Sons, Inc. 1975 (in English)
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

<table>
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<tr>
<td>Version</td>
<td>2</td>
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</table>

**Events**

| SS 2020 | 2178450 | Seminar in Materials Science | 2 SWS | Seminar (S) | 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:

**Seminar in Materials Science**

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

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<th>Events</th>
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<tbody>
<tr>
<td>SS 2020</td>
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</tbody>
</table>

**Prerequisites**  
none
### 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

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**Exams**

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<th>Sensors</th>
<th>Prüfung (PR)</th>
<th>Menesklou</th>
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</thead>
</table>
3.304 Course: Signals and Systems [T-ETIT-109313]

**Responsible:** Prof. Dr.-Ing. Fernando Puente León

**Organisation:** KIT Department of Electrical Engineering and Information Technology

**Part of:** M-MACH-104882 - Courses of the Department of Electrical Engineering and Information Technology

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<td>Each winter term</td>
<td>1 terms</td>
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</table>

**Prerequisites**

none
**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

<table>
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<tbody>
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<td>Each summer term</td>
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**Events**

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<th>2114095</th>
<th>Simulation of Coupled Systems</th>
<th>2 SWS</th>
<th>Lecture (V)</th>
<th>Geimer, Xiang</th>
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**Exams**

<table>
<thead>
<tr>
<th>SS 2020</th>
<th>76T-MACH-105172</th>
<th>Simulation of Coupled Systems</th>
<th>Prüfung (PR)</th>
<th>Geimer</th>
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</thead>
</table>

**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 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.

**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 knowledge of Matlab/Simulink
- Basic knowledge of dynamics of machines
- 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 hydraulics 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:*
Simulation of Coupled Systems
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
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**  
Completed coursework

**Credits**  
0

**Recurrence**  
Each summer term

**Version**  
1

**Exams**

| SS 2020 | 76-T-MACH-108888 | Simulation of Coupled Systems - Advance | Prüfung (PR) | Geimer |

**Competence Certificate**
Preparation of semester report

**Prerequisites**
none
3.07 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

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<td>Each summer term</td>
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Events

<table>
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<th>Events</th>
<th>SS 2020</th>
<th>2170491</th>
<th>Simulator Exercises Combined Cycle Power Plants</th>
<th>2 SWS</th>
<th>Practical course (P)</th>
<th>Schulenberg</th>
</tr>
</thead>
</table>

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:

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 malfunctions 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.
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

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<tr>
<td>Written examination</td>
<td>6</td>
<td>Each winter term</td>
<td>1</td>
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</table>

**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.

**Responsible:** Dr. Ron Dagan  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-105134 - Elective Module Mechanical Engineering

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<tr>
<td>Oral examination</td>
<td>4</td>
<td>Each winter term</td>
<td>3</td>
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</table>

**Exams**

| 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**

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:** Oral examination  
**Credits:** 4  
**Recurrence:** Each winter term  
**Version:** 3

---

**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**  
Basic course in materials science and engineering  
Basic course in mathematics  
Physical chemistry
### 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

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<tr>
<td>Oral exam</td>
<td>3</td>
<td>Each summer term</td>
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</table>

**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:

**Strategic product development - identification of potentials of innovative products**

2146198, SS 2020, 2 SWS, Language: German, [Open in study portal](#)

**Content**
Introduction into future management, Development of scenarios, scenario-based strategy development, trend management, strategic early detection, innovation and technology management, scenarios in product development, from profiles of requirements to new products, examples out of industrial praxis.
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

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<td>Oral examination</td>
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<td>Each winter term</td>
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**Competence Certificate**
oral exam, 20 min

**Prerequisites**
none
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

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<tr>
<td>Oral examination</td>
<td>4</td>
<td>Each summer term</td>
<td>1</td>
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Events

| SS 2020 | 2126775 | Structural Ceramics | 2 SWS | Lecture (V) | Hoffmann |

Competence Certificate
Oral examination, 20 min

Prerequisites
none

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

Structural Ceramics
2126775, SS 2020, 2 SWS, Language: German, Open in study portal

Literature
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

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<td>Oral examination</td>
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Events

<table>
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<tr>
<th>Events</th>
<th>SS 2020</th>
<th>2174580</th>
<th>Structural Materials</th>
<th>4 SWS</th>
<th>Lecture / Practice (VÜ)</th>
<th>Guth, Lang</th>
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<td>76-T-MACH-100293</td>
<td>Structural Materials</td>
<td></td>
<td>Prüfung (PR)</td>
<td>Lang, Guth</td>
</tr>
</tbody>
</table>

Competence Certificate

Oral exam, about 25 minutes

Prerequisites
none

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

Structural Materials
2174580, SS 2020, 4 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Content

Lectures and tutorial 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, component with residual stresses and loading at high homologous temperatures.

requirements:
none

workload:

Precence: 42h
Self study: 138h
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

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.
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

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<td>Each winter term</td>
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Competence Certificate
oral examination (ca. 30 Minuten)

Prerequisites
none
Course: Sustainable Product Engineering [T-MACH-105358]

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

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**Events**

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<td>Lecture (V)</td>
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**Competence Certificate**

written exam (60 min)

**Prerequisites**

none

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

**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 simulation during the process of development 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 and 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 simulation during the process of development of technical products.
- develop skills such as team skills / project / self / presentation based on realistic projects.
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

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<tr>
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<td>Each winter term</td>
<td>2</td>
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**Prerequisites**
none
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**  
Oral examination

**Credits**  
4

**Recurrence**  
Each summer term

**Version**  
1

<table>
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<th>SS 2020</th>
<th>2106033</th>
<th>System Integration in Micro- and Nanotechnology</th>
<th>2 SWS</th>
<th>Lecture (V)</th>
<th>Gengenbach</th>
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</table>

**Competence Certificate**
oral exam (Duration: 30 min)

**Prerequisites**
none

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

**System Integration in Micro- and Nanotechnology**
2106033, SS 2020, 2 SWS, Language: German, Open in study portal

**Lecture (V)**

**Content**

**Content:**
- Introduction
- Definition system integration
- Integration of mechanical functions (flexures)
- Plasma treatment of surfaces
- Adhesive bonding
  - Packaging
  - Low Temperature Cofired Ceramics (LTCC)
  - Assembly of hybrid systems
- Monolithic/hybrid system integration
- Modular system integration
- Integration of electrical/electronic functions
- Mounting techniques
- molded Interconnect Devices (MID)
- Functional printing
- Coating
- Capping
- Housing

First steps towards system integration nanotechnology

**Learning objectives:**
Students acquire fundamental knowledge about challenges and system integration processes.

**Literature**
- J. Franke, Räumliche elektronische Baugruppen (3D-MID), Carl Hanser-Verlag München, 2013

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Modules of Mechanical Engineering for Exchange Students  
Module Handbook as of 15/02/2020  
398
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

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**Events**

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<tr>
<td>SS 2020</td>
<td>2174576</td>
<td>Systematic Materials Selection</td>
<td>3 SWS</td>
<td>Lecture (V)</td>
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<td>SS 2020</td>
<td>2174577</td>
<td>Übungen zu 'Systematische Werkstoffauswahl'</td>
<td>1 SWS</td>
<td>Practice (Ü)</td>
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**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:**

**Systematic Materials Selection**

2174576, SS 2020, 3 SWS, Language: German, Open in study portal

**Lecture (V)**

**Content**
Important aspects and criteria of materials selection are examined and guidelines for a systematic approach to materials selection are developed. 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:**
Willing SPO 2007 (B.Sc.)
The course Material Science I [21760] has to be completed beforehand.

Willing (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
## 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

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<th>Systems Engineering for Automotive Electronics</th>
<th>2 SWS</th>
<th>Lecture (V)</th>
<th>Bortolazzi</th>
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<td>Tutorial for 2311642 Systems Engineering for Automotive Electronics</td>
<td>1 SWS</td>
<td>Practice (Ü)</td>
<td>Pistorius</td>
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</table>

### Prerequisites

none
### 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

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<td>Lecture (V)</td>
<td>Schmid</td>
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</table>

**Competence Certificate**

Written exam (60 min)  
Only dictionary is allowed

**Prerequisites**

none

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

#### Technical Design in Product Development

2146179, SS 2020, 2 SWS, Language: German, [Open in study portal](#)

**Literature**

Hexact (R) Lehr- und Lernportal

**Responsible:** Dr. Ferdinand Schmidt

**Organisation:** KIT Department of Mechanical Engineering

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

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**Exams**


**Competence Certificate**

oral exam, 30 minutes

**Prerequisites**

none

**Responsible:** Dr. Ferdinand Schmidt

**Organisation:** KIT Department of Mechanical Engineering

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

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**Events**

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<td>Technical energy systems for buildings 2: System concepts</td>
<td>2 SWS</td>
<td>Lecture (V) Schmidt</td>
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**Exams**

<table>
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<th>Events</th>
<th>Description</th>
<th>Recurrence</th>
<th>Instructor</th>
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</table>

**Competence Certificate**

oral exam, 30 minutes

**Prerequisites**

none

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

**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**
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

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**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.
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

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Events

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<td>3 SWS</td>
<td>3166526</td>
<td>Technical Thermodynamics and Heat Transfer II</td>
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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 - Exercises in Technical Thermodynamics and Heat Transfer II must have been passed.

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

Technical Thermodynamics and Heat Transfer II
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
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

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Events

| SS 2020 | 2174579 | Technology of steel components | 2 SWS | Lecture (V) | Schulze |

Competence Certificate
Oral exam, about 25 minutes

Prerequisites
none

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

Technology of steel components
2174579, SS 2020, 2 SWS, Language: German, Open in study portal

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
Literatur
Skript wird in der Vorlesung ausgegeben

VDEh: Werkstoffkunde Stahl, Bd. 1: Grundlagen, Springer-Verlag, 1984


V. Schulze: Modern Mechanical Surface Treatments, Wiley, Weinheim, 2005
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

### Competence Certificate
oral exam, 20 min

### Prerequisites
none

### Details

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<td>Each winter term</td>
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</table>
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

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**Prerequisites**  
none

Responsible: Prof. Dr.-Ing. Alexander Fidlin
Organisation: KIT Department of Mechanical Engineering

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

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Events

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<td>2 SWS</td>
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<td>Fidlin</td>
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<td>SS 2020 2163114</td>
<td>Übungen zu Stabilitätstheorie</td>
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Exams

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<td>Theory of Stability</td>
<td>Prüfung (PR)</td>
<td>Fidlin</td>
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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:

Theory of Stability
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
**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

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<td>Prüfung (PR)</td>
<td>Stieglitz</td>
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**Competence Certificate**  
Oral examination, 30 minutes

**Prerequisites**  
none
3.32 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

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**Exams**

| SS 2020 | 76-T-MACH-105363 | Thermal Turbomachines I | Prüfung (PR) | Bauer |

**Competence Certificate**

oral exam, duration 30 min.

**Prerequisites**

none
### 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

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<td>Each summer term</td>
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#### 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

| 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**  
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)
Sigloch, H.: Strömungsmaschinen, Carl Hanser Verlag, 1993

Thermal Turbomachines II (in English)
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 describe and analyse not only the individual components but also entire assemblies. The students can assess 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)
Sigloch, H.: Strömungsmaschinen, Carl Hanser Verlag, 1993
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

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Exams

SS 2020 | 76-T-MACH-106372 | Thermal-Fluid-Dynamics | Prüfung (PR) | Ruck

Competence Certificate
oral exam of about 30 minutes

Prerequisites
none
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

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**Type**  
Oral examination

**Credits**  
4

**Recurrence**  
Each summer term

**Version**  
1

**Events**

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<th>SS 2020</th>
<th>2178123</th>
<th>Thin film and small-scale mechanical behavior</th>
<th>2 SWS</th>
<th>Lecture (V)</th>
<th>Weygand, Gruber</th>
</tr>
</thead>
</table>

**Competence Certificate**  
oral exam 30 minutes

**Prerequisites**  
none

**Recommendation**  
preliminary knowledge in materials science, physics and mathematics

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

---

**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**

2. L.B. Freund and S. Suresh: „Thin Film Materials“
3.336 Course: Tires and Wheel Development for Passenger Cars [T-MACH-102207]

Responsible: Dr.-Ing. Günter Leister
Organisation: KIT Department of Mechanical Engineering

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

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<td>4</td>
<td>Each summer term</td>
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Events

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<th>SS 2020</th>
<th>2114845</th>
<th>Tires and Wheel Development for Passenger Cars</th>
<th>2 SWS</th>
<th>Lecture (V)</th>
<th>Leister</th>
</tr>
</thead>
</table>

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:

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 including Design and manufacturing methods, Wheeltesting
7. Tire pressure: 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
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

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<tr>
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<td>4</td>
<td>Each winter term</td>
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</table>

**Competence Certificate**  
The assessment consists of a written exam taking place in the recess period (90 min).

**Prerequisites**  
one

**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 and 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
3.38 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: Oral examination
Credits: 8
Recurrence: Each winter term
Version: 2

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 - Exercises - Tribology must have been passed.

Recommendation
preliminary knowledge in mathematics, mechanics and materials science
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

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<td>Oral examination</td>
<td>4</td>
<td>Each winter term</td>
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**Exams**

| 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.

**Responsible:** Prof. Dr.-Ing. Thomas Böhlke

**Organisation:** KIT Department of Mechanical Engineering

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

**Type**
- Completed coursework

**Credits**
- 1

**Recurrence**
- Each winter term

**Version**
- 3

**Competence Certificate**

Successfully solving the homework sheets. Details are announced in the first lecture.

**Prerequisites**

None
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

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<td>Recurrence</td>
<td>Each summer term</td>
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<td>Version</td>
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</table>

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:

Tutorial Mathematical Methods in Micromechanics
2162281, SS 2020, 1 SWS, Language: German, Open in study portal

Content
see lecture "Mathematical Methods in Micromechanics"
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

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Competence Certificate
oral exam, duration: approximately 30 minutes
no tools or reference materials may be used during the exam

Prerequisites
none
**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  

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**Events**

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<td>SS 2020 2190499 Vacuum and Tritium Technology in Nuclear Fusion</td>
<td>2 SWS</td>
<td>Day, Größle</td>
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**Exams**

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<th>Recurrence</th>
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<td>SS 2020 76-T-MACH-108784 Vacuum and Tritium Technology in Nuclear Fusion</td>
<td>Prüfung (PR)</td>
<td>Day, Bornschein</td>
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**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:**

**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
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

**Events**

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<tr>
<td>Oral examination</td>
<td>4</td>
<td>Each winter term</td>
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**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:**

**Vehicle Ride Comfort & Acoustics I**

2114856, SS 2020, 2 SWS, Language: English

**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 phenomena 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 chassis regarding driving comfort and acoustic under consideration of goal conflicts.

**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 chassis 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.
Literature
2. Russel C. Hibbeler, Technische Mechanik 3, Dynamik, Pearson Studium, München, 2006

Das Skript wird zu jeder Vorlesung zur Verfügung gestellt
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

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<td>2 SWS</td>
<td>Lecture (V)</td>
<td>Gauterin</td>
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<tr>
<td>SS 2020 2114857 Vehicle Ride Comfort &amp; Acoustics II</td>
<td>2 SWS</td>
<td>Lecture (V)</td>
<td>Gauterin</td>
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**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:*
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.

Vehicle Ride Comfort & Acoustics II
2114857, SS 2020, 2 SWS, Language: English, 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.

The script will be supplied in the lectures.
3.346 Course: Vehicle Ergonomics [T-MACH-108374]

Responsible: Dr.-Ing. Tobias Heine
Organisation: KIT Department of Mechanical Engineering

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

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<tr>
<td>Written examination</td>
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Events

- **SS 2020 2110050 Vehicle Ergonomics 2 SWS Lecture (V) Heine**

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:

### Vehicle Ergonomics

2110050, SS 2020, 2 SWS, Language: German, Open in study portal

**Lecture (V)**

**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.

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

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

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<td>Written exam</td>
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<td>Each winter term</td>
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Exams

Competence Certificate
Written exam, 90 minutes

Prerequisites
none

Recommendation
none
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

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<td>Written examination</td>
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<td>Each winter term</td>
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**Competence Certificate**
Written examination

**Duration:** 90 minutes

**Auxiliary means:** none

**Prerequisites**
none
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

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<tr>
<td>SS 2020 2114856</td>
<td>3</td>
<td>Each summer term</td>
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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:

Vehicle Ride Comfort & Acoustics I
2114856, SS 2020, 2 SWS, Language: English, Open in study portal

Content
1. Perception of noise and vibrations
2. 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 chassis 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
2. Russel C. Hibbeler, Technische Mechanik 3, Dynamik, Pearson Studium, München, 2006

Das Skript wird zu jeder Vorlesung zur Verfügung gestellt
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**  
Oral examination  
**Credits**  
3  
**Recurrence**  
Each summer term  
**Version**  
1

### Events

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<th>SS 2020</th>
<th>2114857</th>
<th>Vehicle Ride Comfort &amp; Acoustics II</th>
<th>2 SWS</th>
<th>Lecture (V)</th>
<th>Gauterin</th>
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### 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.

### 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.
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

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<td>Written examination</td>
<td>5</td>
<td>Each winter term</td>
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**Exams**

| SS 2020 | 76-T-MACH-105290 | Vibration Theory | Prüfung (PR) | Fidlin |

**Competence Certificate**

written exam, 180 min.

**Prerequisites**

none
**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

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<th>Type</th>
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<th>Recurrence</th>
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<tbody>
<tr>
<td>Oral examination</td>
<td>4</td>
<td>Each summer term</td>
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</table>

**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:*

**Virtual Engineering (Specific Topics)**

3122031, SS 2020, 2 SWS, Language: English, Open in study portal

**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
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: Written examination
Credits: 4
Recurrence: Each winter term
Version: 2

Competence Certificate
Written examination 90 min.

Prerequisites
None
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

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<td>Each summer term</td>
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Events

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<tr>
<th>SS 2020</th>
<th>2122378</th>
<th>Virtual Engineering II</th>
<th>2/1 SWS Lecture / Practice (VÜ)</th>
<th>Ovtcharova, Mitarbeiter</th>
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</thead>
</table>

Competence Certificate
Written examination 90 min.

Prerequisites
None

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

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
### 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

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<tr>
<td>Examination of another type</td>
<td>4</td>
<td>Each term</td>
<td>2</td>
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**Competence Certificate**  
Assessment of another type (graded)

**Prerequisites**  
None

**Annotation**  
Number of participants is limited
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

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Events

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<th>Type</th>
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<tr>
<td>SS 2020 2118097</td>
<td>2 SWS</td>
<td>Lecture (V) Furmans</td>
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</table>

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:

Warehousing and distribution systems
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

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

WISSE, 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
### 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

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<td>Each winter term</td>
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</table>

**Exams**

| SS 2020 | 76-T-MACH-105443 | Wave Propagation | Prüfung (PR) | Seemann |

**Competence Certificate**

oral exam, 30 min.
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
Oral examination

Credits
4

Recurrence
Each winter term

Version
1

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.
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

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

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<td>1</td>
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**Responsible:** Prof. Dr.-Ing. Hans-Jörg Bauer

**Organisation:** KIT Department of Mechanical Engineering

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

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### Events

| SS 2020 | 2171488 | Workshop on computer-based flow measurement techniques | 3 SWS | Practical course (P) | Bauer, Mitarbeiter |

### Exams

| 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:*

**Workshop on computer-based flow measurement techniques**

2171488, SS 2020, 3 SWS, Language: German, [Open in study portal](#)
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

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 exercise

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