Module Handbook
Module Offers in Mechanical Engineering for temporary students pursuing a degree in Germany

SPO
Valid from Winter Term 2021/22
Date: 15/09/2021

KIT DEPARTMENT OF MECHANICAL ENGINEERING
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<td>Numerical Simulation of Multi-Phase Flows - T-MACH-105420</td>
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<td>Occupational Safety and Environmental Protection - T-MACH-105386</td>
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<td>Polymers in MEMS B: Physics, Microstructuring and Applications - T-MACH-102191</td>
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<td>Powertain Systems Technology B: Stationary Machinery - T-MACH-105216</td>
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<td>Practical Training in Basics of Microsystem Technology - T-MACH-102164</td>
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3.307. Simulation of Coupled Systems - Advance - T-MACH-108888
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3.309. Smoothed Particle Hydrodynamics (SPH) in Computational Fluid Dynamics - T-MACH-111396
3.310. Solar Energy - T-ETIT-100774
3.311. Solar Thermal Energy Systems - T-MACH-106493
3.312. Solid State Reactions and Kinetics of Phase - T-MACH-107667
3.313. Strategic Product Development - Identification of Potentials of Innovative Products - T-MACH-105696
3.314. Structural Analysis of Composite Laminates - T-MACH-105970
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3.321. System Integration in Micro- and Nanotechnology - T-MACH-105555
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3.337. Thermal-Fluid-Dynamics - T-MACH-106372
3.338. Thin Film and Small-scale Mechanical Behavior - T-MACH-105554
3.339. Tires and Wheel Development for Passenger Cars - T-MACH-102207
3.340. Tractors - T-MACH-105423
3.341. Tribology - T-MACH-105531
3.342. Turbine and Compressor Design - T-MACH-105365
3.343. Tutorial Introduction to the Finite Element Method - T-MACH-110330
3.344. Tutorial Mathematical Methods in Micromechanics - T-MACH-110379
3.345. Tutorial Nonlinear Continuum Mechanics - T-MACH-111027

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<td>3.353</td>
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## Mandatory

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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

<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
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<td>M-MACH-104847</td>
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<td>M-MACH-104848</td>
<td>Major Field Energy and Environmental Engineering</td>
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<td>Major Field Automotive Engineering</td>
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<td>M-MACH-104850</td>
<td>Major Field Mechatronics and Microsystem Technology</td>
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<td>M-MACH-104851</td>
<td>Major Field Product Development and Construction</td>
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<td>M-MACH-104852</td>
<td>Major Field Production Technology</td>
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<tr>
<td>M-MACH-104853</td>
<td>Major Field Theoretical Foundations of Mechanical Engineering</td>
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<td>M-MACH-104854</td>
<td>Major Field Materials and Structures for High Performance Systems</td>
<td>90 CR</td>
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<td>M-MACH-104878</td>
<td>Specification in Mechanical Engineering</td>
<td>60 CR</td>
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<tr>
<td>M-MACH-105134</td>
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### 1.2 Courses of Other Faculties and Soft Skills

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<td>M-MACH-104883</td>
<td>Courses of the Department of Informatics</td>
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<tr>
<td>M-MACH-104884</td>
<td>Courses of the Department of Economics and Management</td>
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<td>M-MACH-104885</td>
<td>Courses of the Department of Mathematics</td>
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<tr>
<td>M-MACH-105100</td>
<td>Courses of the Department of Chemical and Process Engineering</td>
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<tr>
<td>M-MACH-105405</td>
<td>Courses of the Department of Civil Engineering, Geo and Environmental Sciences</td>
<td>10 CR</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

<table>
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<th>Credits</th>
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<th>Recurrence</th>
<th>Duration</th>
<th>Language</th>
<th>Level</th>
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<td>12</td>
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<td>Each term</td>
<td>1 term</td>
<td>English</td>
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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_CiW (between 0 and 90 credits)

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<tr>
<td>T-CIWVT-110571</td>
<td>Design of a Jet Engine Combustion Chamber</td>
<td>6 CR</td>
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<tr>
<td>T-CIWVT-110576</td>
<td>Energy from Biomass</td>
<td>6 CR</td>
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<tr>
<td>T-CIWVT-111095</td>
<td>Liquid Transportation Fuels</td>
<td>6 CR</td>
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<tr>
<td>T-CIWVT-108873</td>
<td>Practical Course Combustion Technology</td>
<td>4 CR</td>
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</table>

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 Chemical and Process 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 brick courses

Learning type
Tutorial
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  
**Grading scale:** Grade to a tenth  
**Recurrence:** Each term  
**Duration:** 1 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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<tr>
<td>T-BGU-109581</td>
<td>Fluid Mechanics of Turbulent Flows</td>
<td>4 CR</td>
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<td>T-BGU-100047</td>
<td>Basics of Finite Elements</td>
<td>5 CR</td>
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<td>Betsch</td>
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<tr>
<td>T-BGU-110842</td>
<td>Modeling of Turbulent Flows - RANS and LES</td>
<td>6 CR</td>
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<td>Uhlmann</td>
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<tr>
<td>T-BGU-108485</td>
<td>Project Report Water Distribution Systems</td>
<td>2 CR</td>
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</table>

**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

<table>
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<tr>
<th>Credits</th>
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<th>Recurrence</th>
<th>Duration</th>
<th>Language</th>
<th>Level</th>
<th>Version</th>
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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.

<table>
<thead>
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<th>Lecturers</th>
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<tr>
<td>T-WIWI-102758 Introduction to Operations Research I and II</td>
<td>9 CR</td>
<td>Nickel, Rebennack, Stein</td>
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<td>T-WIWI-107501 Energy Market Engineering</td>
<td>4,5 CR</td>
<td>Weinhardt</td>
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<td>T-WIWI-102864 Entrepreneurship</td>
<td>3 CR</td>
<td>Terzidis</td>
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<td>T-WIWI-102900 Financial Analysis</td>
<td>4,5 CR</td>
<td>Luedecke</td>
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<td>T-WIWI-102870 Logistics and Supply Chain Management</td>
<td>3,5 CR</td>
<td>Schultmann, Wiens</td>
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<td>T-WIWI-102800 Management Accounting 1</td>
<td>4,5 CR</td>
<td>Wouters</td>
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<td>T-WIWI-109864 Product and Innovation Management</td>
<td>3 CR</td>
<td>Klarmann</td>
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<td>T-WIWI-103091 Production and Logistics Controlling</td>
<td>3 CR</td>
<td>Rausch</td>
</tr>
<tr>
<td>T-WIWI-103134 Project Management</td>
<td>3,5 CR</td>
<td>Schultmann</td>
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<tr>
<td>T-WIWI-102629 Management and Strategy</td>
<td>3,5 CR</td>
<td>Lindstädt</td>
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</table>

**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

<table>
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<th>Duration</th>
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<td>Each term</td>
<td>2 terms</td>
<td>German/English</td>
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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.

<table>
<thead>
<tr>
<th>Election block: Exchange Students_ETIT (between 0 and 90 credits)</th>
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<tbody>
<tr>
<td>T-ETIT-101930 Medical Imaging Techniques I 3 CR Dössel</td>
</tr>
<tr>
<td>T-ETIT-101931 Medical Imaging Techniques II 3 CR Dössel</td>
</tr>
<tr>
<td>T-ETIT-101956 Bioelectric Signals 3 CR Loewe</td>
</tr>
<tr>
<td>T-ETIT-106492 Biomedical Measurement Techniques I 3 CR Nahm</td>
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<tr>
<td>T-ETIT-101918 Digital Technology 6 CR Becker</td>
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<tr>
<td>T-ETIT-110883 Electric Power Transmission &amp; Grid Control 4 CR Leibfried</td>
</tr>
<tr>
<td>T-ETIT-100807 Electrical Machines 4 CR Becker</td>
</tr>
<tr>
<td>T-ETIT-101954 Electrical Machines and Power Electronics 6 CR Becker</td>
</tr>
<tr>
<td>T-ETIT-101923 Electric Energy Systems 5 CR Leibfried</td>
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<tr>
<td>T-ETIT-109318 Electronic Devices and Circuits 6 CR Ulusoy</td>
</tr>
<tr>
<td>T-ETIT-108386 Electrical Engineering and Electronics 8 CR Becker</td>
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<tr>
<td>T-ETIT-109820 Electrical Engineering and Electronics 8 CR Becker</td>
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<tr>
<td>T-ETIT-104644 Energy Storage and Network Integration 4 CR Noe</td>
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<tr>
<td>T-ETIT-100784 Hybrid and Electric Vehicles 4 CR Becker</td>
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<td>T-ETIT-100694 Methods of Signal Processing 6 CR Heizmann</td>
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<td>T-ETIT-101939 Photovoltaics 6 CR Powalla</td>
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<td>T-ETIT-100716 Industrial Circuitry 3 CR Becker</td>
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<td>T-ETIT-101911 Sensors 3 CR Menesklou</td>
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<td>T-ETIT-109313 Signals and Systems 6 CR Heizmann</td>
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<tr>
<td>T-ETIT-100774 Solar Energy 6 CR Richards</td>
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<td>T-ETIT-106970 Superconducting Materials for Energy Applications 4 CR Grilli</td>
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<tr>
<td>T-ETIT-101921 System Dynamics and Control Engineering 6 CR Hohmann</td>
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<tr>
<td>T-ETIT-100677 Systems Engineering for Automotive Electronics 4 CR Bortolazzi</td>
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<tr>
<td>T-ETIT-101952 Theory of Probability 5 CR Jäkel</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>
<thead>
<tr>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
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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)**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
<th>Instructor</th>
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<tbody>
<tr>
<td>T-INFO-101466</td>
<td>Information Processing in Sensor Networks</td>
<td>6 CR</td>
<td>Hanebeck</td>
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<tr>
<td>T-INFO-101356</td>
<td>Cognitive Systems</td>
<td>6 CR</td>
<td>Neumann, Waibel</td>
</tr>
<tr>
<td>T-INFO-101377</td>
<td>Localization of Mobile Agents</td>
<td>6 CR</td>
<td>Hanebeck</td>
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<tr>
<td>T-INFO-101294</td>
<td>Mechano-Informatics and Robotics</td>
<td>4 CR</td>
<td>Asfour</td>
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<tr>
<td>T-INFO-101266</td>
<td>Human-Machine-Interaction</td>
<td>6 CR</td>
<td>Beigl</td>
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<tr>
<td>T-INFO-101310</td>
<td>Patent Law</td>
<td>3 CR</td>
<td>Hössle, Koch</td>
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<tr>
<td>T-INFO-101357</td>
<td>Medical Robotics</td>
<td>3 CR</td>
<td>Kröger, Mathis-Ullrich</td>
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<tr>
<td>T-INFO-108014</td>
<td>Robotics I - Introduction to Robotics</td>
<td>6 CR</td>
<td>Asfour</td>
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<tr>
<td>T-INFO-105723</td>
<td>Robotics II: Humanoid Robotics</td>
<td>3 CR</td>
<td>Asfour</td>
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<tr>
<td>T-INFO-109931</td>
<td>Robotics III - Sensors and Perception in Robotics</td>
<td>3 CR</td>
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</table>

**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 Heilmaier
Prof. Dr.-Ing. Carsten Proppe

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

<table>
<thead>
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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.

<table>
<thead>
<tr>
<th>Election block: Exchange Students_MATH (between 0 and 90 credits)</th>
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<tbody>
<tr>
<td>T-MATH-102242 Numerical Mathematics for Students of Computer Science</td>
</tr>
<tr>
<td>T-MATH-109620 Probability Theory and Statistics</td>
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</table>

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>
<thead>
<tr>
<th>Credits</th>
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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 ()

<table>
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<tbody>
<tr>
<td>T-MACH-105308</td>
<td>Atomistic Simulations and Molecular Dynamics</td>
<td>4 CR</td>
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<td>Gumbsch, Schneider, Weygand</td>
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<tr>
<td>T-MACH-105407</td>
<td>CFD for Power Engineering</td>
<td>4 CR</td>
<td></td>
<td>Otic</td>
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<tr>
<td>T-MACH-109302</td>
<td>Computational Homogenization on Digital Image Data</td>
<td>6 CR</td>
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<td>Schneider</td>
</tr>
<tr>
<td>T-MACH-106698</td>
<td>A holistic approach to power plant management</td>
<td>4 CR</td>
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<td>Seidl, Stieglitz</td>
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<tr>
<td>T-MACH-108407</td>
<td>NMR micro probe hardware conception and construction</td>
<td>4 CR</td>
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<td>Korvink</td>
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<tr>
<td>T-MACH-110431</td>
<td>Digital microstructure characterization and modeling</td>
<td>6 CR</td>
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<tr>
<td>T-MACH-105444</td>
<td>Combined Cycle Power Plants</td>
<td>4 CR</td>
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<td>Schulenberg</td>
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<tr>
<td>T-MACH-105182</td>
<td>Introduction to Microsystem Technology I</td>
<td>4 CR</td>
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<td>Badilita, Jouda, Korvink</td>
</tr>
<tr>
<td>T-MACH-105183</td>
<td>Introduction to Microsystem Technology II</td>
<td>4 CR</td>
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<td>Jouda, Korvink</td>
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<tr>
<td>T-MACH-105530</td>
<td>Fundamentals of reactor safety for the operation and dismantling of nuclear power plants</td>
<td>4 CR</td>
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<td>Sanchez-Espinoza</td>
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<tr>
<td>T-MACH-105162</td>
<td>Fundamentals of Automobile Development I</td>
<td>2 CR</td>
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<tr>
<td>T-MACH-105163</td>
<td>Fundamentals of Automobile Development II</td>
<td>2 CR</td>
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<tr>
<td>T-MACH-105459</td>
<td>High Temperature Materials</td>
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<td>T-MACH-109185</td>
<td>Innovative Project</td>
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<td>Class, Terzidis</td>
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<td>T-MACH-105466</td>
<td>Introduction to Neutron Cross Section Theory and Nuclear Data Generation</td>
<td>4 CR</td>
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<td>T-MACH-105402</td>
<td>Nuclear Power Plant Technology</td>
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<td>Coal Fired Power Plants</td>
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<tr>
<td>T-MACH-105224</td>
<td>Machine Dynamics II</td>
<td>4 CR</td>
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<td>T-MACH-105223</td>
<td>Machine Vision</td>
<td>8 CR</td>
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<tr>
<td>T-MACH-105189</td>
<td>Mathematical Models and Methods for Production Systems</td>
<td>6 CR</td>
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<tr>
<td>T-MACH-105782</td>
<td>Micro Magnetic Resonance</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>Microsystems Simulation</td>
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<td>T-MACH-111026</td>
<td>Nonlinear Continuum Mechanics</td>
<td>3 CR</td>
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<tr>
<td>T-MACH-102191</td>
<td>Polymers in MEMS B: Physics, Microstructuring and Applications</td>
<td>4 CR</td>
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<td>Worgull</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>Rapp, Worgull</td>
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<td>Reliability Engineering 1</td>
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<td>T-MACH-105445</td>
<td>Simulator Exercises Combined Cycle Power Plants</td>
<td>2 CR</td>
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<td>Schulenberg</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>
<td>6 CR</td>
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<tr>
<td>T-MACH-105364</td>
<td>Thermal Turbomachines II</td>
<td>6 CR</td>
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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, Kirchlechner, Weygand</td>
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<td>Tutorial Nonlinear Continuum Mechanics</td>
<td>1 CR</td>
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<td>T-MACH-102206</td>
<td>Vehicle Ride Comfort &amp; Acoustics I</td>
<td>3 CR</td>
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<tr>
<td>T-MACH-102205</td>
<td>Vehicle Ride Comfort &amp; Acoustics II</td>
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<td>T-MACH-102123</td>
<td>Virtual Engineering I</td>
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<td>T-MACH-102124</td>
<td>Virtual Engineering II</td>
<td>4 CR</td>
<td>Ovtcharova</td>
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<tr>
<td>T-MACH-105529</td>
<td>Heat Transfer in Nuclear Reactors</td>
<td>4 CR</td>
<td>Cheng</td>
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**Election block: Elective Area B ()**

<table>
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<th>Course Title</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>T-MACH-102141</td>
<td>Constitution and Properties of Wear-resistant Materials</td>
<td>4 CR</td>
<td>Ulrich</td>
</tr>
<tr>
<td>T-MACH-105451</td>
<td>Drive Systems and Possibilities to Increase Efficiency</td>
<td>2 CR</td>
<td>Kollmeier</td>
</tr>
<tr>
<td>T-MACH-105530</td>
<td>Fundamentals of reactor safety for the operation and dismantling of nuclear power plants</td>
<td>4 CR</td>
<td>Sanchez-Espinoza</td>
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<tr>
<td>T-MACH-105786</td>
<td>Contact Mechanics</td>
<td>4 CR</td>
<td>Greiner</td>
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<tr>
<td>T-MACH-106700</td>
<td>Do it! – Service-Learning for prospective mechanical engineers</td>
<td>2 CR</td>
<td>Deml</td>
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<tr>
<td>T-MACH-105537</td>
<td>Principles of Medicine for Engineers</td>
<td>4 CR</td>
<td>Pylatiuk</td>
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<tr>
<td>T-MACH-106493</td>
<td>Solar Thermal Energy Systems</td>
<td>4 CR</td>
<td>Dagan</td>
</tr>
<tr>
<td>T-MACH-105574</td>
<td>Mechatronical Systems and Products</td>
<td>3 CR</td>
<td>Hohmann, Matthiesen</td>
</tr>
<tr>
<td>T-MACH-106707</td>
<td>Workshop on Computer-based Flow Measurement Techniques</td>
<td>4 CR</td>
<td>Bauer</td>
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<tr>
<td>T-MACH-105652</td>
<td>Fundamentals of Combustion Engine Technology</td>
<td>5 CR</td>
<td>Bernhardt, Kubach, Pfeil, Toedter, Wagner</td>
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</tbody>
</table>

**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

**Workload**

Up to 30 CP per semester, depending on the selected brick courses.

**Learning type**

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

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

Part of: KIT-Department of Mechanical Engineering Courses

Credits: 90
Grading scale: Grade to a tenth
Recurrence: Each term
Duration: 2 terms
Language: German/English
Level: 4
Version: 4

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 ()

<table>
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<th>Course Name</th>
<th>Credits</th>
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<tbody>
<tr>
<td>T-MACH-105173</td>
<td>Analysis of Exhaust Gas and Lubricating Oil in Combustion Engines</td>
<td>4 CR</td>
<td>Gohl</td>
</tr>
<tr>
<td>T-MACH-105655</td>
<td>Alternative Powertrain for Automobiles</td>
<td>4 CR</td>
<td>Noreikat</td>
</tr>
<tr>
<td>T-MACH-105307</td>
<td>Drive Train of Mobile Machines</td>
<td>4 CR</td>
<td>Geimer, Wydra</td>
</tr>
<tr>
<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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<tr>
<td>T-MACH-108887</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 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

**Learning type**

Lectures, Tutorials
# 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

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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-105326 Hydraulic Fluid Machinery</td>
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<td>T-MACH-105331 Laboratory Exercise in Energy Technology</td>
<td>4 CR Bauer, Maas, Wirbser</td>
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<td>T-MACH-110838 Numerical Fluid Mechanics with PYTHON</td>
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<td>T-MACH-105405 Reactor Safety I: Fundamentals</td>
<td>4 CR Sanchez-Espinoza</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

Credits: 60
Grading scale: Grade to a tenth
Recurrence: Each term
Duration: 2 terms
Language: German/English
Level: 4
Version: 3

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

Election block: Exchange Students_Fundamentals of Engineering ()

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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

Learning type
Lectures, Tutorials
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

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-105392 FEM Workshop - Constitutive Laws</td>
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## Module: Major Field Materials and Structures for High Performance Systems

**[M-MACH-104854]**

### Module Offers in Mechanical Engineering for Temporary Students

1. **Date:** 15/09/2021
2. **Valid from Winter Term 2021/2022**

### Course Overview

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<td>Binder, Liebig</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 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

### Credits
90

### Grading scale
Grade to a tenth

### Recurrence
Each term

### Duration
2 terms

### Language
German/English

### Level
4

### Version
3

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

### Election block: Exchange Students_Mechatronics and Microsystem Technology ()

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<td>T-MACH-105238</td>
<td>Actuators and Sensors in Nanotechnology</td>
<td>4 CR</td>
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<td>T-MACH-100966</td>
<td>BioMEMS - Microsystems Technologies for Life-Sciences and Medicine I</td>
<td>4 CR</td>
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<td>T-MACH-100967</td>
<td>BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II</td>
<td>4 CR</td>
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<td>T-MACH-100968</td>
<td>BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III</td>
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<td>T-MACH-102172</td>
<td>Bionics for Engineers and Natural Scientists</td>
<td>4 CR</td>
<td>Hölscher</td>
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<td>T-MACH-102169</td>
<td>Chemical, Physical and Material Scientific Aspects of Polymers in Microsystem Technologies</td>
<td>3 CR</td>
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<td>T-MACH-105314</td>
<td>Computational Intelligence</td>
<td>4 CR</td>
<td>Mikut, Reinartz, Reischl</td>
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<td>Digital Control</td>
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<td>T-MACH-100535</td>
<td>Introduction into Mechatronics</td>
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<td>Böhland, Reischl</td>
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<td>T-MACH-105228</td>
<td>Organ Support Systems</td>
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<td>T-MACH-102166</td>
<td>Fabrication Processes in Microsystem Technology</td>
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<td>Cognitive Automobiles - Laboratory</td>
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<td>Measurement II</td>
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<td>T-MACH-102192</td>
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<td>Polymers in MEMS B: Physics, Microstructuring and Applications</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-102164</td>
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<td>T-MACH-105555</td>
<td>System Integration in Micro- and Nanotechnology</td>
<td>4 CR</td>
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<td>T-MACH-110272</td>
<td>System Integration in Micro- and Nanotechnology 2</td>
<td>4 CR</td>
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<td>T-MACH-102149</td>
<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

<table>
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<td>2 terms</td>
<td>German/English</td>
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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_Product Development and Construction ()**

| T-MACH-106744 | Agile Product Innovation Management - Value-driven Planning of New Products | 4 CR | Kläger |
| T-MACH-105215 | Applied Tribology in Industrial Product Development | 4 CR | Albers, Lorentz, Matthiesen |
| T-MACH-102185 | CATIA CAD Training Course  
This item will not influence the grade calculation of this parent. | 2 CR | Ovtcharova |
| T-MACH-105216 | Powertrain Systems Technology B: Stationary Machinery | 4 CR | Albers, Matthiesen, Ott |
| T-MACH-102187 | CAD-NX Training Course  
This item will not influence the grade calculation of this parent. | 2 CR | Ovtcharova |
| T-MACH-105212 | CAE-Workshop | 4 CR | Albers, Matthiesen |
| T-MACH-105312 | CATIA Advanced | 4 CR | Ovtcharova |
| T-MACH-105182 | Introduction to Microsystem Technology I | 4 CR | Badilita, Jouda, Korvink |
| T-MACH-105183 | Introduction to Microsystem Technology II | 4 CR | Jouda, Korvink |
| T-MACH-106743 | IoT Platform for Engineering | 4 CR | Ovtcharova |
| T-MACH-105330 | Design with Plastics | 4 CR | Liedel |
| T-MACH-105221 | Lightweight Engineering Design | 4 CR | Albers, Burkardt |
| T-MACH-105231 | Leadership and Management Development | 4 CR | Albers, Matthiesen, Ploch |
| T-MACH-105442 | Intellectual Property Rights and Strategies in Industrial Companies | 4 CR | Albers, Matthiesen, Zacharias |
| T-MACH-105440 | Leadership and Conflict Management | 4 CR | Hatzl |
| T-MACH-105347 | Project Management in Global Product Engineering Structures | 4 CR | Albers, Gutzmer, Matthiesen |
| T-MACH-105696 | Strategic Product Development - Identification of Potentials of Innovative Products | 3 CR | Albers, Matthiesen, Siebe |
| T-MACH-105358 | Sustainable Product Engineering | 4 CR | Albers, Matthiesen, Ziegahn |
| T-MACH-105361 | Technical Design in Product Development | 4 CR | Albers, Matthiesen, Schmid |
| T-MACH-102123 | Virtual Engineering I | 4 CR | Ovtcharova |
| T-MACH-102124 | Virtual Engineering II | 4 CR | Ovtcharova |

**Competence Certificate**  
Oral exams: duration approx. 5 min per credit point  
Written exams: duration approx. 20 - 25 min per credit point  
Amount, type and scope of the success control can vary according to the individually choice.
Competence Goal
Major Field Product Development and Construction serves as a comprehensive, in-depth analysis in selected areas of mechanical engineering.

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

Content
See individual bricks
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

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<td>Each term</td>
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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_Production Technology ()**

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<td>Human Factors Engineering II</td>
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<td>T-MACH-105830</td>
<td>Human Factors Engineering III: Empirical research methods</td>
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<td>T-MACH-108844</td>
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<td>Manufacturing Technology</td>
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<td>4 CR</td>
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<td>Basics of Technical Logistics I</td>
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<td>T-MACH-105386</td>
<td>Occupational Safety and Environmental Protection</td>
<td>4 CR</td>
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<td>Information Systems and Supply Chain Management</td>
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<td>T-MACH-105346</td>
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<td>8 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**
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
## 2.15 Module: Major Field Theoretical Foundations of Mechanical Engineering [M-MACH-104853]

### Responsible:
Prof. Dr.-Ing. Thomas Böhlke

### Organisation:
KIT Department of Mechanical Engineering

### Credits
90

### Grading scale
Grade to a tenth

### Recurrence
Each term

### Duration
2 terms

### Language
German/English

### Level
4

### Version
3

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

### Election block: Exchange Students_Theoretical Foundations of Mechanical Engineering ()

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<td>Introduction into the Multi-Body Dynamics</td>
<td>5 CR</td>
<td>Seemann</td>
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<tr>
<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>Fluid-Structure-Interaction</td>
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<td>T-MACH-105290</td>
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<td>Wave Propagation</td>
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<td>Seemann</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

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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_Bricks in English_Elective ()**

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<td>T-MACH-105381</td>
<td>Virtual Engineering (Specific Topics)</td>
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<td>T-MACH-105407</td>
<td>CFD for Power Engineering</td>
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<td>A holistic approach to power plant management</td>
<td>4 CR</td>
<td>Seidl, Stieglitz</td>
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<td>T-MACH-105154</td>
<td>Vehicle Comfort and Acoustics I</td>
<td>4 CR</td>
<td>Gauterin</td>
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<tr>
<td>T-MACH-105155</td>
<td>Vehicle Comfort and Acoustics II</td>
<td>4 CR</td>
<td>Gauterin</td>
</tr>
<tr>
<td>T-MACH-105444</td>
<td>Combined Cycle Power Plants</td>
<td>4 CR</td>
<td>Schulenberg</td>
</tr>
<tr>
<td>T-MACH-105220</td>
<td>Fundamentals of Energy Technology</td>
<td>8 CR</td>
<td>Badea, Cheng</td>
</tr>
<tr>
<td>T-MACH-100092</td>
<td>Automotive Engineering I</td>
<td>8 CR</td>
<td>Gauterin, Unrau</td>
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<tr>
<td>T-MACH-102117</td>
<td>Automotive Engineering II</td>
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<td>T-MACH-105379</td>
<td>Global Logistics</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>T-MACH-105162</td>
<td>Fundamentals of Automobile Development I</td>
<td>2 CR</td>
<td>Frech</td>
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<tr>
<td>T-MACH-105163</td>
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<td>Introduction to Neutron Cross Section Theory and Nuclear Data Generation</td>
<td>4 CR</td>
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<td>T-MACH-105402</td>
<td>Nuclear Power Plant Technology</td>
<td>4 CR</td>
<td>Badea, Cheng, Schulenberg</td>
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<td>T-MACH-105223</td>
<td>Machine Vision</td>
<td>8 CR</td>
<td>Lauer, Stiller</td>
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<td>Magnet Technology of Fusion Reactors</td>
<td>4 CR</td>
<td>Fietz, Weiss</td>
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<td>T-MACH-105424</td>
<td>Machine Dynamics II</td>
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<td>Proppe</td>
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<td>Mathematical Models and Methods for Production Systems</td>
<td>6 CR</td>
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<td>T-MACH-105557</td>
<td>Microenergy Technologies</td>
<td>4 CR</td>
<td>Kohl</td>
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<td>T-MACH-105782</td>
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<td>4 CR</td>
<td>Korvink, MacKinnon</td>
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<td>Nonlinear Continuum Mechanics</td>
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<td>Simulator Exercises Combined Cycle Power Plants</td>
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<td>T-MACH-105456</td>
<td>Ten Lectures on Turbulence</td>
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<td>Thermal Turbomachines I</td>
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Module Offers in Mechanical Engineering for Temporary Students, Date: 15/09/2021 Valid from Winter Term 2021/2022
<table>
<thead>
<tr>
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<th>Course Title</th>
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<th>Instructor(s)</th>
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<td>Thermal Turbomachines II</td>
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<td>T-MACH-105554</td>
<td>Thin Film and Small-scale Mechanical Behavior</td>
<td>4</td>
<td>Gruber, Kirchlechner, Weygand</td>
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<td>Tutorial Nonlinear Continuum Mechanics</td>
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<td>T-MACH-102123</td>
<td>Virtual Engineering I</td>
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<td>T-MACH-102124</td>
<td>Virtual Engineering II</td>
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<td>T-MACH-105529</td>
<td>Heat Transfer in Nuclear Reactors</td>
<td>4</td>
<td>Cheng</td>
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</table>

**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**

On the basis of general principles, the students have acquired specialized knowledge in selected areas of mechanical engineering.

**Prerequisites**

None

**Content**

See individual bricks

**Annotation**

The courses in this module are offered in English.

**Workload**

Up to 30 CP per semester, depending on the selectedbrick courses.
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

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

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<tr>
<th>Term</th>
<th>Event Code</th>
<th>Event Name</th>
<th>SWS</th>
<th>Type</th>
<th>Lecturer</th>
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<tbody>
<tr>
<td>WT 21/22</td>
<td>2189404</td>
<td>A holistic approach to power plant management</td>
<td>2</td>
<td>Lecture / Online</td>
<td>Seidl</td>
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**Exams**

<table>
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<th>Term</th>
<th>Event Code</th>
<th>Event Name</th>
<th>Type</th>
<th>Lecturer</th>
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<tbody>
<tr>
<td>WT 21/22</td>
<td>76-T-MACH-106698</td>
<td>A holistic approach to power plant management</td>
<td>Online</td>
<td>Seidl</td>
</tr>
</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:

**A holistic approach to power plant management**

2189404, WS 21/22, 2 SWS, Language: English, Open in study portal

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled
Content

Main Contents:
- The structure of electricity markets
- Requirements from network operators
- The basics of commodity markets
- The impact of regulation on power plant operation
- The role of behavioral economics in power plant decision making
- Integration of renewable energy sources into the electricity market
- Calibration of power plant operation and maintenance to market requirements
- Asset management for power plant fleets
- Applying financial engineering to optimize asset utilization
- Day-to-day decision making for power plant operation

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

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

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

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

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

Oral exam of about 25 min.

Literature

G. Balzer, C. Schorn, Asset Management für Infrastrukturflanlagen - Energie und Wasser, VDI
R. Weron, Modeling and Forecasting Electricity Loads and Prices: A Statistical Approach, Wiley
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

<table>
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**Events**

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<tr>
<th>WT 21/22</th>
<th>2141866</th>
<th>Actuators and sensors in nanotechnology</th>
<th>2 SWS</th>
<th>Lecture / ⬇</th>
<th>Kohl, Sommer</th>
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**Exams**

<table>
<thead>
<tr>
<th>ST 2021</th>
<th>76-T-MACH-105238</th>
<th>Actuators and Sensors in Nanotechnology</th>
<th>Kohl, Sommer</th>
</tr>
</thead>
</table>

Legend: 🖥 Online, ⬇ Blended (On-Site/Online), 🗷 On-Site, ✗ Cancelled

**Competence Certificate**

oral exam

**Prerequisites**

none

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

**Actuators and sensors in nanotechnology**

2141866, WS 21/22, 2 SWS, Language: German, Open in study portal

Lecture (V) Blended (On-Site/Online)
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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<td>4</td>
<td>Grade to a third</td>
<td>Each summer term</td>
<td>2</td>
</tr>
</tbody>
</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)
3.4 Course: Agile Product Innovation Management - Value-driven Planning of New Products [T-MACH-106744]

**Responsible:** Hon.-Prof. Dr. Roland Kläger

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
<thead>
<tr>
<th>Type</th>
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<tr>
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<td>Grade to a third</td>
<td>Each summer term</td>
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</table>

**Events**

| ST 2021 | 2122300 | Agile product innovation management - value-driven planning of new products | Lecture / Practice (VÜ) / Kläger |

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ☑ Cancelled

**Competence Certificate**

Oral examination, 20 min.

**Prerequisites**

None

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

**Agile product innovation management - value-driven planning of new products**

2122300, SS 2021, SWS, Language: German, Open in study portal

**Content**

Students are able to:

- replicate the essential correlations, procedures and structure elements for the product / innovation planning and to use it as a guideline for the planning of new products
- describe agile innovation processes and the essential prerequisites
- demonstrate the added value of a product in consideration of a system-oriented approach. In addition, they are able to interpret unique selling points (USP)
- deduce the correlation between the added value of superior products and the creativity/innovation
- to apply methods and tools for digital product planning on specific use cases
- explain elements and methods of computer-based ideas management and requirements modeling
- describe the support of the product planning process by RP systems accompanying the development process and select 3D printing processes suitable for specific applications

**Literature**

Vorlesungsfolien / Lecture slides
Course: Alternative Powertrain for Automobiles [T-MACH-105655]

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

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

Type: Written examination
Credits: 4
Grading scale: Grade to a third
Recurrence: Each winter term
Version: 1

Events
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<td>4</td>
<td>Grade to a third</td>
<td>Each winter term</td>
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</table>

Competence Certificate
written exam

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

Sustainable Vehicle Drivetrains
2133132, WS 21/22, 2 SWS, Open in study portal
Lecture (V)
Blended (On-Site/Online)

Content
History
Infrastructure
Market Situation
Legislation
Alternative Fuels
Innovative Drivetrains
Hybrids
Plug-In Hybrids
BEV
Fuel Cells
### 3.6 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

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

| ST 2021 | 2134150 | Analysis of Exhaust Gas und Lubricating Oil in Combustion Engines | 2 SWS | Lecture / 📦 | Gohl |

#### Exams

| ST 2021 | 76--T-Mach-105173 | Analysis of Exhaust Gas and Lubricating Oil in Combustion Engines | Gohl |

**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗽 On-Site, ✗ Cancelled

**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 2021, 2 SWS, Language: German, Open in study portal

**Literature**  
Die Vorlesungsunterlagen werden vor jeder Veranstaltung an die Studenten verteilt.
### 3.7 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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<td>Grade to a third</td>
<td>Each summer term</td>
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</table>

**Events**

| ST 2021 | 2134134 | Analysis tools for combustion diagnostics | 2 SWS | Lecture / 🧩 | Pfeil |

**Exams**

| ST 2021 | 76-T-MACH-105167 | Analysis Tools for Combustion Diagnostics | Koch |
| WT 21/22 | 76-T-MACH-105167 | Analysis Tools for Combustion Diagnostics | Koch |

### 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 2021, 2 SWS, Language: German, Open in study portal

### Literature

Skript, erhältlich in der Vorlesung
3.8 Course: Applied Materials Simulation [T-MACH-105527]

**Responsible:** Prof. Dr. Peter Gumbsch
Dr.-Ing. Johannes Schneider

**Organisation:** KIT Department of Mechanical Engineering

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

**Type**
Oral examination

**Credits**
4

**Grading scale**
Grade to a third

**Recurrence**
Each summer term

**Version**
3

**Events**

<table>
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**Exams**

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</table>

**Events**

ST 2021 2182614 Applied Materials Simulation 4 SWS Lecture / Practice (VÜ) Gumbsch, Schulz

**Exams**

ST 2021 76-T-MACH-105527 Applied Materials Modelling Gumbsch, Schulz

**Legend:** Online, Blended (On-Site/Online), On-Site, Cancelled

**Competence Certificate**
oral exam ca. 30 minutes
no tools or reference materials

**Prerequisites**
The successful participation in Übungen zu Angewandte Werkstoffsimulation is the condition for the admittance to the oral exam in Angewandte Werkstoffsimulation.

T-MACH-110928 – Exercises for Applied Materials Simulation has not been started.

T-MACH-110929 – Applied Materials Modelling has not been started.

**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 Simulation**
2182614, SS 2021, 4 SWS, Language: German, Open in study portal

**Lecture / Practice (VÜ)**
Online

**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
Organizational issues
Die Vorlesung wir nur als Aufzeichnung angeboten!
Bitte besuchen Sie die englischsprachige Veranstaltung "Applied Materials Simulation" (21 82 616)!
Weitere Informationen finden Sie in ILIAS.
Kontakt: johannes.schneider@kit.edu

Literature
3.9 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

**Events**

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<td>2</td>
<td>Lecture / 🗣️</td>
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**Exams**

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<td>Applied Tribology in Industrial Product Development</td>
<td>2</td>
<td>Lecture / Lorentz</td>
<td>4</td>
<td>Grade to a third</td>
<td>Each winter term</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:

**Content**

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

The students are able to

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

Further content:

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

Regular attendance: 21 h  
Self-study: 99 h  
Exam: oral exam

**Literature**

Vorlesungsfolien werden im Ilias veröffentlicht.  
The lecture script will be allocated at Ilias.
3.10 Course: Atomistic Simulations and Molecular Dynamics [T-MACH-105308]

**Responsible:** Prof. Dr. Peter Gumbsch  
Dr.-Ing. Johannes Schneider  
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

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

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<tr>
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<td>Atomistic simulations and molecular dynamics</td>
<td>Lecture / Practice (VÜ)</td>
<td>3 SWS</td>
<td>Grade to a third</td>
<td>Each summer term</td>
<td>Weygand, Gumbsch</td>
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**Exams**

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<td>Atomistic Simulations and Molecular Dynamics</td>
<td>Lecture / Practice (VÜ)</td>
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<td></td>
<td>Weygand, Gumbsch</td>
</tr>
</tbody>
</table>

**Legend:**
- 🖥 Online
- 🧩 Blended (On-Site/Online)
- 🗣 On-Site
- ❌ Cancelled

**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**

<table>
<thead>
<tr>
<th>Event Code</th>
<th>Code</th>
<th>Title</th>
<th>Type</th>
<th>Credits</th>
<th>Grade scale</th>
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<tr>
<td>2181740</td>
<td>SS 2021</td>
<td>Atomistic simulations and molecular dynamics</td>
<td>Lecture / Practice (VÜ)</td>
<td>3 SWS</td>
<td>Grade to a third</td>
<td></td>
<td>Weygand, Gumbsch</td>
</tr>
</tbody>
</table>

Open in study portal
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 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

Organizational issues
Die Vorlesung wird auf Englisch angeboten!


Kontakt: daniel.weygand@kit.edu

Admission to the course is possible until 15.4.2021 (first lecture) without password. The course is offered asynchronously. The lecture slides and an audio review of the most important elements of the lecture will be made accessible via ILIAS.

Literature

3.11 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

<table>
<thead>
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<td>Grade to a third</td>
<td>Each summer term</td>
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</table>

**Events**

| ST 2021  | 2150904 | Automated Manufacturing Systems | 6 SWS | Lecture / Practice ( / Fleischer |

**Exams**

| ST 2021  | 76-T-MACH-108844 | Automated Manufacturing Systems | Fleischer |

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

**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 2021, 6 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ) Online
Content
The lecture provides an overview of the structure and functioning of automated manufacturing systems. In the introduction chapter the basic elements for the realization of automated manufacturing systems are given. This includes:

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

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

Learning Outcomes:
The students ...

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

Workload:
MACH:
regular attendance: 63 hours
self-study: 177 hours

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

Organizational issues
Vorlesungstermine dienstags 8.00 Uhr und donnerstags 8.00 Uhr, Übungstermine donnerstags 9.45 Uhr.
Bekanntgabe der konkreten Übungstermine erfolgt in der ersten Vorlesung.

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/).
### 3.12 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

<table>
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<td>2113805</td>
<td>Automotive Engineering I</td>
<td>4 SWS</td>
<td>Lecture</td>
<td>Gauterin, Unrau</td>
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<tr>
<td>WT 21/22</td>
<td>2113809</td>
<td>Automotive Engineering I</td>
<td>4 SWS</td>
<td>Lecture</td>
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**Exams**

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<td>76-T-MACH-100092</td>
<td>Automotive Engineering</td>
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<td>Unrau, Gauterin</td>
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</table>

**Legend:**  
🖥 Online,  
🧩 Blended (On-Site/Online),  
🗣 On-Site,  
🗙 Cancelled

**Competence Certificate**

Written examination  

Duration: 120 minutes  

Auxiliary means: none

**Prerequisites**

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

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

**Automotive Engineering I**  
2113805, WS 21/22, 4 SWS, Language: German, Open in study portal  

**Lecture (V) On-Site**

**Content**

1. History and future of the automobile  
2. Driving mechanics: driving resistances and driving performance, mechanics of longitudinal and lateral forces, active and passive safety  
3. Drive systems: combustion engine, hybrid and electric drive systems  
4. Transmission: clutches (e.g. friction clutch, visco clutch), transmission (e.g. mechanical transmission, hydraulic fluid transmission)  
5. Power transmission and distribution: drive shafts, cardon joints, differentials

**Learning Objectives:**

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

**Organizational issues**

Kann nicht mit der Veranstaltung [2113809] kombiniert werden.  
Can not be combined with lecture [2113809].
Literature

Automotive Engineering I
2113809, WS 21/22, 4 SWS, Language: English, Open in study portal

Content
1. History and future of the automobile
2. Driving mechanics: driving resistances and driving performances, mechanics of longitudinal and lateral forces, active and passive safety
3. Drive systems: combustion engine, hybrid and electric drive systems
4. Transmission: clutches (e.g. friction clutch, visco clutch), transmission (e.g. mechanical transmission, hydraulic fluid transmission)
5. Power transmission and distribution: drive shafts, cardan joints, differentials

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

Organizational issues
Kann nicht mit LV Grundlagen der Fahrzeugtechnik I [2113805] kombiniert werden.
Can not be combined with lecture [2113805] Grundlagen der Fahrzeugtechnik I.

Literature
**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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Legend: 🖥️ Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**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 2021, 2 SWS, Language: German, Open in study portal

Lecture (V)  
Online

**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.

**Organizational issues**

Kann nicht mit der Veranstaltung [2114855] kombiniert werden.  
Can not be combined with lecture [2114855]
Literature

Automotive Engineering II
2114855, SS 2021, 2 SWS, Language: English, 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 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:
**3.14 Course: Automotive Vision [T-MACH-105218]**

- **Responsible:** Dr. Martin Lauer
  Prof. Dr.-Ing. Christoph Stiller
- **Organisation:** KIT Department of Mechanical Engineering
- **Part of:** M-MACH-104849 - Major Field Automotive Engineering

- **Type:** Written examination
- **Credits:** 6
- **Grading scale:** Grade to a third
- **Recurrence:** Each summer term
- **Version:** 2

**Events**

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<td>2138340</td>
<td>Automotive Vision</td>
<td>3 SWS</td>
<td>Lecture / Online</td>
<td>Grade to a third</td>
<td>Each summer term</td>
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**Exams**

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<td>Lecture / Online</td>
<td>Grade to a third</td>
<td>Each summer term</td>
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</tbody>
</table>

**Competence Certificate**

Type of Examination: written exam
Duration of Examination: 60 minutes

**Prerequisites**

none

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

**Automotive Vision**

2138340, SS 2021, 3 SWS, Language: English, Open in study portal

**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 bekanntgegeben.
3.15 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

### Summary
- **Type:** Written examination
- **Credits:** 7
- **Grading scale:** Grade to a third
- **Recurrence:** Each winter term
- **Version:** 3

### Events

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<th>Type</th>
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<td>WT 21/22 2137301</td>
<td>Measurement and Control Systems</td>
<td>3</td>
<td>Lecture/On-Site</td>
<td>Stiller</td>
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<tr>
<td>WT 21/22 2137302</td>
<td>Measurement and Control Systems (Tutorial)</td>
<td>1</td>
<td>Practice/On-Site</td>
<td>Stiller, Fischer, Le Large</td>
</tr>
<tr>
<td>WT 21/22 3137020</td>
<td>Measurement and Control Systems</td>
<td>3</td>
<td>Lecture/On-Site</td>
<td>Stiller</td>
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<td>WT 21/22 3137021</td>
<td>Measurement and Control Systems (Tutorial)</td>
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<td>Stiller, Le Large, Fischer</td>
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### Exams

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<tr>
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<tr>
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<td>Basis of Measurement and Control Systems</td>
<td>On-Site</td>
<td>Stiller</td>
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</tbody>
</table>

### Competence Certificate
- **written exam**
- 2.5 hours

### Prerequisites
- none

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

- **Measurement and Control Systems**
  - Code: 2137301, WS 21/22, 3 SWS, Language: German, Open in study portal
  - Lecture (V) On-Site
**Content**

**Lehrinhalt (EN):**

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

**Lernziele (EN):**

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

**Voraussetzungen (EN)**

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

**Nachweis (EN)**

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

**Arbeitsaufwand (EN):**

210 hours

**Organizational issues**

Mittwochs: die ersten vier Vorlesungen online (20.10., 27.10., 10.11., 24.11.), Präsenz 08.12., 12.01., 26.01.

**Literature**

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

- Measurement and Control Systems:
  
  
  
  R. Dorf and R. Bishop: Modern Control Systems, Addison-Wesley
  

- Regelungstechnische Bücher:
  
  J. Lunze: Regelungstechnik 1 & 2, Springer-Verlag
  
  R. Unbehauen: Regelungstechnik 1 & 2, Vieweg-Verlag
  
  O. Föllinger: Regelungstechnik, Hüthig-Verlag
  
  W. Leonhard: Einführung in die Regelungstechnik, Teubner-Verlag
  

- Messtechnische Bücher:
  
  
  
  
  W. Pfeiffer: Elektrische Messtechnik, VDE Verlag Berlin 1999
  
  Kronmüller, H.: Prinzipien der Prozeßmeßtechnik 2, Schnäcker-Verlag, Karlsruhe, 1. Aufl., 1980
Content
Lehrinhalt (EN):
1 Dynamic systems
2 Properties of important systems and modeling
3 Transfer characteristics and stability
4 Controller design
5 Fundamentals of measurement
6 Estimation
7 Sensors
8 Introduction to digital measurement

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

Nachweis (EN): written exam; duration 2.5 h; paper reference materials only (no calculator)
Arbeitsaufwand (EN): 180 hours

Organizational issues
Dienstags finden die ersten vier Vorlesungen (19.10., 26.10., 09.11., 23.11.) online, danach in Präsenz statt (07.12., 11.01., 25.01.).

Literature

- Measurement and Control Systems:
  R. Dorf and R. Bishop: Modern Control Systems, Addison-Wesley

- Regelungstechnische Bücher:
  J. Lunze: Regelungstechnik 1 & 2, Springer-Verlag
  R. Unbehauen: Regelungstechnik 1 & 2, Vieweg-Verlag
  O. Föllinger: Regelungstechnik, Hüthig-Verlag
  W. Leonhard: Einführung in die Regelungstechnik, Teubner-Verlag

- Messtechnische Bücher:
  E. Schrüfer: Elektrische Meßtechnik, Hanser-Verlag, München, 5. Aufl., 1992
  W. Pfeiffer: Elektrische Messtechnik, VDE Verlag Berlin 1999
  Kronmüller, H.: Prinzipien der Prozeßmess technik 2, Schnäcker-Verlag, Karlsruhe, 1. Aufl., 1980

Measurement and Control Systems (Tutorial)
3137021, WS 21/22, 1 SWS, Language: English, Open in study portal

Practice (Ü)
On-Site

Content
Tutorial for Event 3137020

Organizational issues
Die ersten zwei Übungen (02.11., 16.11.) finden online statt, danach in Präsenz (30.11., 14.12., 18.01., 01.02., 08.02.).
3.16 Course: Basics of Finite Elements [T-BGU-100047]

**Responsible:** Prof. Dr.-Ing. Peter Betsch  
**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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**Competence Certificate**  
oral exam, appr. 30 min.

**Prerequisites**  
none

**Recommendation**  
none

**Annotation**  
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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**Exams**

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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🔊 On-Site, ❌ Cancelled

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

**Prerequisites**
none

**Recommendation**
Knowledge of the basics of technical mechanics preconditioned.

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

**Basics of Technical Logistics**
2117095, WS 21/22, 3 SWS, Language: German, Open in study portal

**Lecture / Practice (VÜ)**
Blended (On-Site/Online)

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

Students are able to:
- Describe processes and machines of technical logistics,
- Model the fundamental structures and the impacts of material handling machines with mathematical models,
- Refer to industrially used machines
- Model real machines applying knowledge from lessons and calculate their dimensions.
Organizational issues
Die Erfolgskontrolle erfolgt in Form einer schriftlichen oder mündlichen Prüfung (nach §4 (2), 1 bzw. 2SPO).
The assessment consists of a written or oral exam according to Section 4 (2), 1 or 2 of the examination regulation.
Es wird Kenntnis der Grundlagen der Technischen Mechanik vorausgesetzt.
Basics knowledge of technical mechanics is preconditioned.
Ergänzungsblätter, Präsentationen, Tafel.
Supplementary sheets, presentations, blackboard.
Präsenz: 48 Std
Nacharbeit: 132 Std
presence: 48h
rework: 132h

Literature
Empfehlungen in der Vorlesung / Recommendations during lessons
Course: Basics of Technical Logistics II [T-MACH-109920]

**Responsible:** Dr.-Ing. Maximilian Hochstein

**Organisation:** KIT Department of Mechanical Engineering

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

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Legend: 🖥 Online, ☑ Blended (On-Site/Online), ☘ On-Site, ✗ Cancelled

**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:** Maximilian Naumann  
Dr. Moritz Werling  

**Organisation:** KIT Department of Mechanical Engineering  

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

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<td>Behaviour Generation for Vehicles</td>
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**Exams**

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<td>Behaviour Generation for Vehicles</td>
<td>Stiller</td>
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</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:**

#### Behaviour Generation for Vehicles

2138336, WS 21/22, 2 SWS, Language: German, Open in study portal

**Content**

Lernziele (EN):

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

Nachweis: written exam

Arbeitsaufwand: 120 hours

**Organizational issues**


**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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Events

| ST 2021  | 2305264 | Bioelectric Signals | 2 SWS | Lecture / 🖥 | Loewe |

Exams

| ST 2021  | 7305264 | Bioelectric Signals |         |                 | Loewe |

Legend: 🖥 Online, 🌈 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

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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Events

| WT 21/22 | 2305269 | Biomedical Measurement Techniques I | 2 SWS | Lecture | Nahm, Schaufelberger |

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:** apl. 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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<td>2 SWS</td>
<td>Lecture / Blended (On-Site/Online)</td>
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**Exams**

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗓 On-Site, ✗ Cancelled

**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 I**

2141864, WS 21/22, 2 SWS, Language: German, Open in study portal

**Literature**

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

M. Madou  
Fundamentals of Microfabrication  
Taylor & Francis Ltd.; Auflage: 3. Auflage, 2011
3.23 Course: BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II [T-MACH-100967]

Responsible: apl. 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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Events

| ST 2021 | 2142883 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II | 2 SWS | Lecture / Online | Guber |

Exams

| ST 2021 | 76-T-MACH-100967 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine II | 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 II
2142883, SS 2021, 2 SWS, Language: German, Open in study portal

Lecture (V) Online

Content

Examples of use in Life-Sciences and biomedicine: Microfluidic Systems:
LabCD, Protein Cristallisation
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

Organizational issues

Die Vorlesung findet im Sommersemester aufgrund der aktuellen Situation bis auf Weiteres online statt. Zu jedem Vorlesungstermin werden via ILIAS die jeweiligen Folien im PDF-Format zur Verfügung gestellt.

Die Vorlesung wird voraussichtlich mit der Software ZOOM oder MS Teams zu den im Vorlesungsverzeichnis angekündigten Terminen (hier: Montag 11:30 - 13:00 Uhr) durchgeführt werden. Weitere Informationen werden sobald wie möglich via ILIAS zur Verfügung gestellt.

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:** apl. 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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**Events**

| ST 2021 | 2142879 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III | 2 SWS | Lecture / 🖥 | Guber |

**Exams**

| ST 2021 | 76-T-MACH-100968 | BioMEMS - Microsystems Technologies for Life-Sciences and Medicine III | 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 2021, 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

**Organizational issues**

Die Vorlesung findet im Sommersemester aufgrund der aktuellen Situation bis auf Weiteres online statt. Zu jedem Vorlesungstermin werden via ILIAS die jeweiligen Folien im PDF-Format zur Verfügung gestellt.

Die Vorlesung wird voraussichtlich mit der Software ZOOM oder MS Teams zu den im Vorlesungsverzeichnis angekündigten Terminen (hier: Montag: 14:00 - 15:30 Uhr) durchgeführt werden. Weitere Informationen werden sobald wie möglich via ILIAS zur Verfügung gestellt.

**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]

**Responsible:** apl. Prof. Dr. Hendrik Hölscher

**Organisation:** KIT Department of Mechanical Engineering

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

### Type Credits Grading scale Recurrence Version
Oral examination 4 Grade to a third Each summer term 1

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### Exams

| ST 2021 | 76-T-MACH-102172 | Bionics for Engineers and Natural Scientists | Hölscher |
| WT 21/22 | 76-T-MACH-102172 | Bionics for Engineers and Natural Scientists | Hölscher |

Legend: 🤖 Online, Blended (On-Site/Online), 🗣 On-Site, ⬹ Cancelled

**Competence Certificate**
written or oral exam

**Prerequisites**
none

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

**V Bionics for Engineers and Natural Scientists**

2142140, SS 2021, 2 SWS, Language: German, Open in study portal

**Lecture (V)**

**Online**

**Content**

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

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

**Basic knowledge in physics and chemistry**

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

**Organizational issues**


Die Prüfung findet als Klausur statt und es werden zwei Termine angeboten werden (voraussichtlich in der ersten Woche nach Vorlesungsende im Sommersemester und in der ersten Woche vor Vorlesungsbeginn im Wintersemester).

**Literature**

Folien und Literatur werden in ILIAS zur Verfügung gestellt.
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

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**Events**

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**Exams**

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**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 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.

**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:_

Module Offers in Mechanical Engineering for Temporary Students, Date: 15/09/2021 Valid from Winter Term 2021/2022
**BUS-Controls**
2114092, SS 2021, 2 SWS, Language: German, Open in study portal

**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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Exams

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<td>BUS-Controls - Advance</td>
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<td>76-T-MACH-108889</td>
<td>BUS-Controls - Advance</td>
<td>Geimer</td>
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</table>

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

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<td>CAD-NX training course</td>
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**Exams**

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<tr>
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<td>76-T-MACH-102187</td>
<td>CAD-NX Training Course</td>
<td>Ovtcharova</td>
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</tbody>
</table>

**Competence Certificate**  
Practical verification as academic achievement by working on a design task on the 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 2021, 2 SWS, Language: German/English, Open in study portal  
Practical course (P)  
Blended (On-Site/Online)

**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.

**Organizational issues**  
Das Praktikum wird mehrmals in der vorlesungsfreien Zeit als einwöchige Blockveranstaltung angeboten. Weitere Informationen siehe ILIAS.

**Literature**

Praktikumsskript
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.

Organizational issues
Siehe ILIAS zur Lehrveranstaltung

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>Block / 🗣</td>
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<td>3 SWS</td>
<td>Block / 🗣</td>
<td>Albers, Mitarbeiter</td>
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</table>

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, 🗿 Cancelled

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:

CAE-Workshop
2147175, SS 2021, 3 SWS, Language: German, Open in study portal

Block (B) On-Site

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: 88.5 h

Organizational issues
Wir empfehlen den Workshop ab dem 5. Semester.
Anmeldung erforderlich. Weitere Informationen siehe IPEK-Homepage.
Anwesenheitspflicht

Literature
Kursunterlagen werden in Ilias bereitgestellt.
Content is provided on Ilias.
CAE-Workshop
2147175, WS 21/22, 3 SWS, Language: German, Open in study portal

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:

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- 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: 88.5 h

Organizational issues
Wir empfehlen den Workshop ab dem 5. Semester.
Anmeldung erforderlich. Weitere Informationen siehe IPEK-Homepage.
Anwesenheitspflicht

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

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<th>Ovtcharova</th>
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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 2021, 3 SWS, Language: German/English, Open in study portal

**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.

**Organizational issues**  
Siehe ILIAS-Kurs.

**Literature**  
Keine / None

**Advanced CATIA**  
2123380, WS 21/22, 3 SWS, Language: German/English, Open in study portal

**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.

**Organizational issues**  
Siehe ILIAS zur Lehrveranstaltung

**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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**Exams**

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**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 2021, 3 SWS, Language: German/English, [Open in study portal](#)

**Practical course (P)**

Online

**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.

**Organizational issues**

Das Praktikum wird mehrmals in der vorlesungsfreien Zeit als einwöchige Blockveranstaltung angeboten. Weitere Informationen siehe ILIAS.

**Literature**

Praktikumskript
**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 constraints
- 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.

**Organizational issues**

Siehe ILIAS zur Lehrveranstaltung

**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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**Competence Certificate**
oral exam
3.33 Course: CFD for Power Engineering [T-MACH-105407]

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

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

**Type:** Oral examination  
**Credits:** 4  
**Grading scale:** Grade to a third  
**Recurrence:** Each summer term  
**Version:** 1

### Events

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### Exams

| ST 2021 | 76-T-MACH-105407 | CFD in Power Engineering | Otic |

Legend: 📥 Online, ☑ Blended (On-Site/Online), ☑ On-Site, ☑ Cancelled

**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 2021, 2 SWS, Language: English, [Open in study portal](#)
Content

Contents:
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 the open-source CFD computer program OpenFOAM to give a "hands on" insight into the simulation of turbulent flows. After completing the course you should be able to establish a connection between theory and CFD modeling and simulation for energy applications.

Tentative Course Outline:
The weekly coverage might change as it depends on the progress of the class.

Content
1 Introduction: What is Computational Fluid Dynamics?
2 Governing Equations
3 Numerical Methods: Introduction
4 Numerical Methods: Finite Volume
5 Numerical Methods: Solution of ordinary differential equations
6 Numerical Methods: Convergence and numerical stability
7 Turbulence and Turbulence Modelling
8 Reynolds Averaged Navier-Stokes Simulation Approach
9 Heat Transfer

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

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

Literature
Vorlesungsskript
Projektskript und Unterlagen
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

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Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
Successful solution of problems

Prerequisites
none

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

**Content**

- Successful solution of problems
- A CD containing the course material will be handed out to the students
  - Introduction to using Open Foam
  - Grid generation
  - Boundary conditions
  - Numerical errors
  - Discretization schemes
  - Turbulence models
  - Two phase flow - spray
  - Two Phase flow - Volume of Fluid method

The students are able to:

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

**Organizational issues**

Voraussichtlicher Termin des Praktikums: 26.07.-30.07.2021

Der aktuelle Status (Termin/Ort) wird auf der ITS-homepage bekanntgegeben.
Literature

- Dokumentation zu Open Foam
- www.openfoam.com/docs

**CFD-Lab using OpenFOAM**

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<th>V</th>
<th>2169459, WS 21/22, 3 SWS, Language: German, Open in study portal</th>
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<tr>
<td>Practical course (P)</td>
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### Content

- Successful solution of problems
- A CD containing the course material will be handed out to the students
- Introduction to using Open Foam
- Grid generation
- Boundary conditions
- Numerical errors
- Discretization schemes
- Turbulence models
- Two phase flow - spray
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- choose and define appropriate boundary conditions
- estimate numerical errors and asses them
- judge turbulence models and select an appropriate model
- simulate 2-phase flows using suitable models

**Organizational issues**

Praktikum findet in Präsenz statt, sofern es die COVID-Inzidenzwerte zulassen.

**Literature**

- Dokumentation zu Open Foam
- www.openfoam.com/docs
### 3.35 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

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

**Prerequisites**  
none
3.36 Course: Coal Fired Power Plants [T-MACH-105410]

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

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

Type: Oral examination  Credits: 4  Grading scale: Grade to a third  Recurrence: Each winter term  Version: 1

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

Prerequisites
none
3.37 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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**Events**

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<td>ST 2021 2138341 Cognitive Automobiles - Laboratory 3 SWS / 🧩 Stiller, Lauer, Kamran</td>
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**Exams**

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<tr>
<td>ST 2021 76-T-MACH-105378 Cognitive Automobiles - Laboratory Stiller</td>
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</table>

**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:

**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
Literatur
Dokumentation zur SW und HW werden als pdf bereitgestellt.
3.38 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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<td>ST 2021 24572</td>
<td>Kognitive Systeme 4 SWS Lecture / Practice /</td>
<td>Waibel, Stüker, Neumann</td>
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<td>Cognitive Systems</td>
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**Exams**

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🔷 On-Site, ✗ Cancelled
## 3.39 Course: Combined Cycle Power Plants [T-MACH-105444]

**Responsible:** Hon.-Prof. Dr. 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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**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:**

### 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:
3.40 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>2133113</td>
<td>CO2-neutral combustion engines and their fuels I</td>
<td>4</td>
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Legend: 📱 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled  

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

**Prerequisites**  
none

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

**CO2-neutral combustion engines and their fuels I**

2133113, WS 21/22, 4 SWS, Language: German, Open in study portal  

**Lecture / Practice (VÜ)**  
Blended (On-Site/Online)

**Content**  
Introduction, History, Concepts  
Working Principle and Applications  
Characteristic Parameters  
Engine Parts  
Drive Train  
Fuels  
Gasoline Engines  
Diesel Engines  
Exhaust Gas Aftertreatment
3 COURSES

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

3.41 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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<td>Koch, Kubach</td>
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Legend: 🖥 Online, ✭ Blended (On-Site/Online), ✩ On-Site, ✗ Cancelled

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:

CO2-neutral combustion engines and their fuels II
21341511, SS 2021, 3 SWS, Language: German, Open in study portal
Lecture / Practice (VÜ)
Blended (On-Site/Online)
### 3.42 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

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#### Exams

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**Legend:**  🖥 Online, 🧩 Blended (On-Site/Online), ⏰ On-Site, ✗ Cancelled

**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 2021, 2 SWS, Language: German, Open in study portal

**Lecture (V) Online**
Content

Physical connections of fiber reinforcement

Use and examples
- Automotive construction
- Transport
- Energy and construction
- Sport and recreation

Resins
- Thermoplastics
- Duromeres

Mechanisms of reinforcements
- Glas fibers
- Carbon fibers
- Aramid fibers
- Natural fibers

Semi-finished products - textiles

Process technologies - prepregs

Recycling of composites

Aim of this lecture:

Students know different polymer resin materials and fiber materials and can deduce their character and use. They understand the reinforcing effect of fibers in a matrix surrounding as well as the tasks of the single components in a compound. They know about the influence of the length of fibers, their mechanical characters and performance in a polymer matrix compound.

Students know the important industrial production processes for continuous and discontinuous reinforced polymer matrix compounds.

Literature

Literatur Leichtbau II

[1-7]


Course: Computational Dynamics [T-MACH-105349]

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

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

Type: Oral examination
Credits: 4
Grading scale: Grade to a third
Recurrence: Each summer term
Version: 1

Events

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<th>ST 2021</th>
<th>2162246</th>
<th>Computational Dynamics</th>
<th>2 SWS</th>
<th>/</th>
<th>Proppe</th>
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Exams

| ST 2021 | 76-T-MACH-105349 | Computational Dynamics | Proppe |

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗓 On-Site, ✗ Cancelled

Competence Certificate
oral exam, 30 min.

Prerequisites
none

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

Computational Dynamics
2162246, SS 2021, 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

Organizational issues
Fr., 15:45-17:15, Geb. 10.91, Grashof-Hörsaal

Literature
1. Ein Vorlesungsskript wird bereitgestellt!
3 COURSES

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

3.44 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

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Events

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<th>Lecture 2161123</th>
<th>Computational homogenization on digital image data (Lecture)</th>
<th>2 SWS</th>
<th>Lecture / Online</th>
<th>Schneider</th>
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<tr>
<td>WA 21/22</td>
<td>Lecture 2161124</td>
<td>Computational homogenization on digital image data (Tutorial)</td>
<td>2 SWS</td>
<td>Practice / Blended (On-Site/Online)</td>
<td>Risthaus, Schneider</td>
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Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
oral exam, 30 min

Prerequisites
nein

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

**Computational homogenization on digital image data (Lecture)**
2161123, WS 21/22, 2 SWS, Language: English, Open in study portal
Lecture (V) Blended (On-Site/Online)

Content

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

Literature


**Computational homogenization on digital image data (Tutorial)**
2161124, WS 21/22, 2 SWS, Language: English, Open in study portal
Practice (Ü) Blended (On-Site/Online)

Content

Please refer to the lecture "Computational homogenization on digital image data".
## Course: Computational Intelligence [T-MACH-105314]

**Responsible:** apl. Prof. Dr. Ralf Mikut  
Dr. Ines Reinartz  
apl. Prof. Dr. Markus Reischl

**Organisation:** KIT Department of Mechanical Engineering

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

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### Events

**WT 21/22:**  
2105016  
**Computational Intelligence**  
2 SWS  
Lecture / 🧩  
Mikut, Reischl, Reinartz

### Exams

**ST 2021:**  
76-T-MACH-105314  
Computational Intelligence  
Mikut

**WT 21/22:**  
76-T-MACH-105314  
Computational Intelligence  
Mikut

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

### Competence Certificate

Written exam (Duration: 1h)

### Prerequisites

none

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

#### Computational Intelligence

2105016, WS 21/22, 2 SWS, Language: German, Open in study portal

**Lecture (V)**  
Blended (On-Site/Online)

### Content

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

**Content:**

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

**Learning objectives:**

The students are able to apply the fundamental methods of computational intelligence (fuzzy logic, artificial neural networks, evolutionary algorithms, deep learning) efficiently. They know the basic mathematical foundations and are able to transfer these methods to practical applications.
Literature
Kroll, A. Computational Intelligence: Eine Einführung in Probleme, Methoden und technische Anwendungen Oldenbourg Verlag, 2013
Mikut, R.: Data Mining in der Medizin und Medizintechnik. Universitätsverlag Karlsruhe; 2008 (PDF frei im Internet)
3.46 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>Practice / 📅</td>
<td>2 SWS</td>
<td>Grade to a third</td>
<td>Each winter term</td>
<td>Krause, Schneider, Langhoff</td>
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<td>2161250</td>
<td>Computational Mechanics I</td>
<td>Lecture / 📅</td>
<td>2 SWS</td>
<td>Grade to a third</td>
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<td>Consultation-hour (Sprech)</td>
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<td>Each winter term</td>
<td>Krause, Schneider, Langhoff</td>
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**Legend:** 📅 Online, 📅 Blended (On-Site/Online), ☑ On-Site, ✗ Cancelled

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

**Prerequisites**
none

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

This course is geared to MSc students.

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

**Computational Mechanics I (Tutorial)**
2161147, WS 21/22, 2 SWS, Language: German, Open in study portal
Practice (Ü) Blended (On-Site/Online)

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

**Literature**
Siehe Literaturhinweise Vorlesung "Rechnerunterstützte Mechanik I".

**Computational Mechanics I**
2161250, WS 21/22, 2 SWS, Language: German, Open in study portal

**Literature**
### 3.47 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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<td>(Sprech)</td>
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#### Exams

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**Legend:**  
Online, Blended (On-Site/Online), On-Site, Cancelled

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

**Prerequisites**  
none

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

#### Computational Mechanics II

2162296, SS 2021, 2 SWS, Language: German, Open in study portal  

**Content**  
overview quasistatic nonlinear phenomena; numerics of nonlinear systems; balance equations of geometrically nonlinear solid mechanics; infinitesimal plasticity; linear and geometrically nonlinear thermoelasticity

**Organizational issues**  
Diese Lehrveranstaltung (gemeinsam mit der begleitenden Studienleistung "Übung zu Rechnerunterstützte Mechanik II") wird im SS 2021 als Blockveranstaltung angeboten. Bitte beachten Sie die Aushänge am Institut und auf der Homepage.

**Literature**  

#### Tutorial Computational Mechanics II

2162297, SS 2021, 2 SWS, Language: German, Open in study portal  

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

**Organizational issues**  
siehe Vorlesung "Rechnerunterstützte Mechanik II"

**Literature**  
siehe Vorlesung "Rechnerunterstützte Mechanik II"
### 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

<table>
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### Events

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### Exams

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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 2021, 2 SWS, Language: German, Open in study portal

**Lecture (V) Online**

### Content

This course serves as an introduction into the computational modelling and simulation of technical system road/ vehicle. A method based perspective is taken which allows for a unified treatment of various kinds of vehicles. The vehicle model is obtained by dividing the system into functional subsystems and defining interfaces between these subsystems.

In the first part of the course, vehicle models will be developed based on models of the suspensions, the road, and the contact forces between road and vehicle. The focus of the second part of the course is on computational methods for linear and non-linear models of vehicle systems. The third part of the course discusses design criteria for stability, safety and ride comfort. Multibody dynamics simulations will be carried out using Matlab/ Simulink.

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

3.49 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

<table>
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**Competence Certificate**
Oral exam, 30 min.

**Prerequisites**
none

**Recommendation**
Knowledge of EM III/IV
3.50 Course: Constitution and Properties of Protective Coatings [T-MACH-105150]

**Responsible:** apl. Prof. Dr. Sven Ulrich

**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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**Exams**

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<td>Constitution and Properties of Protective Coatings</td>
<td>Ulrich</td>
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</table>

**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 📚 On-Site, ☑ Cancelled

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

**Prerequisites**
none

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

**Constitution and Properties of Protective Coatings**

<table>
<thead>
<tr>
<th>Code</th>
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<td>Lecture (V)</td>
<td>On-Site</td>
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</table>

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

Teaching Content:

- introduction and overview
- concepts of surface modification
- coating concepts
- coating materials
- methods of surface modification
- coating methods
- characterization methods
- state of the art of industrial coating of tools and components
- new developments of coating technology
- regular attendance: 22 hours
- self-study: 98 hours

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

**Recommendations:** none

**Organizational issues**

Falls die Vorlesung online stattfinden muss, bitte um Anmeldung unter sven.ulrich@kit.edu bis zum 10.10.21.

Den entsprechenden MS Teams Link erhalten Sie dann per E-Mail am 11.10.21.
Literature

Abbildungen und Tabellen werden verteilt; Copies with figures and tables will be distributed
3.51 Course: Constitution and Properties of Wearresistant Materials [T-MACH-102141]

**Responsible:** apl. Prof. Dr. Sven Ulrich

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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<td>Constitution and Properties of Wear resistant materials</td>
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<td>Constitution and Properties of Wearresistant Materials</td>
<td>Ulrich</td>
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</table>

**Events**

**Exams**

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**Competence Certificate**

oral examination (about 30 min)

no tools or reference materials

**Prerequisites**

none

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

**Constitution and Properties of Wear resistant materials**

2194643, SS 2021, 2 SWS, Language: German, Open in study portal

**Lecture (V)**

**Online**

**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
- stellite 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
Organizational issues
Aufgrund der aktuellen Situation findet die Blockveranstaltung online in folgendem Zeitraum statt:
06.04.-08.04.2021: jeweils von 8:00-16:00 Uhr;
Ort: online per MS-Teams
Anmeldung verbindlich bis zum 02.04.2021 unter sven.ulrich@kit.edu.
Nach der Anmeldung wird Ihnen der Link zur Vorlesung per E-Mail am 05.04.2021 mitgeteilt.

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

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

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

Type: Oral examination
Credits: 4
Grading scale: Grade to a third
Recurrence: Each summer term
Version: 1

Events

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<th>Contact Mechanics</th>
<th>2 SWS</th>
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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:

Contact Mechanics
2181220, SS 2021, 2 SWS, Language: German, Open in study portal

Lecture (V)
Online

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

1. Introduction: contact area and stiffness
2. Theory of the elastic half-space
3. Contact of nonadhesive spheres: Hertz theory
4. Physics and chemistry of adhesive interactions at interfaces
5. Contact of adhesive spheres: theories of Johnson-Kendall-Roberts, Derjaguin-Muller-Toporov and Maugis-Dugdale
6. Surface roughness: topography, power spectral density, structure of real surfaces, fractal surfaces as a model, metrology
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, Savkoo, 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

Organizational issues
Weitere Informationen finden Sie in ILIAS.
Kontakt: christian.greiner@kit.edu
Literature
K. L. Johnson, Contact Mechanics (Cambridge University Press, 1985)
D. Maugis, Contact, Adhesion and Rupture of Elastic Solids (Springer-Verlag, 2000)
### 3.53 Course: Control Technology [T-MACH-105185]

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

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

<table>
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**Exams**

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</table>

**Legend:** 🌐 Online, 🧩 Blended (On-Site/Online), 🗂 On-Site, ✗ Cancelled

**Competence Certificate**

Written Exam (60 min)

**Prerequisites**

none

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

**Control Technology**

2150683, SS 2021, 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/) bereitgestellt.

Media:
Lecture notes will be provided in ilias (https://ilias.studium.kit.edu/).
3.54 Course: Cooling of Thermally High Loaded Gas Turbine Components [T-MACH-105414]

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

**Organisation:** KIT Department of Mechanical Engineering

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

**Type** Oral examination  
**Credits** 4  
**Grading scale** Grade to a third  
**Recurrence** Each summer term  
**Version** 1

### Events

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<td>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**  
210463, SS 2021, 2 SWS, Language: German, Open in study portal  
Lecture (V)  
Blended (On-Site/Online)

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

Responsible: Stefan Meisenbacher
        apl. Prof. Dr. Ralf Mikut
        apl. Prof. Dr. 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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Exams

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<td>Written exam</td>
<td>76-T-MACH-105694</td>
<td>Mikut</td>
</tr>
</tbody>
</table>

Competence Certificate
Written exam (Duration: 1h)

Prerequisites
none

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

Content

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

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

Literature

Vorlesungsunterlagen (ILIAS)

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


3.56 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

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**Events**

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<td>2 SWS</td>
<td>Lecture / 📚</td>
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</table>

**Legend:** 📚 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Canceled

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**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 and as a semester project.

---

**Literature:**

See german recommendations

---

*Below you will find excerpts from events related to this course:*
**Design and Development of Mobile Machines**

2113079, WS 21/22, 2 SWS, Language: German, Open in study portal

**Lecture (V)**
Blended (On-Site/Online)

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

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

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

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

**Recommendations:**
Knowledge in Fluid Technology (SoSe, LV 21093)

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

**Literature**
Keine.
3.57 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>Design and Development of Mobile Machines - Advance</td>
<td>Geimer</td>
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</table>

**Competence Certificate**
Preparation of semester report

**Prerequisites**
none
3.58 Course: Design and Optimization of Conventional and Electrified Automotive Transmissions [T-MACH-110958]

**Responsible**: Prof. Dr.-Ing. Albert Albers  
Dr.-Ing. Hartmut Faust

**Organisation**: KIT Department of Mechanical Engineering

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

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**Events**

| ST 2021 | 2146208 | Design and Optimization of Conventional and Electrified Automotive Transmissions | 2 SWS | Lecture / Online | Faust |

**Exams**

| ST 2021 | 76-T-MACH-105536 | Design and Optimization of Conventional and Electrified Automotive Transmissions | Faust, Albers |

**Legend**: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, 🗑 Cancelled

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

**Prerequisites**
one

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

### Design and Optimization of Conventional and Electrified Automotive Transmissions

2146208, SS 2021, 2 SWS, Language: German, Open in study portal

**Lecture (V) Online**

**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)

**Organizational issues**


**Lernziele**

Die Studenten erwerben das Wissen aus aktuellen Getriebe-, Hybrid- und reinen Elektroantriebs-Entwicklungen über ...

- die Funktionsweise und Auslegung von konventionellen und elektrifizierten Fahrzeuggetrieben und deren Komponenten;
- Konstruktions- und Funktionsprinzipien der wichtigsten Komponenten von Handschalt-, Doppelkupplungs-, stufenlosen und Planetenautomat-Gtrieben;
- komfortrelevante Zusammenhänge und Abhilfemaßnahmen;
- die Hybridisierung und Elektrifizierung der Triebstränge auf Basis bekannter Getriebetypen und mit speziellen sogenannten Dedicated Hybrid Transmissions (DHT) sowie Bewertung der Konzepte auf Systemebene.
3.59 Course: Design of a Jet Engine Combustion Chamber [T-CIWVT-110571]

**Responsible:** Prof. Dr.-Ing. Nikolaos Zarzalis  
**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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**Exams**

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**Competence Certificate**
Success control is an examination of another kind according to § 4 Abs. 2 Nr. 3 SPO.
Project: Participation and presentation as well as a final oral examination amounting to max. 30 minutes.

**Prerequisites**
None
3.60 Course: Design of Highly Stresses Components [T-MACH-105310]

**Responsible:** apl. Prof. Dr. Jarir Aktaa  
**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  
**Grading scale** Grade to a third  
**Recurrence** Each winter term  
**Version** 1

| Events |  
|---|---|---|---|---|---|
| WT 21/22 | 2181745 | Design of highly stresses components | 2 SWS | Lecture / ⚡ | Aktaa  

| Exams |  
|---|---|---|---|
| ST 2021 | 76-T-MACH-105310 | Design of Highly Stresses Components | Aktaa |

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), ⚡ On-Site, ⏹️ Cancelled

**Competence Certificate**  
oral exam

---

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

**Design of highly stresses components**  
2181745, WS 21/22, 2 SWS, Language: German, Open in study portal

**Content**

Contents of the lecture:

- rules of common design codes
- classical models for elasto-plasticity and creep
- lifetime rules for creep, fatigue and creep-fatigue interaction
- unified constitutive models for thermo-elasto-viscoplasticity
- continuum mechanical models for damage at high temperatures
- application of advanced material models in FE-codes

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

**Qualification:** Materials Science, solid mechanics II

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

**Literature**


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

**Responsible:** Markus Liedel  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-104851 - Major Field Product Development and Construction

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**Competence Certificate**  
Oral exam, about 20 minutes

**Prerequisites**  
none

**Recommendation**  
Poly I

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

**Design with Plastics**  
2174571, SS 2021, 2 SWS, Language: German, Open in study portal  
Lecture (V) Cancelled
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).

Organizational issues

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  
ST 2021 | 76-T-MACH-108721 | Designing with Composites |

**Competence Certificate**  
Oral exam, 20 minutes

**Prerequisites**  
None

**Annotation**  
The lecture notes are made available via ILIAS.
3.63 Course: Development of Oil-Hydraulic Powertrain Systems [T-MACH-105441]

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

**Organisation:** KIT Department of Mechanical Engineering

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

**Type**  
Oral examination

**Credits**  
4

**Grading scale**  
Grade to a third

**Recurrence**  
Each winter term

**Version**  
1

**Events**

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

**Prerequisites**
none

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

**Development of Oil-Hydraulic Powertrain Systems**
2113072, WS 21/22, 2 SWS, Language: German, Open in study portal

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

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

Knowledge in the fluidics

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

**Organizational issues**
siehe Homepage
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

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

**Digital Control**

2137309, WS 21/22, 2 SWS, Language: German, Open in study portal

**Content**

**Lehrinhalt (EN):**

1. Introduction into digital control:  
   Motivation for digital implementation of controllers  
   Structure of digital feedback control loops  
   Sample and hold units

2. State space analysis and design:
   Discretisation of continuous-time systems  
   Discrete-time state space equations  
   Stability - definition and criteria  
   State feedback design by eigenvalue assignment  
   PI state feedback controller  
   Luenberger observer, separation theorem
   Systems with dead-time  
   Deadbeat design

3. Analysis and design based on z-transform:  
   z-transform - definition and theorems  
   Control loop description in the z domain  
   Stability criteria  
   Root locus controller design  
   Transfer of continuous-time controllers into discrete-time controllers

**Voraussetzungen (EN):**

Basic studies and preliminary examination; basic lectures in automatic control

**Lernziele (EN):**

The lecture introduces key methods for the analysis and design of digital feedback control systems. Starting point is the discretisation of linear, continuous-time models. State space based and z-transform based controller design techniques are presented for discrete-time, single-input single-output systems. Furthermore, plants with dead-time and deadbeat design are covered.

Nachweis: written examination; duration: 60 minutes; no tools or reference materials may be used during the exam.

**Arbeitsaufwand:** 120 hours

**Literature**

- Föllinger, O.: Lineare Abtastsysteme. 4. Auflage, R. Oldenbourg Verlag, München Wien 1990
Course: Digital microstructure characterization and modeling [T-MACH-110431]

Responsibility: Jun.-Prof. Dr. Matti Schneider

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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Exams

| ST 2021 | 76-T-MACH-110431 | Digital microstructure characterization and modeling | Schneider |

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

<table>
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Events

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<th>Digital Technology</th>
<th>3 SWS</th>
<th>Lecture</th>
<th>Becker</th>
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<td>WT 21/22</td>
<td>2311617</td>
<td>Tutorial for 2311615 Digital Technology</td>
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<td>Practice</td>
<td>Höfer</td>
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</table>

Exams

| ST 2021      | 7311615 | Digital Technology | Becker |

Prerequisites

none
3.67 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

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

**Prerequisites**  
none
3.69 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

<table>
<thead>
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**Events**

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<td>2 SWS</td>
<td>Lecture / Online</td>
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<tr>
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<td>Übung zu 'Antriebsstrang mobiler Arbeitsmaschinen'</td>
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**Exams**

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<thead>
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<td>Drive Train of Mobile Machines</td>
<td>Geimer</td>
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</table>

**Legend:** Online, Blended (On-Site/Online), On-Site, Cancelled

**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 mechanics engineering
- Basic knowledge of hydraulics
- Interest in mobile machinery

**Annotation**
At the end of the lecture, participants can explain the structure and function of all discussed drive trains of mobile machines. They can analyze complex gearbox schematics and synthesize simple transmission functions using rough calculations.

**Content:**
In this course the different drive trains of mobile machinery will be discussed. The focus of this course is:

- mechanical gears
- torque converter
- hydrostatic drives
- power split drives
- electrical drives
- hybrid drives
- axles
- terra mechanics

**Media:** projector presentation

**Literature:** Download of lecture slides from ILIAS. Further literature recommendations during lectures.

*Below you will find excerpts from events related to this course:*
Content
In this course will be discussed the different drive train of mobile machines. The fokus of this course is:
- improve knowledge of fundamentals
- mechanical gears
- torque converter
- hydrostatic drives
- continuous variable transmission
- electrical drives
- hybrid drives
- axles
- terra mechanic

Recommendations:
- general basics of mechanical engineering
- basic knowledge in hydraulics
- interest in mobile machines

- regular attendance: 21 hours
- self-study: 89 hours

Literature
Skriptum zur Vorlesung downloadbar über ILIAS
3.70 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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<td>Lecture / 📱</td>
<td>2 SWS</td>
<td>Grade to a third</td>
<td>Each winter term</td>
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<td>WT 21/22</td>
<td>2163112</td>
<td>Übungen zu Dynamik des Kfz-Antriebsstrangs</td>
<td>Practice</td>
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<td>Fidlin, Luo</td>
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**Exams**

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<td>76-T-MACH-105226</td>
<td>Dynamics of the Automotive Drive Train</td>
<td>Lecture (V)</td>
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**Legend:** 🖥 Online, 📱 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

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

**Prerequisites**  
none

**Recommendation**  

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

### Dynamics of the Automotive Drive Train  
2163111, WS 21/22, 2 SWS, Language: German, Open in study portal  
**Lecture (V)**  
Blended (On-Site/Online)

**Content**

- Main components of the vehicle powertrain and their modelling  
- Typical driving situations  
- Problem-oriented models for particular driving situations  
- System analysis and optimization with respect to dynamic behavior

**Literature**

- Pfeiffer F., Mechanical System Dynamics, Springer, 2008  

### Übungen zu Dynamik des Kfz-Antriebsstrangs  
2163112, WS 21/22, 2 SWS, Language: German, Open in study portal  
**Practice (Ü)**

**Content**  
Exercises related to the lecture
### 3.71 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

<table>
<thead>
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<td>Lecture</td>
<td>Leibfried</td>
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<td>2307393</td>
<td>Übungen zu 2307391 Elektroenergiesysteme</td>
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**Exams**

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<td>Leibfried</td>
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</table>

**Prerequisites**

none
### 3.72 Course: Electric Power Transmission & Grid Control [T-ETIT-110883]

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<tbody>
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<td>Lecture</td>
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</table>

**Competence Certificate**
The examination consists of a written paper and an oral presentation of the students work. The overall impression is rated.

**Prerequisites**
none
### 3.73 Course: Electric Rail Vehicles [T-MACH-102121]

**Responsible:** Prof. Dr.-Ing. Marcus Geimer  
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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<tr>
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<td>Tesar, Gratzfeld</td>
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<td>ST 2021</td>
<td>76-T-MACH-102121</td>
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<td>Tesar, Otto, Gratzfeld</td>
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<td>Electric Rail Vehicles</td>
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<td>Tesar, Otto, Gerhardt, 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

- Code: 2114346, SS 2021, 2 SWS, Language: German, [Open in study portal](#)  
- **Lecture (V) Online**

**Content**

1. Introduction: history of electric traction in railways, 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, converters, drives for vehicles at dc and ac lines and without contact wire, multi-system, dual power and hybrid vehicles, conventional drives for existing vehicles  
5. Train control management system: definitions, bus systems, components, network architectures, examples, future trends  
6. Vehicle concepts: modern vehicle concepts for mass transit and electric main line  
7. Traction power supply: power supply of railway vehicles, comparison electric traction and diesel traction, dc and ac networks, system pantograph and contact wire

**Organizational issues**

- **Die Vorlesung "Elektrische Schienenfahrzeuge" findet im SS 2021 als asynchrone Online-Veranstaltung statt.**

**Literature**

- Eine Literaturliste steht den Studierenden auf der Ilias-Plattform zum Download zur Verfügung.  
- A bibliography is available for download (Ilias-platform).
### Course: Electrical Engineering and Electronics [T-ETIT-108386]

**Responsible:** Dr.-Ing. Klaus-Peter Becker  
**Organisation:** KIT Department of Electrical Engineering and Information Technology  
**Part of:** M-MACH-104882 - Courses of the Department of Electrical Engineering and Information Technology

<table>
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#### Events

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#### Exams

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<td>Becker</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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<td>Practice</td>
<td>Becker, Mitarbeiter*innen</td>
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<th>Credits</th>
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</table>

**Annotation**  
Exam will be held in german language
# 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

<table>
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## Events

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<th>Electrical Machines and Power Electronics</th>
<th>2 SWS</th>
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<td>2 SWS</td>
<td>Practice / Online</td>
<td>Hiller</td>
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</table>

## Exams

| ST 2021 | 7306307 | Electrical Machines and Power Electronics | | Hiller |

**Prerequisites**

*none*

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), ⚡ On-Site, ✗ Cancelled
3.78 Course: Electronic Devices and Circuits [T-ETIT-109318]

Responsible: Prof. Dr.-Ing. Ahmet Cagri Ulusoy
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>
<thead>
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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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<td>Electronic Devices and Circuits</td>
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Exams

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<td>Ulusoy</td>
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Legend: 🔄 Online, 🔄 Blended (On-Site/Online), 🔄 On-Site, 📚 Cancelled

Prerequisites

None
3.79 Course: Energy and Process Technology I [T-MACH-102211]

**Responsible:** Prof. Dr.-Ing. Hans-Jörg Bauer  
Prof. Dr. Ulrich Maas  
Dr.-Ing. Corina Schwitzke  
Dr. Amin Velji

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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<tr>
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<td>6 SWS</td>
<td>Bauer, Mitarbeiter, Wagner, Maas</td>
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<td>WT 21/22</td>
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<td></td>
<td></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

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

**Energy and Process Technology I**
2157961, WS 21/22, 6 SWS, Language: German, Open in study portal

**Lecture / Practice (VÜ)**
Blended (On-Site/Online)

**Content**
The last third of the lecture deals with the topic **Thermal Turbomachinery**. The basic principles, the functionality and the scope of application of gas and steam turbines for the generation of electrical power and propulsion technology are addressed.

The students are able to:

- describe and calculate the basic physical-technical processes
- apply the mathematical and thermodynamical description
- reflect on and explain the diagrams and schematics
- comment on diagrams
- explain the functionality of gas and steam turbines and their components
- name the applications of thermal turbomachinery and their role in the field of electricity generation and propulsion technology

**Organizational issues**
Vorlesung findet in Präsenz statt, sofern die COVID-Inzidenzwerte es zulassen.
3.80 Course: Energy and Process Technology II [T-MACH-102212]

Responsible: Prof. Dr. Ulrich Maas
Dr.-Ing. Corina Schwitzke

Organisation: KIT Department of Mechanical Engineering

Type: Written examination
Credits: 9
Grading scale: Grade to a third
Recurrence: Each summer term
Version: 1

Events

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<th>Grading scale</th>
<th>Recurrence</th>
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<td>2170832</td>
<td>Energy and Process Technology II</td>
<td>6 SWS</td>
<td>Lecture / Practice (VÜ)</td>
<td>Schwitzke, Pritz, Maas</td>
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Exams

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<tr>
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<th>Type</th>
<th>Credits</th>
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<td>Energy and Process Technology II</td>
<td>Wirbser, Schwitzke, Bauer, Pritz</td>
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<td>Energy and Process Technology II</td>
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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
2170832, SS 2021, 6 SWS, Language: German, Open in study portal
Lecture / Practice (VÜ)
Blended (On-Site/Online)

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
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>
<thead>
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**Exams**

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<td>Koch, Kubach</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**

oral exam, 25 minutes, no auxiliary means

**Prerequisites**

none

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

Energy Conversion and Increased Efficiency in Internal Combustion Engines  
2133121, WS 21/22, 2 SWS, Language: German, Open in study portal

**Content**

1. Introduction
2. Thermodynamics of combustion engines
3. Fundamentals
4. Gas exchange
5. Flow field
6. Wall heat losses
7. Combustion in gasoline engines
8. Pressure Trace Analysis
9. Combustion in Diesel engines
10. Waste heat recovery
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**

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<th>Energy demand of buildings – fundamentals and applications, with building simulation exercises</th>
<th>4 SWS</th>
<th>Lecture / Practice ( / 🗣️) Schmidt</th>
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**Exams**

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<td>Schmidt</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣️ On-Site, ⬠ Cancelled

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

<table>
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<tr>
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<tr>
<td>2158203, SS 2021</td>
<td>4 SWS, Language: German</td>
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</tbody>
</table>
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 from Biomass [T-CIWVT-110576]

**Responsible:** Dr.-Ing. Siegfried Bajohr  
Prof. Dr. Nicolaus Dahmen

**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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**Events**

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<td>Energy from Biomass</td>
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**Competence Certificate**

The examination is a written examination with a duration of 90 minutes (section 4 subsection 2 number 1 SPO).

**Prerequisites**

None
3.84 Course: Energy Market Engineering [T-WIWI-107501]

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

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Exams

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<th>Weinhardt</th>
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Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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 2021, 2 SWS, Language: German, Open in study portal

Lecture (V) Online

Literature

3.85 Course: Energy Storage and Network Integration [T-ETIT-104644]

**Responsible:** Prof. Dr. Mathias Noe  
**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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**Events**

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**Exams**

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<tr>
<td>Energy Storage and Network Integration</td>
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</tbody>
</table>

**Prerequisites**

Neither participation in "Energiespeicher und Netzintegration" (ETIT) nor in "Energiespeicher und Netzintegration" (MACH). Only one out of these three exams is allowed.

**Recommendation**

Basic knowledge in the fields of Electrical Engineering and Thermodynamics is helpful.

**Annotation**

Exam and Lecture will be held in English.

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

**Tutorial for 2312687 Energy Storage and Network Integration**

2312689, WS 21/22, 1 SWS, Language: English, [Open in study portal](#)

**Content**

Campus North - dates will be announced in the beginning of the semester in the lecture

In order to gain credits, both, the lecture and the tutorial, have to be completed (participation in VL 23687 "Energy Storage and Network Integration").

**Organizational issues**

siehe Aushang; Campus Nord, Termine werden in der Vorlesung bekanntgegeben.

**Responsible:** apl. Prof. Dr. Ron Dagan  
**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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**Exams**

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<td>WT 21/22</td>
<td>76-T-MACH-105408</td>
<td>Energy Systems I: Renewable Energy</td>
<td>Dagan</td>
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**Legend:** 🖥 Online, 🧱 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

**Competence Certificate**
oral exam, approx. 1/2 hour

**Prerequisites**
none

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

### Energy Systems I - Renewable Energy
2129901, WS 21/22, 3 SWS, Language: German, Open in study portal

**Content**
The course deals with fundamental aspects of renewable energies.

1. The first part deals with the basic concepts of absorbing solar beans, in an efficient manner accounting for the minimization of heat losses. In this context, selective topics on thermodynamics as well as fluid dynamics are introduced. In the second part few applications are discussed and optimizations techniques of solar collectors construction and their heat transfer are presented.
2. The use of solar energy as a source for heat generation is followed by the idea of electricity generation. Introductive aspects of Photovoltaic technologies are illuminated.
3. The last part presents additional regenerative energy sources such as wind and geothermal energy.

The student knows the principles of the feasibility of energy gain by means of renewable energies, in particular the solar energy.

**Regular attendance:** 34 hours  
**Self-study:** 146 hours

**Organizational issues**
Die Veranstaltung wird nur online gehalten, falls durch Corona Einschränkungen vorgegeben werden.
3.87 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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<th>Events</th>
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<th>Lecture</th>
<th>Room</th>
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**Exams**

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**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 2021, 2 SWS, Language: German, [Open in study portal](#)

**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

**Organizational issues**

Mo (26.07.2021), 09:00 bis 17:00
Di (27.07.2021), 09:00 bis 17:00
Mi (28.07.2021), 09:00 bis 17:00
Literature
Dieter Schmidt, Reaktortechnik, Band 1: Grundlagen, ISBN 3 7650 2003 6
**3.88 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

<table>
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<th>Version</th>
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<td>pass/fail</td>
<td>Each summer term</td>
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**Introductive Information**
- **Events**
  - ST 2021 2134001: Engine Laboratory 2 SWS Practical course / Wagner
  - ST 2021 76-T-MACH-105337: Engine Laboratory 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:**

**Organizational issues**

**Literature**
- Versuchsbeschreibungen
3.89 Course: Engine Measurement Techniques [T-MACH-105169]

Responsible: Dr.-Ing. Sören Bernhardt
Organisation: KIT Department of Mechanical Engineering

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

Type: Oral examination
Credits: 4
Grading scale: Grade to a third
Recurrence: Each summer term
Version: 1

Events

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<th>2 SWS</th>
<th>Lecture / Blended (On-Site/Online)</th>
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<tr>
<td>WT 21/22</td>
<td>76-T-MACH-105169</td>
<td>Engine Measurement Techniques</td>
<td>Koch</td>
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</tr>
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</table>

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 2021, 2 SWS, Language: German, Open in study portal
Lecture (V) Blended (On-Site/Online)

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
### 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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#### Events

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**Competence Certificate**

The assessment consists of a written exam (60 minutes) (following §4(2), 1 of the examination regulation). Students are offered the opportunity to earn a grade bonus through separate assignments. If the grade of the written exam is between 4.0 and 1.3, the bonus improves the grade by a maximum of one grade level (0.3 or 0.4). The exact criteria for awarding a bonus will be announced at the beginning of the lecture.

**Prerequisites**

None

**Recommendation**

None

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

**Entrepreneurship**

<table>
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<tr>
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<td>Lecture / Online</td>
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</table>

**Literature**

Füglistaller, Urs, Müller, Christoph und Volery, Thierry (2008): Entrepreneurship  
Ries, Eric (2011): The Lean Startup  
### 3.91 Course: Exercises - Fatigue of Welded Components and Structures [T-MACH-109304]

**Responsible:** Dr. Majid Farajian  
**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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**Events**

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<th>2181731</th>
<th>Fatigue of Welded Components and Structures</th>
<th>2 SWS</th>
<th>Block / Online</th>
<th>Farajian</th>
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**Legend:** 📘 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**  
successful solving of all exercises

**Prerequisites**  
none

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

**Fatigue of Welded Components and Structures**

2181731, WS 21/22, 2 SWS, Language: German, Open in study portal

**Content**  
The lecture gives an introduction to the following topics:  
- weld quality  
- typical damages of welded joints  
- evaluation of notches, defects and residual stresses  
- strength concepts: nominal, structural and notch stress concepts, fracture mechanics  
- life cycle analysis  
- post-treatment methods for an extended lifetime  
- maintenance, reconditioning and repair

The student can

- describe the influence of welding induced notches, defects and residual stresses on component behavior  
- explain the basics of numerical and experimental methods for the evaluation of statically or cyclically loaded welds  
- explain and can apply them  
- derive measures in order to increase the lifetime of structures with welded joints under cyclical load

preliminary knowledge materials science and mechanics recommended

regular attendance: 22.5 hours  
self-study: 97.5 hours

Exercise sheets are handed out regularly.

oral examination (ca. 30 min)

no tools or reference materials

**Organizational issues**

Blockveranstaltung. Zur Teilnahme an der Vorlesung ist eine Anmeldung beim Dozenten per E-Mail an Farajian@slv-duisburg.de erforderlich. Vorlesungstermine und Hörsaal werden den angemeldeten Teilnehmern mitgeteilt.

**Literature**

2. FKM-Richtlinie, Bruchmechanischer Festigkeitsnachweis, Forschungskuratorium Maschinenbau, VDMA Verlag, 2009
### 3.92 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

<table>
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#### Events

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<td>Exercise course Technical Thermodynamics and Heat Transfer I</td>
<td>2</td>
<td>Practice / Online</td>
<td>Maas</td>
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<td>WT 21/22</td>
<td>Technical Thermodynamics and Heat Transfer I (Tutorial)</td>
<td>2</td>
<td>Tutorial ( / Online)</td>
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#### Exams

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<td>Excercises in Technical Thermodynamics and Heat Transfer I</td>
<td>Maas</td>
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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

**Competence Certificate**  
Homework is mandatory.
3.93 Course: Excercises in Technical Thermodynamics and Heat Transfer II [T-MACH-105288]

**Responsible:** Prof. Dr. Ulrich Maas

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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**Events**

| ST 2021 | 2166556 | Technical Thermodynamics and Heat Transfer II (Tutorial) | 2 SWS | Practice / 🧩 | Maas |
| ST 2021 | 3166033 | Technical Thermodynamics and Heat Transfer II (Tutorial) | 2 SWS | Practice / 🧩 | Schießl, Maas |

**Exams**

| ST 2021 | 76-T-MACH-105288 | Excercises in Technical Thermodynamics and Heat Transfer II | Maas |

**Legend:** 🥰 Online, 🧩 Blended (On-Site/Online), ⚖ On-Site, ✗ Cancelled

**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 2021, 2 SWS, Language: German, Open in study portal

**Practice (Ü)**

Blended (On-Site/Online)

**Content**

Calculation of thermodynamical problems

**Literature**

Vorlesungsskriptum


3.94 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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<td>pass/fail</td>
<td>Each winter term</td>
<td>1 terms</td>
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**Events**

| WT 21/22 | 2181114 | Tribology | 5 SWS | Lecture / Practice ( / ) | Dienwiebel, Scherge |

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

**Competence Certificate**

successful solving of all exercises

**Prerequisites**

none

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

**Tribology**

2181114, WS 21/22, 5 SWS, Language: German, Open in study portal

**Lecture / Practice (VÜ)**

Online
Content

- Chapter 1: Friction
  adhesion, geometrical and real area of contact, Friction experiments, friction powder, tribological stressing, environmental influences, tribological age, contact models, Simulation of contacts, roughness.
- Chapter 2: Wear
  plastic deformation at the asperity level, dissipation modes, mechanical mixing, Dynamics of the third body, running-in, running-in dynamics, shear stress.
- Chapter 3: Lubrication
  base oils, Stribeck plot, lubrication regimes (HD, EHD, mixed lubrication), additives, oil characterization, solid lubrication.
- Chapter 4: Measurement Techniques
  friction measurement, tribometer, dissipated frictional power, conventional wear measurement, continuous wear measurement (RNT)
- Chapter 5: Roughness
  profilometry, surface roughness parameters, evaluation length and filters, bearing ratio curve, measurement error
- Chapter 6: Accompanying Analysis
  multi-scale topography measurement, chemical surface analysis, structural analysis, mechanical analysis

Exercises are used for complementing and deepening the contents of the lecture as well as for answering more extensive questions raised by the students.

The student can

- describe the fundamental friction and wear mechanisms, which occur in tribologically stressed systems
- evaluate the friction and wear behavior of tribological systems
- explain the effects of lubricants and their most important additives
- identify suitable approaches to optimize tribological systems
- explain the most important experimental methods for the measurement of friction and wear, and is able to use them for the characterisation of tribo pairs
- choose suitable methods for the evaluation of roughness and topography from the nm-scale to the mm-scale and is able to interpret the determined values in respect to their effect on the tribological behavior
- describe the most important surface-analytical methods and their physical principles for the characterization of tribologically stressed sliding surfaces

preliminary knowledge in mathematics, mechanics and materials science recommended
regular attendance: 45 hours
self-study: 195 hours
oral examination (ca. 40 min)
no tools or reference materials
admission to the exam only with successful completion of the exercises

Literature

3.95 Course: Exercises for Applied Materials Simulation [T-MACH-107671]

**Responsible:** Prof. Dr. Peter Gumbsch  
Dr.-Ing. Johannes Schneider  

**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>4 SWS</td>
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<td>Gumbsch, Schulz</td>
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<th>Credits</th>
<th>Exam</th>
<th>Lecturer</th>
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<tbody>
<tr>
<td>ST 2021 76-T-MACH-107671</td>
<td>4 SWS</td>
<td>Exercises for Applied Materials Simulation</td>
<td>Gumbsch, Schulz</td>
</tr>
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</table>

**Competence Certificate**
successful solving of all exercises

**Prerequisites**
T-MACH-110928 – Exercises for Applied Materials Simulation has not been started

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

**Applied Materials Simulation**  
2182614, SS 2021, 4 SWS, Language: German, [Open in study portal](#)

**Lecture / Practice (VÜ)**  
**Online**

**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

**Organizational issues**
Die Vorlesung wir nur als Aufzeichnung angeboten!
Bitte besuchen Sie die englischsprachige Veranstaltung "Applied Materials Simulation" (21 82 616)!
Weitere Informationen finden Sie in ILIAS.
Kontakt: johannes.schneider@kit.edu
Literature

## 3.96 Course: Exercises for Materials Characterization [T-MACH-107685]

### Responsible
Dr.-Ing. Jens Gibmeier  
apl. Prof. Dr. Reinhard Schneider

### 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

### Grading scale
pass/fail

### Recurrence
Each summer term

### Version
4

### Events
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<td>Each summer term</td>
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### Exams
- **ST 2021 2174586 Materials Characterization**  
  2 SWS  
  Lecture / Online  
  Responsible: Schneider, Gibmeier

- **ST 2021 76-T-MACH-107685 Exercises for Materials Characterization**  
  Gibmeier

### Prerequisites
T-MACH-110945 – Exercises for Materials Characterization has not been started

### Literature
Vorlesungsskript (will be given at the beginning of the event).

### Content
The following methods will be introduced within this lecture:

- microscopic methods: optical microscopy, electron microscopy (SEM/TEM), atomic force microscopy
- material and microstructure analyses by means of X-ray, neutron and electron beams
- analysis methods at SEM/TEM (e.g. EELS)
- spectroscopic methods (e.g. EDS / WDS)

### Learning objectives
The students have fundamental knowledge about methods of material analysis. They have a basic understanding to transfer this fundamental knowledge on problems in engineering science. Furthermore, the students have the ability to describe technical material by its microscopic and submicroscopic structure.

### Organizational issues

The lecture will be online (asynchronous). The lecture notes, supplementary material and the recording of lecture slides with audio track will be managed via ILIAS. The registration will be possible without restriction until 30.04.2021. Subsequently, registration is only possible by direct contacting Dr.-Ing. Jens Gibmeier. In summer term 2021 the lecture will be in German. The English course will be offered in winter term 2021 (starting in October 2021)

### Legend
Online, Blended (On-Site/Online), On-Site, Cancelled

### Competence Certificate
Regular attendance

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

**Materials Characterization**  
2174586, SS 2021, 2 SWS, Language: German, Open in study portal
3.97 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

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**Events**

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**Competence Certificate**

successful processing of exercises

**Prerequisites**

T-MACH-110926 – Exercises for Solid State Reactions and Kinetics of Phase Transformations has not been started

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

**Exercises for Solid State Reactions and Kinetics of Phase Transformations**

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<td>2</td>
<td></td>
<td>Each winter term</td>
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**Content**

1. Fick’s laws of diffusion  
2. Calculation of diffusion coefficients  
3. Diffusion and solidification

**Recommendations:** Lecture in Solid State Reactions and Kinetics of Phase Transformations; Basic course in materials science and engineering; physical chemistry  

Reinforcement of the lecture by the solution of practical and lecture-relevant exercises  

regular attendance: 14 hours  
self-study: 46 hours

**Literature**

Vorlesungsskript;  
Lecture notes
**3.98 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

<table>
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**Events**

| ST 2021 | 2162225 | Experimental Dynamics | 3 SWS | Lecture / 📱 | Fidlin |
| ST 2021 | 2162228 | Übungen zu Experimentelle Dynamik | 2 SWS | Practice / 🖥 | Fidlin, Bitner |

**Exams**

| ST 2021 | 76-T-MACH-105514 | Experimental Dynamics | Fidlin |

Legend: 📱 Online, 🖥 Blended (On-Site/Online), ⚫ On-Site, ✗ Cancelled

**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 2021, 3 SWS, Language: German, Open in study portal  
Lecture (V) Blended (On-Site/Online)

**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
3.99 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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<td>2 SWS</td>
<td>Lecture / Online</td>
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<td>WT 21/22</td>
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<td>Experimental Fluid Mechanics</td>
<td>Kriegseis</td>
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</table>

**Competence Certificate**  
oral exam - 30 minutes

**Prerequisites**  
one

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

**Experimental Fluid Mechanics**  
2154446, SS 2021, 2 SWS, Language: German, Open in study portal  
**Lecture (V) Online**

**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

**Organizational issues**  
Die Vergabe von Leistungspunkten zu den Veranstaltungen mit LVNr 2154446 und 2153530 schließt sich gegenseitig aus.

**Literature**  
Content
The students can describe the relevant physical principles of experimental fluid mechanics. They are qualified to comparatively discuss the introduced measurement techniques. Furthermore, they are able to distinguish (dis-)advantages of the respective approaches. The students can evaluate and discuss measurement signal and data obtained with the common fluid mechanical measuring techniques.

This lecture focuses on experimental methods of fluid mechanics and their application to solve flow problems of practical relevance. In addition, measurement signals and data, obtained with the discussed measuring techniques, are evaluated, presented and discussed.

The lecture covers a selection of the following topics:

- measuring techniques and measureable quantities
- measurements in turbulent flows
- pressure measurements
- hot wire measurements
- optical measuring techniques
- error analysis
- scaling laws
- signal and data evaluation

Literature
### 3.100 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>WT 21/22</td>
<td>2173560</td>
<td>Welding Lab Course, in groups</td>
<td>3</td>
<td>Dietrich, Schulze</td>
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**Legend:** 🖥 Online, 🟱 Blended (On-Site/Online), ☑ On-Site, ✗ Cancelled

**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!

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

**Welding Lab Course, in groups**  
2173560, WS 21/22, 3 SWS, Language: German, Open in study portal

**Practical course (P)**  
On-Site

**Content**  
The lab takes place at the beginning of the winter semester break once a year. The registration is possible during the lecture period in the secretariat of the Institute of Applied Materials (IAM – WK). The lab is carried out in the Handwerkskammer Karlsruhe.

**Learning objectives:** The students are capable to name a survey of current welding processes and their suitability for joining different metals. The students can evaluate the advantages and disadvantages of the individual procedures. The students have weld with different welding processes.

**Requirements:**  
Certificate to be issued after evaluation of the lab class report  
You need sturdy shoes and long clothes!

**Workload:**  
regular attendance: 31,5 hours  
preparation: 8,5 hours  
lab report: 80 hours

**Organizational issues**  
Praktikum findet nur statt, wenn es die Pandemie-Situation zulässt.

**Literature**  
wird im Praktikum ausgegeben
**3.101 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

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<th>2 SWS</th>
<th>Lecture / 🖥️</th>
<th>Bade</th>
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**Exams**

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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 2021, 2 SWS, Language: German, Open in study portal

**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  
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
### 3.102 Course: Failure Analysis [T-MACH-105724]

**Responsible:** Prof. 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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**Competence Certificate**

oral examination, ca. 30 min

**Prerequisites**

none

**Recommended**

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

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

#### Failure Analysis

2182572, WS 21/22, 2 SWS, Open in study portal

**Content**

Aim, procedure and content of examining failure  
Examination methods  
Types of failure:  
Failure due to mechanical loads  
Failure due to corrosion in electrolytes  
Failure due to thermal loads  
Failure due to tribological loads  
Damage systematics  

The students are able to discuss damage evaluation and to perform damage investigations. They know the common necessary investigation methods and can regard failures considering load and material resistance. Furthermore they can describe and discuss the most important types of failure and damage appearance.

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

regulat attendance: 21 hours  
self-study: 99 hours  
oral exam, duration: ca. 30 minutes  
no notes

**Literature**

### 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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<th>Lecture / Practice (VÜ)</th>
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<td>2181711</td>
<td>Failure of structural materials: deformation and fracture</td>
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<th>Lecture / Practice (VÜ)</th>
<th>Weygand, Gumbsch</th>
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<td>Failure of Structural Materials: Deformation and Fracture</td>
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<tr>
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<td>76-T-MACH-102140</td>
<td>Failure of Structural Materials: Deformation and Fracture</td>
<td>Weygand, Gumbsch, Kraft</td>
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</tbody>
</table>

**Competence Certificate**  
oral exam ca. 30 minutes  
no tools or reference materials

**Prerequisites**  
none

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

---

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

**Failure of structural materials: deformation and fracture**  
2181711, WS 21/22, 3 SWS, Language: German, Open in study portal  
Lecture / Practice (VÜ)  
Online

---

Legend: 🃏 Online, ☞ Blended (On-Site/Online), 🗓 On-Site, ⤲ Cancelled
Content

1. Introduction
2. Linear elasticity
3. Classification of stresses
4. Failure due to plasticity
   - Tensile test
   - Dislocations
   - Hardening mechanisms
   - Guidelines for dimensioning
5. Composite materials
6. Fracture mechanics
   - Hypotheses for failure
   - Linear elastic fracture mechanics
   - Crack resistance
   - Experimental measurement of fracture toughness
   - Defect measurement
   - Crack propagation
   - Application of fracture mechanics
   - Atomistics of fracture

The student

- Has the basic understanding of mechanical processes to explain the relationship between externally applied load and materials strength.
- Can explain the foundation of linear elastic fracture mechanics and is able to determine if this concept can be applied to a failure by fracture.
- Can describe the main empirical materials models for deformation and fracture and can apply them.
- Has the physical understanding to describe and explain phenomena of failure.

Preliminary knowledge in mathematics, mechanics and materials science recommended

Regular attendance: 22.5 hours
Self-study: 97.5 hours

The assessment consists of an oral examination (ca. 30 min) according to Section 4(2), 2 of the examination regulation.

Organizational issues

Übungstermine werden in der Vorlesung bekannt gegeben!

Literature

- Bruchvorgänge in metallischen Werkstoffen, D. Aurich (Werkstofftechnische Verlagsgesellschaft Karlsruhe), relativ einfach aber dennoch umfassender Überblick für metallische Werkstoffe
### 3.104 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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**Events**

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**Legend:**  
🖥 Online,  🧩 Blended (On-Site/Online),  🗣 On-Site,  ❌ Cancelled

**Competence Certificate**  
oral exam ca. 30 minutes  
no tools or reference materials

**Prerequisites**  
none

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

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

**Failure of Structural Materials: Fatigue and Creep**  
2181715, WS 21/22, 2 SWS, Language: German, [Open in study portal]  
Lecture (V)  
Blended (On-Site/Online)
Content
1 Fatigue
1.1 Introduction
1.2 Lifetime
1.3 Fatigue Mechanisms
1.4 Material Selection
1.5 Notches and Shape Optimization
1.6 Case Studies: ICE-Accidents

2 Creep
2.1 Introduction
2.2 High Temperature Plasticity
2.3 Phänomenological Description of Creep
2.4 Creep Mechanisms
2.5 Alloying Effects

The student
- has the basic understanding of mechanical processes to explain the relationships between externally applied load and materials strength.
- can describe the main empirical materials models for fatigue and creep and can apply them.
- has the physical understanding to describe and explain phenomena of failure.
- can use statistical approaches for reliability predictions.
- can use its acquired skills, to select and develop materials for specific applications.

preliminary knowledge in mathematics, mechanics and materials science recommended
regular attendance: 22.5 hours
self-study: 97.5 hours

The assessment consists of an oral examination (ca. 30 min) according to Section 4(2), 2 of the examination regulation.

Literature
- Bruchvorgänge in metallischen Werkstoffen, D. Aurich (Werkstofftechnische Verlagsgesellschaft Karlsruhe), relativ einfach aber dennoch umfassender Überblick für metallische Werkstoffe
- Fatigue of Materials, Subra Suresh (2nd Edition, Cambridge University Press); Standardwerk über Ermüdung, alle Materialklassen, umfangreich, für Einsteiger und Fortgeschrittene
3.105 Course: Fatigue of Metallic Materials [T-MACH-105354]

**Responsible:** Dr.-Ing. Stefan Guth

**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

**Grading scale:** Grade to a third

**Recurrence:** Each winter term

**Version:** 2

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**Exams**

- **ST 2021**
  - **76-T-MACH-105354**
  - Fatigue of Metallic Materials
  - Guth

**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

**Competence Certificate**

Oral exam, about 20 minutes

**Prerequisites**

none

**Recommendation**

Basic knowledge in Materials Science will be helpful.

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

**Fatigue of Metallic Materials**

2173585, WS 21/22, 2 SWS, Language: German, Open in study portal

**Lecture (V)**

Blended (On-Site/Online)

**Content**

- Introduction: some interesting cases of damage
- Cyclic Stress Strain Behaviour
- Crack Initiation
- Crack Propagation
- Lifetime Behaviour under Cyclic Loading
- Fatigue of Notched Components
- Influence of Residual Stresses
- Structural Durability

**Learning objectives:**

The students are able to recognise the deformation and the failure behaviour of metallic materials under cyclic loading and to assign it to the basic microstructural processes. They know the sequence and the development of fatigue damages and can evaluate the initiation and the growth of fatigue cracks.

The students can assess the cyclic strength behaviour of metallic materials and components both qualitatively and quantitatively and know the procedures for the assessment of single-stage, multistage and stochastic cyclical loadings. Furthermore, they can take into account the influence of residual stresses.

**Requirements:**

none, basic knowledge in Material Science will be helpful

**Workload:**

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

**Literature**

Ein Manuskript, das auch aktuelle Literaturhinweise enthält, wird in der Vorlesung verteilt.
3.106 Course: Fatigue of Welded Components and Structures [T-MACH-105984]

**Responsible:** Dr. Majid Farajian  
**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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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**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

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

**Fatigue of Welded Components and Structures**

2181731, WS 21/22, 2 SWS, Language: German, Open in study portal

**Content**

The lecture gives an introduction to the following topics:

- weld quality  
- typical damages of welded joints  
- evaluation of notches, defects and residual stresses  
- strength concepts: nominal, structural and notch stress concepts, fracture mechanics  
- life cycle analysis  
- post-treatment methods for an extended lifetime  
- maintenance, reconditioning and repair

The student can:

- describe the influence of welding induced notches, defects and residual stresses on component behavior  
- explain the basics of numerical and experimental methods for the evaluation of statically or cyclically loaded welds  
- explain and can apply them  
- derive measures in order to increase the lifetime of structures with welded joints under cyclical load

preliminary knowledge materials science and mechanics recommended

regular attendance: 22.5 hours  
self-study: 97.5 hours  
Exercise sheets are handed out regularly.  
oral examination (ca. 30 min)  
no tools or reference materials
Organizational issues
Blockveranstaltung. Zur Teilnahme an der Vorlesung ist eine Anmeldung beim Dozenten per E-Mail an Farajian@slv-duisburg.de erforderlich. Vorlesungstermine und Hörsaal werden den angemeldeten Teilnehmern mitgeteilt.

Literature
2. FKM-Richtlinie, Bruchmechanischer Festigkeitsnachweis, Forschungskuratorium Maschinenbau, VDMA Verlag, 2009
3.107 Course: FEM Workshop - Constitutive Laws [T-MACH-105392]

**Responsible:**  Dr. Katrin Schulz  
Dr. Daniel Weygand  

**Organisation:**  KIT Department of Mechanical Engineering  

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

**Type**  
Completed coursework  

**Credits**  
4  

**Grading scale**  
pass/fail  

**Recurrence**  
Each term  

**Version**  
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<td>ST 2021</td>
<td>2183716</td>
<td>FEM Workshop -- Constitutive Laws</td>
<td>2 SWS</td>
<td>Block / 📚</td>
<td>Schulz, Weygand</td>
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</tbody>
</table>

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**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 2021, 2 SWS, Language: German, Open in study portal  
Block (B)  
Blended (On-Site/Online)

**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

**Organizational issues**  
Blockveranstaltung, Termine werden noch bekannt gegeben!  

**Kontakt:**  daniel.weygand@kit.edu
# 3.108 Course: Financial Analysis [T-WIWI-102900]

**Responsible:** Dr. Torsten Luedecke  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-MACH-104884 - Courses of the Department of Economics and Management

<table>
<thead>
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<td>Each summer term</td>
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### Events

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<td>Financial Analysis</td>
<td>2 SWS</td>
<td>Lecture / Online</td>
<td>Luedecke</td>
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<td>ST 2021</td>
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<td>Übungen zu Financial Analysis</td>
<td>2 SWS</td>
<td>Practice / Online</td>
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### Exams

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Legend: 📥 Online, 🧩 Blended (On-Site/Online), ⚪ On-Site, ✗ Cancelled

### 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**  
  Code: 2530205, SS 2021, 2 SWS, Language: English, [Open in study portal](#)

### Literature


Responsible: Prof. Dr. Claus Günther
Organisation: KIT Department of Mechanical Engineering

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

<table>
<thead>
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Events

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<td>2 SWS</td>
<td>Lecture / 🗣️</td>
<td>Günther</td>
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Competence Certificate
oral exam, Duration: 30 minutes
no auxiliary means

Prerequisites
none

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

**Finite Difference Methods for numerical solution of thermal and fluid dynamical problems**

2153405, WS 21/22, 2 SWS, Language: German, Open in study portal

Lecture (V) On-Site

Content

This lecture will be omitted until further.

The students can apply the most important difference schemes for the numerical solution of steady and transient problems which are typical for thermal and fluid flow problems. They are able to discuss the most relevant properties of difference schemes such as consistency, stability and convergence. Furthermore, they can estimate the order of the numerical error and non-appearance of numerical oscillations.

The students get a basic knowledge of relevant numerical algorithms and the use of them in commercial and open fluid flow codes.

The lecture initially presents an overview and then the most important difference schemes for the numerical solution of steady and transient problems which are typical for thermal and fluid flow problems. The most relevant properties of difference schemes at one side as consistency, stability and convergence, at the other side the order of the numerical error and non-appearance of numerical oscillations are described. Algorithms for the solution of coupled systems of equations, characteristic for fluid flow and thermal problems, are reviewed.

- Spatial and temporal discretization
- Properties of difference schemes
- Numerical stability, consistency, convergence
- Nonhomogeneous meshes
- Coupled and noninteracting calculation methods

Organizational issues

Diese Vorlesung wird als Blockvorlesung vom 14. - 18.02.2022 angeboten. Vorherige Anmeldung an claus.günther@kit.edu und heide.hofmann@kit.edu

Literature

Folienkopien
3.110 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

<table>
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**Events**

| ST 2021 | 2182731 | Finite Element Workshop | 2 SWS | Block / X | Weygand, Mattheck, Tesari |

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**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:

**Finite Element Workshop**
2182731, SS 2021, 2 SWS, Language: German, [Open in study portal](#)

**Block (B) Cancelled**

**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

**Organizational issues**
Der Workshop kann im Sommersemester 2021 leider nicht angeboten werden!
3.111 Course: Flows and Heat Transfer in Energy Technology [T-MACH-105403]

Responsibility: 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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<td>Each winter term</td>
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Events

| WT 21/22 | 2189911 | Tutorial 'Flows and Heat Transfer in Energy Technology ' | 1 SWS | Practice / Cheng, Mitarbeiter |

Exams

| ST 2021 | 76-T-MACH-105403 | Flows and Heat Transfer in Energy Technology | Cheng |

Competence Certificate
oral exam, 20 min

Prerequisites
none
3.112 Course: Flows with Chemical Reactions [T-MACH-105422]

Responsible: apl. 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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Events

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<td>Flows with chemical reactions</td>
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Exams

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<td>Flows with Chemical Reactions</td>
<td>Class</td>
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Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
oral exam, duration 30 minutes
Auxiliary none

Prerequisites
none

Recommendation
Fluid Mechanics (T-MACH-105207)
Mathematical Methods in Fluid Mechanics (T-MACH-105295)

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

Flows with chemical reactions
2153406, WS 21/22, 2 SWS, Language: German/English, Open in study portal
Lecture (V)
Online

Content
The students can describe flow scenarios, where a chemical reaction is confined to a thin layer. They can choose simplifying approaches for the underlying chemistry and discuss the problems with focus on the fluid mechanic aspects. The students are able to solve simple problems analytically. Furthermore, they are qualified to discuss simplifications as relevant for an efficient numerical solution of complex problems.

In the lecture we mainly consider problems, where chemical reaction is confined to a thin layer. The problems are solved analytically or they are at least simplified allowing for efficient numerical solution procedures. We apply simplified chemistry and focus on the fluid mechanic aspects of the problems.

Literature
Vorlesungsskript

Buckmaster, J.D.; Ludford, G.S.S.: Lectures on Mathematical Combustion, SIAM 1983
3 COURSES

Course: Fluid Mechanics 1&2 [T-MACH-105207]

T 3.113 Course: Fluid Mechanics 1&2 [T-MACH-105207]

Responsible: Prof. Dr.-Ing. Bettina Frohnapfel
Organisation: KIT Department of Mechanical Engineering

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

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Exams

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Legend:
- Online
- Blended (On-Site/Online)
- On-Site
- Cancelled

Competence Certificate
written exam 3 hours

Prerequisites
none

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

Fluid Mechanics I
2154512, SS 2021, 3 SWS, Language: German, Open in study portal

Content

Introduction to the fundamentals of fluid mechanics for students of mechanical engineering and related fields, physics and mathematics. The lecture is complemented by a tutorial.

- Introduction
- Flows in Nature and Technology
- 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
3 COURSES
Course: Fluid Mechanics 1&2 [T-MACH-105207]

Literature

Fluid Mechanics I
3154510, SS 2021, 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

Fluid Mechanics II
2153512, WS 21/22, 3 SWS, Language: German, Open in study portal

Content
The students know how to derive the fundamental equations for mass and momentum conservation and can introduce material laws for fluids into those. They can discuss the physical meaning of the different terms in the Navier-Stokes-Equations. They are capable of simplifying the mathematical equations that describe the motion of fluids and can compute flow quantities for generic problems based on these simplified equations. This includes the calculation of static and dynamic forces acting from the fluid onto the solid as well as the detailed analysis of two-dimensional viscous flows.

tensor notation, fluid elements in continuum, Reynolds transport theorem, conservation of mass and momentum, continuity equation, constitutive law for Newtonian fluids, Navier-Stokes equations, angular momentum and energy conservation, integral form of the conservation equations, forces between fluids and solids, analytical solutions of the Navier-Stokes equations

Literature

Fluid Mechanics II
3153511, WS 21/22, 3 SWS, Language: English, Open in study portal
Content
The students know how to derive the fundamental equations for mass and momentum conservation and can introduce material laws for fluids into those. They can discuss the physical meaning of the different terms in the Navier-Stokes-Equations. They are capable of simplifying the mathematical equations that describe the motion of fluids and can compute flow quantities for generic problems based on these simplified equations. This includes the calculation of static and dynamic forces acting from the fluid onto the solid as well as the detailed analysis of two-dimensional viscous flows.

tensor notation, fluid elements in continuum, Reynolds transport theorem, conservation of mass and momentum, continuity equation, constitutive law for Newtonian fluids, Navier-Stokes equations, angular momentum and energy conservation, integral form of the conservation equations, forces between fluids and solids, analytical solutions of the Navier-Stokes equations

Literature

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>Grade to a third</td>
<td>Each summer term</td>
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Events

| ST 2021       | 6221806 | Fluid Mechanics of Turbulent Flows | 4 SWS | Lecture / Practice ( / | Uhlmann |

Exams

| ST 2021       | 8244110841 | Fluid Mechanics of Turbulent Flows | Uhlmann |

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

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

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<td>Lecture / Online</td>
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Exams

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<th>Code</th>
<th>Course</th>
<th>Type</th>
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<td>Geimer</td>
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Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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

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

Fluid Technology

2114093, WS 21/22, 2 SWS, Language: German, Open in study portal

Lecture (V) Blended (On-Site/Online)

Content

In the range of hydrostatics the following topics will be introduced:

- Hydraulic fluids
- Pumps and motors
- Valves
- Accessories
- Hydraulic circuits.

In the range of pneumatics the following topics will be introduced:

- Compressors
- Motors
- Valves
- Pneumatic circuits.

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

Literature

Skriptum zur Vorlesung Fluidtechnik
Institut für Fahrzeugsystemtechnik
downloadbar
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

<table>
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<td>Grade to a third</td>
<td>Each summer term</td>
<td>1</td>
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**Events**

| ST 2021 | 2154453 | Fluid-Structure-Interaction with Python | 2 SWS | Mühlhausen |

**Exams**

| ST 2021 | 76-T-MACH-105474 | Fluid-Structure-Interaction | Mühlhausen |

Legend: 🌐 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**
oral exam 30 minutes

**Prerequisites**
none

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

**Fluid-Structure-Interaction with Python**

2154453, SS 2021, 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: apl. Prof. Marc Kamlah
Organisation: KIT Department of Mechanical Engineering

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

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<th>Recurrence</th>
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<td>Each winter term</td>
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Events

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<td>Lecture</td>
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Exams

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<td>Lecture</td>
<td>Kamlah</td>
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Legend: 🖥 Online, 🧱 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

Competence Certificate

oral exam

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

**Foundations of nonlinear continuum mechanics**

2181720, WS 21/22, 2 SWS, Language: German, Open in study portal

**Lecture (V)**

On-Site

Content

The lecture is organized in three parts. In the first part, the mathematical foundations of tensor algebra and tensor analysis are introduced, usually in cartesian representation. In the second part of the lecture, the kinematics, i.e. the geometry of deformation is presented. Besides finite deformation, geometric linearization is discussed. The third part of the lecture deals with the physical balance laws of thermomechanics. It is shown, how a special classical theory of continuum mechanics can be derived by adding a corresponding constitutive model. For the illustration of the theory, elementary examples are discussed repeatedly.

The students understand the fundamental structure of a continuum theory consisting of kinematics, balance laws and constitutive model. In particular, they recognize non-linear continuum mechanics as a common structure including all continuum theories of thermomechanics, which are obtained by adding a corresponding constitutive model. The students understand in detail the kinematics of finite deformation and know the transition to the geometrically linear theory they are familiar with. The students know the spatial and material representation of the theory and the different related tensors. The students take the balance laws as physical postulates and understand their respective physical motivation.


regular attendance: 22,5 hours
self-study: 97,5 hours
oral exam ca. 30 minutes

**Literature**

Vorlesungsskript
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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**Exams**

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<th>Wilhelm</th>
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</table>

**Legend:** 🖥 Online, 🕵️ Blended (On-Site/Online), 🗣 On-Site, ✗ Cancedled

**Competence Certificate**  
oral exam; about 25 minutes

**Prerequisites**  
Materials Science I & II must be passed.

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

**V Foundry Technology**  
2174575, SS 2021, 2 SWS, Language: German, Open in study portal

**Lecture (V)**  
Blended (On-Site/Online)

**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).
Organizational issues
Vorlesungstermine: 23.4., 30.4., 7.5., 21.5., 11.6., 18.6., 2.7., 16.7.

Literature
Literaturhinweise werden in der Vorlesung gegeben
Reference to literature, documentation and partial lecture notes given in lecture
### 3.119 Course: Fuels and Lubricants for Combustion Engines [T-MACH-105184]

**Responsible:** Hon.-Prof. Dr. Bernhard Ulrich Kehrwald  
Dr.-Ing. Heiko Kubach  

**Organisation:** KIT Department of Mechanical Engineering  

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

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**Events**

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**Exams**

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<td>Kehrwald</td>
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</tbody>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**

oral examination, Duration: ca. 25 min., no auxiliary means

**Prerequisites**

none

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

**Fuels and Lubricants for Combustion Engines**  
2133108, WS 21/22, 2 SWS, Language: German, Open in study portal

**Content**

Introduction and basics

Fuels for Gasoline and Diesel engines

Hydrogen

Lubricants for Gasoline and Diesel engines

Coolants for combustion engines

**Literature**

Skript
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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*Legend:* 🖥 Online, 🧩 Blended (On-Site/Online), 👤 On-Site, ✗ Cancelled

**Competence Certificate**

The assessment consists of an oral exam (20 min) taking place at the agreed date.

Auxiliary means: none

The re-examination is offered upon agreement.

**Prerequisites**

none
3.121 Course: Fundamentals for Design of Motor-Vehicle Bodies I [T-MACH-102116]

Responsible: Dipl.-Ing. Horst Dietmar Bardehle
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-104849 - Major Field Automotive Engineering

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Events
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| WT 21/22           | 2113814 | Fundamentals for Design of Motor-Vehicles Bodies I | 1 SWS | Lecture / 🗣 | Bardehle       |

Exams
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| ST 2021           | 76-T-MACH-102116 | Fundamentals for Design of Motor-Vehicle Bodies I | Bardehle, Unrau |
| WT 21/22           | 76-T-MACH-102116 | Fundamentals for Design of Motor-Vehicle Bodies I | Unrau, Bardehle |

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ⏺ Cancelled

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 I
2113814, WS 21/22, 1 SWS, Language: German, Open in study portal

Lecture (V)
On-Site

Content
1. History and design
2. Aerodynamics
3. Design methods (CAD/CAM, FEM)
4. Manufacturing methods of body parts
5. Fastening technology
6. Body in white / body production, body surface

Learning Objectives:
The students have an overview of the fundamental possibilities for design and manufacture of motor-vehicle bodies. They know the complete process, from the first idea, through the concept to the dimensioned drawings (e.g. with FE-methods). They have knowledge about the fundamentals and their correlations, to be able to analyze and to judge relating components as well as to develop them accordingly.

Organizational issues
Termine, nähere Informationen und eventuelle Terminänderungen: siehe Instituts homepage
Dates and further information will be published on the homepage of the institute

Literature
1. Automobiltechnische Zeitschrift ATZ, Friedr. Vieweg & Sohn Verlagsges. mbH, Wiesbaden
2. Automobil Revue, Bern (Schweiz)
3. Automobil Produktion, Verlag Moderne Industrie, Landsberg
3.122 Course: Fundamentals for Design of Motor-Vehicle Bodies II [T-MACH-102119]

**Responsible:** Dipl.-Ing. Horst Dietmar Bardehle

**Organisation:** KIT Department of Mechanical Engineering

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

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**Legends:**

- Online
- Blended (On-Site/Online)
- On-Site
- Cancelled

**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 2021, 1 SWS, Language: German, Open in study portal

**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.

**Organizational issues**

Voraussichtliche Termine, nähere Informationen und evtl. Änderungen: siehe Institutshomepage.

Scheduled dates, further Information and possible changes of date: see homepage of the institute.

**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 [T-MACH-111389]

Responsibilities:

- Dr. Christof Weber
- Organisation: KIT Department of Mechanical Engineering

Part of:

- M-MACH-104849 - Major Field Automotive Engineering

Events

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Competence Certificate

Oral group examination

Duration: appr. 30 minutes

Auxiliary means: none

Prerequisites

none

Annotation

Fundamentals in the Development of Commercial Vehicles I, WT
Fundamentals in the Development of Commercial Vehicles II, ST

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

Fundamentals in the Development of Commercial Vehicles II
2114844, SS 2021, 1 SWS, Language: German, Open in study portal
Lecture (V) Online

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.

Organizational issues

Genaue Termine, nähere Informationen und eventuelle Terminänderungen:
siehe Institutshomepage.
Literature
1. HILGERS, M.: Nutzfahrzeugtechnik lernen, Springer Vieweg, ISSN: 2510-1803

Fundamentals in the Development of Commercial Vehicles I
2113812, WS 21/22, 1 SWS, Language: German, Open in study portal

Content
1. Introduction, definitions, history
2. Development tools
3. Complete vehicle
4. Cab, bodyshell work
5. Cab, interior fitting
6. Alternative drive systems
7. Drive train
8. Drive system diesel engine
9. Intercooled diesel engines

Learning Objectives:
The students have proper knowledge about the process of commercial vehicle development starting from the concept and the underlying original idea to the real design. They know that the customer requirements, the technical realisability, the functionality and the economy are important drivers.
The students are able to develop parts and components. Furthermore they have knowledge about different cab concepts, the interior and the interior design process. Consequently they are ready to analyze and to judge concepts of commercial vehicles as well as to participate competently in the commercial vehicle development.

Organizational issues
Termine und Nähere Informationen: siehe Institutshomepage
Dates and further information will be published on the homepage of the institute.

Literature
T 3.124 Course: Fundamentals of Automobile Development I [T-MACH-105162]

**Responsible:** Hon.-Prof. 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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<tr>
<td>WT 21/22</td>
<td>2113810</td>
<td>Fundamentals of Automobile Development I</td>
<td>1</td>
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<td>2</td>
<td>Grade to a third</td>
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<td>WT 21/22</td>
<td>2113851</td>
<td>Principles of Whole Vehicle Engineering I</td>
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**Exams**

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<tr>
<td>ST 2021</td>
<td>76-T-MACH-105162</td>
<td>Fundamentals of Automobile Development I</td>
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<td>Fundamentals of Automobile Development I</td>
<td>Frech, Unrau</td>
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**Legend:**  
🖥 Online, 🧬 Blended (On-Site/Online), 🗣 On-Site, 🗑 Cancelled

**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 I**  
2113810, WS 21/22, 1 SWS, Language: German, Open in study portal

**Lecture (V)**  
Online

**Content**

1. Process of automobile development  
2. Conceptual dimensioning and design of an automobile  
3. Laws and regulations – National and international boundary conditions  
4. Aero dynamical dimensioning and design of an automobile I  
5. Aero dynamical dimensioning and design of an automobile II  
6. Thermo-management in the conflict of objectives between styling, aerodynamic and packaging guidelines I  
7. Thermo-management in the conflict of objectives between styling, aerodynamic and packaging guidelines II

**Learning Objectives:**

The students have an overview of the fundamentals of the development of automobiles. They know the development process, the national and the international legal requirements that are to be met. They have knowledge about the thermo-management, aerodynamics and the design of an automobile. They are ready to judge goal conflicts in the field of automobile development and to work out approaches to solving a problem.

**Organizational issues**

Termine und nähere Informationen finden Sie auf der Institutshomepage.  
Kann nicht mit Lehrveranstaltung 2113851 kombiniert werden.  
Date and further information will be published on the homepage of the institute.  
Cannot be combined with lecture 2113851.
Literature
Skript zur Vorlesung wird zu Beginn des Semesters ausgegeben
The scriptum will be provided during the first lessons

**Principles of Whole Vehicle Engineering I**
2113851, WS 21/22, 1 SWS, Language: English, Open in study portal

**Content**
1. Process of automobile development
2. Conceptual dimensioning and design of an automobile
3. Laws and regulations – National and international boundary conditions
4. Aero dynamical dimensioning and design of an automobile I
5. Aero dynamical dimensioning and design of an automobile II
6. Thermo-management in the conflict of objectives between styling, aerodynamic and packaging guidelines I
7. Thermo-management in the conflict of objectives between styling, aerodynamic and packaging guidelines II

**Learning Objectives:**
The students have an overview of the fundamentals of the development of automobiles. They know the development process, the national and the international legal requirements that are to be met. They have knowledge about the thermo-management, aerodynamics and the design of an automobile. They are ready to judge goal conflicts in the field of automobile development and to work out approaches to solving a problem.

**Organizational issues**
Termine und nähere Informationen finden Sie auf der Institutshomepage.
Dats and further information will be published on the homepage of the institute.
Kann nicht mit Lehrveranstaltung 2113810 kombiniert werden
Cannot be combined with lecture 2113810.

**Literature**
Skript zur Vorlesung wird zu Beginn des Semesters ausgegeben
The scriptum will be provided during the first lessons
Course: Fundamentals of Automobile Development II [T-MACH-105163]

**Responsible:** Hon.-Prof. Rolf Frech

**Organisation:** KIT Department of Mechanical Engineering

**Part of:**
- M-MACH-104849 - Major Field Automotive Engineering
- M-MACH-104878 - Specification in Mechanical Engineering
- M-MACH-105134 - Elective Module Mechanical Engineering

**Type**
- Written examination

**Credits**
- 2

**Grading scale**
- Grade to a third

**Recurrence**
- Each summer term

**Version**
- 2

**Events**

| ST 2021 | 2114842 | Fundamentals of Automobile Development II | 1 SWS | Block/Online | Frech |
| ST 2021 | 2114860 | Principles of Whole Vehicle Engineering II | 1 SWS | Online | Frech |

**Exams**

| ST 2021 | 76-T-MACH-105163 | Fundamentals of Automobile Development II | Frech, Unrau |
| WT 21/22 | 76-T-MACH-105163 | Fundamentals of Automobile Development II | Unrau, Frech |

**Competence Certificate**

**Written examination**

**Duration:** 90 minutes

**Auxiliary means:** none

**Prerequisites**

none

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

**Fundamentals of Automobile Development II**

2114842, SS 2021, 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.

**Organizational issues**

Vorlesung findet als Blockvorlesung statt.
Kann nicht mit der Veranstaltung [2114860] kombiniert werden.
Cannot be combined with lecture [2114860].

**Literature**

Skript zur Vorlesung ist über ILIAS verfügbar.
Principles of Whole Vehicle Engineering II
2114860, SS 2021, 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.

Organizational issues
Kann nicht mit der Veranstaltung [2114842] kombiniert werden.
Cannot be combined with lecture [2114842].
Raum 219, Geb. 70.04, Campus Ost.
Genaue Termine entnehmen Sie bitte der Institutshomepage.
Scheduled dates:
see homepage of the institute.

Literature
Das Skript zur Vorlesung ist über ILIAS verfügbar.
3.126 Course: Fundamentals of Catalytic Exhaust Gas Aftertreatment [T-MACH-105044]

**Responsible:** Prof. Dr. Olaf Deutschmann  
Prof. Dr. Jan-Dierk Grunwaldt  
Dr.-Ing. Heiko Kubach  
Hon.-Prof. Dr. Egbert Lox

**Organisation:** KIT Department of Mechanical Engineering

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

**Type**  
Oral examination

**Credits**  
4

**Grading scale**  
Grade to a third

**Recurrence**  
Each summer term

**Version**  
1

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**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 2021, 2 SWS, Language: German, Open in study portal

**Organizational issues**  
Blockvorlesung, Termin und Ort werden auf der Homepage des IFKM und ITCP bekannt gegeben.

**Literature**  

**Fundamentals of catalytic exhaust gas aftertreatment**  
2134138, WS 21/22, 2 SWS, Language: German, Open in study portal

**Organizational issues**  
Blockvorlesung, Termin und Ort werden auf der Homepage des IFKM und ITCP bekannt gegeben.
Literature
Skript, erhältlich in der Vorlesung

3.127 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

**Events**

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**Competence Certificate**
oral exam, 30 min

**Prerequisites**
none

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

**Fundamentals of Combustion Engine Technology**
2133123, WS 21/22, 2 SWS, Language: German, Open in study portal

**Content**
Fundamentals of engine processes  
Components of combustion engines  
Mixture formation systems  
Gas exchange systems  
Injection systems  
Exhaust Gas Aftertreatment Systems  
Cooling systems  
Ignition Systems
**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

### Events

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**Exams**

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<td>Fundamentals of Energy Technology</td>
<td>Badea, Cheng</td>
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</table>

**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 2021, 3 SWS, Language: German, Open in study portal

Lecture (V)  
Online

**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
3.129 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

Event: Type | Credits | Grading scale | Recurrence | Version
--- | --- | --- | --- | ---
Oral examination | 4 | Grade to a third | Each winter term | 1

Events

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Competence Certificate
oral exam about 30 minutes

Prerequisites
none

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

Fundamentals of reactor safety for the operation and dismantling of nuclear power plants

2190465, WS 21/22, 2 SWS, Language: German/English, Open in study portal

On-Site

Content
This lecture describes the fundamentals of reactor safety for both the operation and the decommissioning of nuclear power plants. The first part will be focused on reactor safety issues important for the operation of a NPP:

- Safety fundamentals as defense in depth, multi-barrier concepts
- Operational modes of nuclear power plants
- Main components for heat removal, safety systems of selected NPP designs
- Thermal characterization of the core and plant under normal operation conditions
- Accident analysis in nuclear power plants- initiation, methods of evaluations and safety implications

The second part of this lecture will be devoted to explain the neutron physical, radiation protection and safety aspects to be considered for the safe and economical decommissioning of nuclear power plants:

- Life cycle of a nuclear power plant and main strategies and challenges in the NPP decommissioning
- Physical processes responsible for the activation of reactor components during the operation of a nuclear power plant
- Radioactive waste generation in the core, classification and radiological relevance
- Waste classification, minimization methods and intermediate and final disposal
- Risk analysis and prevention, radiation protection issues and the regulatory framework for decommissioning
- Computational methods for the estimation of nuclei inventories, activation and dose rates of reactor components

Knowledge in energy technology, nuclear power plants, reactor physics, radiation protection is welcomed

Time of attendance: 30 hours

Self-study: 90 hours
oral examination: duration: about 30 minutes

Organizational issues
Anmeldung über ILIAS
Literature
Bibliography related to the Block Course “Fundamentals of Reactor Safety for the Operation and Dismantling of NPPs”

7. “Safe and effective nuclear power plant life cycle management towards decommissioning”, IAEA-TECDOC-1305.
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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<td>Lecture / Practice (VÜ)</td>
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**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, materials sciences and physics

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

**Fusion Technology A**

2169483, WS 21/22, 2 SWS, Language: German, Open in study portal

**Lecture / Practice (VÜ) On-Site**

**Content**

To transfer the basic physical concepts of particle physics, fusion and nuclear fission; this includes fundamental questions such as how: What is a plasma? How can it be ignited? What is the difference between magnetic and inertial fusion? Based on this, aspects of the stability of plasmas, their control and particle transport are discussed. After characterizing the plasma, the "fire" of fusion, the confinement in magnetic fields is sketched, which are built up with the help of magnetic technology. Here, knowledge of superconductivity, production and design of magnets is imparted. A reactor operation with a plasma as energy source requires a continuous operation of a tritium and fuel cycle, which is generated by the fusion reactor itself. Since fusion plasmas require small material densities, vacuum technology plays a central role. Finally, the heat generated in the fusion power plant must be converted into a power plant process and the reaction products removed. The functional basics and the structure of these fusion-typical in-vessel components are presented and the current challenges and the state of the art are demonstrated.

The course describes the essential functional principles of a fusion reactor, beginning with plasma, magnet technology, the tritium and fuel cycle, vacuum technology and the associated material sciences. The physical basics will be taught and the engineering laws of scaling will be demonstrated. Special importance is attached to the understanding of the interfaces between the different subject areas, which essentially determine the engineering technical interpretations. Methods for identifying and evaluating the central parameters will be demonstrated. Based on the acquired perception skills, methods for the design of solution strategies will be taught and technical solutions will be identified, their weak points discussed and evaluated.

**Recommendations/Pre-knowledge:**

Basic knowledge of fluid mechanics, materials engineering and physics. Knowledge of heat and mass transfer and electrical engineering is helpful.

Presence time: 21 h  
Self-study: 90 h  
Oral examination:  
Duration: approx. 30 minutes, aids: none
Organizational issues
Die Veranstaltung wird nur online gehalten, falls durch Corona Einschränkungen vorgegeben werden.

Literature
Innerhalb jedes Teilblockes wird eine Literaturliste der jeweiligen Fachliteratur angegeben. Zusätzlich erhalten die Studenten/-innen das Studienmaterial in gedruckter und elektronischer Version.
3.131 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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<td>Each summer term</td>
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**Legend:** 🗣 Online, 🖥 Blended (On-Site/Online), 🗣 On-Site, ☐ Cancelled

**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 2021, 2 SWS, Language: German, Open in study portal
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

3.132 Course: Gasdynamics [T-MACH-105533]

Responsible: Dr.-Ing. Franco Magagnato
Organisation: KIT Department of Mechanical Engineering

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

Type
Oral examination

Credits
4

Grading scale
Grade to a third

Recurrence
Each winter term

Version
1

Events
WT 21/22 2154200 Gasdynamics 2 SWS Lecture / 🧩 Serpieri, Magagnato, Gatti

Exams
ST 2021 76-T-MACH-105533 Gasdynamics Magagnato
WT 21/22 76-T-MACH-105533 Gasdynamics Gatti, Serpieri, Magagnato

Legends: 🏛 Online, 🧩 Blended (On-Site/Online), 🗝 On-Site, ✗ Cancelled

Competence Certificate
oral exam - 30 minutes

Prerequisites
none

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

Gasdynamics
2154200, WS 21/22, 2 SWS, Language: English, Open in study portal

Content
The student can describe the governing equations of Gas Dynamics and the associated basics in Thermodynamics. He will know different flow phenomena of applied Gas Dynamics. He can calculate compressible flows analytically. He is familiar with the Rankine-Hugoniot curve. They can derive the continuity-, the momentum- and the energy equations in differential form. With the help of the stationary flow filament theory they can calculate the normal shock wave and the associated increase of the entropy along past the shock wave. They are able to calculate the stagnation values of the Gas Dynamical variables and to determine their critical values. The students can apply the flow filament theory for variable cross-sectional areas and can distinguish between the different flow fields inside the Laval nozzle that forms with different boundary conditions. He can calculate the values behind an oblique shock wave and can distinguish between detached and attached shock waves. The student can calculate the Prandtl-Meyer expansion wave.

This lecture covers the following topics:

- Introduction to gas dynamics
- Numerical and experimental examples
- Governing equations of gas dynamics
- The transport equations in differential and integral form
- Stationary flow filament theory with and without normal shock waves
- Discussion of the energy equation: Stagnation and critical values
- Flow filament theory at variable cross-sectional area. Flow inside a Laval nozzle
- Oblique shock waves, detached shock waves
- Prandtl-Meyer expansion wave
- Viscous flows (Fanno flow)

Literature
Zierep, J.: Theoretische Gasdynamik, Braun Verlag, Karlsruhe. 1991
3.133 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

<table>
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<th>Recurrence</th>
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<td>Grade to a third</td>
<td>Each winter term</td>
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**Events**

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<td>Gear Technology</td>
<td>2 SWS</td>
<td>Lecture / 🧩</td>
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</table>

**Exams**

| ST 2021 | 76-T-MACH-102148 | Gear Cutting Technology | | Klaiber |

**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🔇 On-Site, ✗ Cancelled

**Competence Certificate**

Oral Exam (20 min)

**Prerequisites**

none

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

**Gear Technology**

2149655, WS 21/22, 2 SWS, Language: German, Open in study portal  
Lecture (V) Blended (On-Site/Online)

**Content**

Based on the gearing theory, manufacturing processes and machine technologies for producing gearings, the needs of modern gear manufacturing will be discussed in the lecture. For this purpose, various processes for various gear types are taught which represent the state of the art in practice today. A classification in soft and hard machining and furthermore in cutting and non-cutting technologies will be made. For comprehensive understanding the processes, machine technologies, tools and applications of the manufacturing of gearings will be introduced and the current developments presented. For assessment and classification of the applications and the performance of the technologies, the methods of mass production and manufacturing defects will be discussed. Sample parts, reports from current developments in the field of research and an excursion to a gear manufacturing company round out the lecture.

**Learning Outcomes:**

The students …

- can describe the basic terms of gearings and are able to explain the imparted basics of the gearwheel and gearing theory.
- are able to specify the different manufacturing processes and machine technologies for producing gearings. Furthermore they are able to explain the functional principles and the dis-/advantages of these manufacturing processes.
- can apply the basics of the gearing theory and manufacturing processes on new problems.
- are able to read and interpret measuring records for gearings. are able to make an appropriate selection of a process based on a given application
- can describe the entire process chain for the production of toothed components and their respective influence on the resulting workpiece properties.

**Workload:**

regular attendance: 21 hours  
self-study: 99 hours

**Organizational issues**

Start: 21.10.2021
**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/).
### 3.134 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>Each summer term</td>
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#### Events

| ST 2021 | 3118095 | Global Logistics | 2 SWS | / | Furmans, Kivelä, Jacobi |

#### Exams

| ST 2021 | 76-T-MACH-105379 | Global Logistics | Furmans |

**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ⌚️ Canceled

**Competence Certificate**

oral exam (20 min)

**Prerequisites**

none

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

<table>
<thead>
<tr>
<th>Global Logistics</th>
<th>3118095, SS 2021, 2 SWS, Language: English, Open in study portal</th>
</tr>
</thead>
</table>
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

Organizational issues

Attendance during lecture is required. Admission to the exam is only possible when attending the lecture.

Literature

Arnold, Dieter; Furmans, Kai : Materialfluss in Logistiksystemen; Springer-Verlag Berlin Heidelberg
3 COURSES
Course: Global Production and Logistics - Part 2: Global Logistics [T-MACH-105159]

T 3.135 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

<table>
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Events

| ST 2021 | 2149600 | Global Logistics | 2 SWS | Lecture / 🧩 | Furmans |

Exams

| ST 2021 | 76-T-MACH-105159 | Global Production and Logistics - Part 2: Global Logistics / New: Global Logistics | Furmans |

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🔴 On-Site, ✗ Cancelled

Competence Certificate
The assessment consists of a 60 minutes written examination (according to §4(2), 1 of the examination regulation).

Prerequisites
none

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

V Global Logistics
2149600, SS 2021, 2 SWS, Language: German, Open in study portal

Lecture (V) Blended (On-Site/Online)
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. Handbuch Logistik, Springer Verlag, 2002 (Neuauflage in Arbeit)
- Domschke. Logistik, Rundreisen und Touren, Oldenbourg Verlag, 1982
- Domschke/Drexel. Logistik, Standorte, Oldenbourg Verlag, 1996
- Gudehus. Logistik, Springer Verlag, 2007
- Tempelmeier. Bestandsmanagement in Supply Chains, Books on Demand 2006
3.136 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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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**

Verbally

**Duration:** 30 up to 40 minutes

**Auxiliary means:** none

**Prerequisites**

none

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

### Handling Characteristics of Motor Vehicles I

2113807, WS 21/22, 2 SWS, Language: German, [Open in study portal](#)

**Lecture (V)**

**On-Site**

**Content**

1. Problem definition: Control loop driver - vehicle - environment (e.g. coordinate systems, modes of motion of the car body and the wheels)

2. Simulation models: Creation from motion equations (method according to D'Alembert, method according to Lagrange, programme packages for automatically producing of simulation equations), model for handling characteristics (task, motion equations)

3. Tyre behavior: Basics, dry, wet and winter-smooth roadway

**Learning Objectives:**

The students know the basic connections between drivers, vehicles and environment. They can build up a vehicle simulation model, with which forces of inertia, aerodynamic forces and tyre forces as well as the appropriate moments are considered. They have proper knowledge in the area of tyre characteristics, since a special meaning comes to the tire behavior during driving dynamics simulation. Consequently they are ready to analyze the most important influencing factors on the driving behaviour and to contribute to the optimization of the handling characteristics.

**Literature**


3.137 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

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** Exams **

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**Legend:** [Online], [Blended (On-Site/Online)], [On-Site], [Cancelled]

**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 2021, 2 SWS, Language: German, [Open in study portal](#)

**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**


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Module Offers in Mechanical Engineering for Temporary Students, Date: 15/09/2021 Valid from Winter Term 2021/2022
3.138 Course: Hands-on BioMEMS [T-MACH-106746]

Responsible: apl. Prof. Dr. Andreas Guber
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-105134 - Elective Module Mechanical Engineering

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Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

**Competence Certificate**

Oral presentation and discussion (30 Min.)

**Prerequisites**

none
3.139 Course: Heat and Mass Transfer [T-MACH-105292]

**Responsible:** Prof. Dr. Ulrich Maas  
Dr.-Ing. Chunkan Yu

**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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<td>Heat and Mass Transfer</td>
<td>Maas</td>
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</table>

**Prerequisites**

none

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

**Heat and Mass Transfer**  
3122512, SS 2021, 2 SWS, Language: English, Open in study portal

**Content**

- Steady and unsteady heat transfer in homogenous materials; Plates, pipe sections and spherical shells
- Molecular diffusion in gases; analogies between heat conduction and mass diffusion
- Convective, forced heat transfer in pipes/channels and around plates and profiles.
- Convective mass transfer, heat-/mass transfer analogy
- Multi phase convective heat transfer (condensation, evaporation)
- Radiative heat transfer

**Organizational issues**

Bitte beachten Sie den Aushang.

**Literature**

- Maas ; Vorlesungsskript "Wärme- und Stoffübertragung"

**Heat and mass transfer**  
2165512, WS 21/22, 2 SWS, Language: German, Open in study portal

**Content**

- Steady and unsteady heat transfer in homogenous materials; Plates, pipe sections and spherical shells
- Molecular diffusion in gases; analogies between heat conduction and mass diffusion
- Convective, forced heat transfer in pipes/channels and around plates and profiles.
- Convective mass transfer, heat-/mass transfer analogy
- Multi phase convective heat transfer (condensation, evaporation)
- Radiative heat transfer
Literature

- Maas; Vorlesungsskript "Wärme- und Stoffübertragung"
- Baehr, H.-D., Stephan, K.: "Wärme- und Stoffübertragung". Springer Verlag, 1993
3.140 Course: Heat Transfer in Nuclear Reactors [T-MACH-105529]

**Responsible:** Prof. Dr.-Ing. Xu Cheng

**Organisation:** KIT Department of Mechanical Engineering

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

**Type** | **Credits** | **Grading scale** | **Recurrence** | **Version**
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Oral examination | 4 | Grade to a third | Each winter term | 1

**Events**

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<td>WT 21/22</td>
<td>2189907</td>
<td>Flow and heat transfer in nuclear reactors</td>
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**Exams**

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<td>Heat Transfer in Nuclear Reactors</td>
<td>Cheng</td>
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</tbody>
</table>

**Competence Certificate**

oral exam, 20 min

**Prerequisites**

none

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

**Flow and heat transfer in nuclear reactors**

2189907, WS 21/22, 2 SWS, Language: English, Open in study portal

**Content**

This lecture is designed for students of mechanical engineering and other engineering disciplines in their Bachelor or Master studies. The students will understand the most important heat transfer processes and learn the methods for the analysis of flow and heat transfer in nuclear reactors. Students are capable of explaining the thermal-hydraulic processes occurring in nuclear reactors and of selecting suitable models or simulation codes for thermal-hydraulic design and analysis.

1. Reactor types and thermal-hydraulic design criteria
2. Heat transfer processes and modeling
3. Pressure drop calculation
4. Temperature distribution in nuclear reactor
5. Numerical analysis methods for nuclear reactor thermal-hydraulics

**Organizational issues**

This compact English lecture will be given on October 11-13, 2021, 09:00-17:00.

**Literature**

1. L.S. Tong, J. Weisman, Thermal-hydraulics of pressurized water reactors, American Nuclear Society, La Grande Park, Illinois, USA
**3.141 Course: Heatpumps [T-MACH-105430]**

**Responsible:** Prof. Dr. Ulrich Maas  
Dr.-Ing. Heinrich 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>76-T-MACH-105430</td>
<td>Lecture / Blended (On-Site/Online)</td>
<td>Maas, Wirbser</td>
<td></td>
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</tbody>
</table>

**Competence Certificate**

Oral exam (20 min)

**Prerequisites**

None

---

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

**Heatpumps**  
2166534, SS 2021, 2 SWS, Language: German, [Open in study portal](#)  
Lecture (V)  
Online

**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  

**Heatpumps**  
2166534, WS 21/22, 2 SWS, Language: German, [Open in study portal](#)  
Lecture (V)  
Blended (On-Site/Online)

**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.
3 COURSES

Course: Heatpumps [T-MACH-105430]

Module Offers in Mechanical Engineering for Temporary Students

Date: 15/09/2021

Valid from Winter Term 2021/2022

Literature

Vorlesungsunterlagen

Bach, K.: Wärmepumpen, Bd. 26 Kontakt und Studium, Lexika Verlag, 1979


### 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

<table>
<thead>
<tr>
<th>Events</th>
<th>Credits</th>
<th>Grade</th>
<th>Recurrence</th>
<th>Type</th>
<th>Version</th>
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<tbody>
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<td>WT 21/22 2183721 High Performance Computing 2 SWS Lecture / Practice (VÜ) Online</td>
<td>5</td>
<td>Grade to a third</td>
<td>Each term</td>
<td>Written examination</td>
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**Exams**
- **ST 2021 76-T-MACH-105398** High Performance Computing | Nestler, Selzer

**Legend:** Online, Blended (On-Site/Online), On-Site, Cancelled

### 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

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

#### High Performance Computing
- **2183721, WS 21/22, 2 SWS, Language: German, Open in study portal**
- Lecture / Practice (VÜ) Online

### Content
Topics of the high performance computing course are:

- architectures of parallel platforms
- parallel programming models
- performance analysis of concurrent programs
- parallelization models
- MPI and OpenMP
- Monte-Carlo method
- 1D & 2D heat diffusion
- raycasting
- n-body problem
- simple phase-field models

The student can explain the foundations and strategies of parallel programming  
can efficiently apply high performance computers for simulations by elaborating respective parallelisation techniques.  
has an overview of typical applications and the specific requirements for parallelization.  
knows the concepts of parallelisation and is capable to apply these to efficiently use high performance computing  
resources and the growing performance of multi core processors in science and industry.  
has experiences in programming of parallel algorithms through integrated computer exercises.  

preliminary knowledge in mathematics, physics and materials science recommended

regular attendance: 22.5 hours lecture, 11.5 hours exercises
self-study: 116 hours

We regularly discuss exercises at the computer.

At the end of the semester, there will be a written exam.
Organizational issues
Termine für die Vorlesung HPC im WS 2021/2022 werden noch bekannt gegeben.

Literature

1. Vorlesungsskript; Übungsaufgabenblätter; Programmgerüste
2. Parallele Programmierung, Thomas Rauber, Gudula Rügner; Springer 2007
3.143 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

<table>
<thead>
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<td>Each summer term</td>
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Events

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<th>ST 2021</th>
<th>2126749</th>
<th>Advanced powder metals</th>
<th>2 SWS</th>
<th>Lecture / Online</th>
<th>Schell</th>
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Exams

<table>
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<th>ST 2021</th>
<th>76-T-MACH-102157</th>
<th>High Performance Powder Metallurgy Materials</th>
<th>Schell</th>
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<tbody>
<tr>
<td>WT 21/22</td>
<td>76-T-MACH-102157</td>
<td>High Performance Powder Metallurgy Materials</td>
<td>Schell</td>
</tr>
</tbody>
</table>

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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 2021, 2 SWS, Language: German, Open in study portal

Literature

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

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Exams

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<th>Grade</th>
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<td>ST 2021</td>
<td>High Temperature Materials</td>
<td>4</td>
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</tbody>
</table>

Competence Certificate
Oral exam, about 25 minutes

Prerequisites
none

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

High Temperature Materials
2174605, WS 21/22, 2 SWS, Language: English, Open in study portal

Content

- Phenomenology of High Temperature Deformation
- Deformation Mechanisms
- High Temperature Structural Materials

learning objectives:
Students are able to

- Define properly the term "high temperature" with respect to materials
- Describe the shape of the creep curve based on underlying deformation mechanisms
- Rationalize the influence of relevant parameters such as temperature, stress, microstructure on the high temperature deformation behavior
- Develop strategies for improving creep resistance of alloys via modifying their composition
- Select properly industrially relevant high temperature structural materials for various applications

Literature
B. Ilschner, Hochtemperaturplastizität, Springer-Verlag, Berlin

**Responsible:** Prof. Dr.-Ing. Tamim Asfour  
Hon.-Prof. Dr. Uwe Spetzger  

**Organisation:** KIT Department of Informatics  
**Part of:** M-MACH-105134 - Elective Module Mechanical Engineering

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<td>Each term</td>
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| Events | | |
|--------|-----------------|-----------------|------------|---------|
| ST 2021 | 24678 | Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy | 2 SWS | Lecture | Spetzger |
| WT 21/22 | 24139 | Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy | 2 SWS | Lecture | Spetzger |

| Exams | | |
|--------|-----------------|-----------------|------------|---------|
| ST 2021 | 7500145 | Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy | Spetzger |
| WT 21/22 | 7500118 | Human Brain and Central Nervous System: Anatomy, Information Transfer, Signal Processing, Neurophysiology and Therapy | Spetzger |

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled
3.146 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

<table>
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<tr>
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<th>Grading scale</th>
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<th>Version</th>
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<tbody>
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<td>Grade to a third</td>
<td>Each winter term</td>
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Events

WT 21/22 2109035 Human Factors Engineering I: Ergonomics 2 SWS Lecture / Online Deml

Exams

ST 2021 76-T-MACH-105518 Human Factors Engineering I Deml

Exams

WT 21/22 76-T-MACH-105518 Human Factors Engineering I Deml

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

Prerequisites
none

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

Human Factors Engineering I: Ergonomics
2109035, WS 21/22, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

Content

The course "Human Factors Engineering I: Ergonomics" takes place in the first half of the semester, until 2021/12/10, on Wednesday and Thursday.

In the second half of the semester, beginning with 2021/12/15, the course "Human Factors Engineering II: Work Organisation" takes place on Wednesday and Thursday.

Content of teaching:

1. Principles of human work
2. Behavioural-science data acquisition
3. workplace design
4. work environment design
5. work management
6. labour law and advocacy groups

Learning target:

The students acquire a basic knowledge in the field of ergonomics:

- They are able to consider cognitive, physiological, anthropometric, and safety technical aspects in order to design workplaces ergonomically.
- Just as well they know physical and psycho-physical fundamentals (e. g. noise, lighting, climate) in the field of work-environmental design.
- Furthermore the students are able to evaluate workplaces by knowing and being able to apply essential methods of time studies and payment systems.
- Finally, they get a first, overall insight into the German labour law as well as into the organisation of advocacy groups beyond companies.

Further on the participants get to know basic methods of behavioral-science data acquisition (e. g. eye-tracking, ECG, dual-task-paradigm).
Organizational issues
In der zweiten Hälfte des Semesters, ab dem 15.12.2021, findet die Veranstaltung "Arbeitswissenschaft II: Arbeitsorganisation" am Mittwoch und Donnerstag statt.
- schriftliche Prüfung
- Die Vorlesung hat einen Arbeitsaufwand von 120 h (=4 LP).

Literature
Die Kursmaterialien stehen auf ILIAS zum Download zur Verfügung.
### 3.147 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

<table>
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<th>Version</th>
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<tbody>
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<td>Grade to a third</td>
<td>Each winter term</td>
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#### Events

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<th>2109036</th>
<th>Human Factors Engineering II: Work Organisation</th>
<th>2 SWS</th>
<th>Lecture / 🧩</th>
<th>Deml</th>
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#### Exams

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<th>76-T-MACH-105519</th>
<th>Human Factors Engineering II</th>
<th>Deml</th>
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<tbody>
<tr>
<td>WT 21/22</td>
<td>76-T-MACH-105519</td>
<td>Human Factors Engineering II</td>
<td>Deml</td>
</tr>
</tbody>
</table>

*Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled*

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

**Prerequisites**  
one

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

### Human Factors Engineering II: Work Organisation

2109036, WS 21/22, 2 SWS, Language: German, [Open in study portal](#)  
**Lecture (V)**  
Blended (On-Site/Online)
**Content**

The course "Human Factors Engineering I: Ergonomics" takes place in the first half of the semester, until 2021/12/10, on Wednesday and Thursday.

In the second half of the semester, beginning with 2021/12/15, the course "Human Factors Engineering II: Work Organisation" takes place on Wednesday and Thursday.

Content of teaching:

1. Fundamentals of work organization
2. Empirical research methods
3. Individual level
   - personnel selection
   - personnel development
   - personnel assessment
   - work satisfaction/motivation
4. Group level
   - interaction and communication
   - management of employees
   - team work
5. Organizational level
   - structural organization
   - process organization
   - production organization

Learning target:

The students gain a first insight into empirical research methods (e.g. experimental design, statistical data evaluation). Particularly, they acquire a basic knowledge in the field of work organisation:

- **Organizational level.** Within this module the students gain also a fundamental knowledge in the field of structural, process, and production organization.
- **Group level.** Besides, they get to know basic aspects of industrial teamwork and they know relevant theories in the field of interaction and communication, the management of employees as well as work satisfaction and motivation.
- **Individual level.** Finally, the students get to know also methods in the field of personnel selection, development, and assessment.

**Organizational issues**


In der zweiten Hälfte des Semesters, ab dem 15.12.2021, findet die Veranstaltung "Arbeitswissenschaft II: Arbeitsorganisation" am Mittwoch und Donnerstag statt.

- schriftliche Prüfung
- Die Vorlesung hat einen Arbeitsaufwand von 120 h (=4 LP).

**Literature**

Die Kursmaterialien stehen auf ILIAS zum Download zur Verfügung.
### 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

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

| ST 2021 | 2110036 | Human Factors Engineering III: Empirical research methods | 2 SWS | Seminar / 🖥 | Deml |

**Exams**

| ST 2021 | 76-T-MACH-105830 | Human Factors Engineering III: Empirical research methods | Deml |

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗓 On-Site, ❌ Cancelled

**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.

**Content**  
The aim of the course is for participants to become familiar with and apply research methods in occupational science. For this purpose, the participants will receive an introduction to the basics of experimental design and they will learn essential methods of data collection and statistical data analysis. Subsequently, the participants will conduct, evaluate and present their own experimental studies on the topics of driver behavior and driving simulation. Weekly face-to-face attendance at lecture sessions as well as small group sessions in the lab is mandatory. Depending on how the corona situation unfolds, the course will be present or online. In addition, an approximately six-page research report and presentation are required as part of the course.

**Organizational issues**  
3.149 Course: Human-Machine-Interaction [TINFO-101266]

**Responsible:** Prof. Dr.-Ing. Michael Beigl

**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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<td>2 SWS</td>
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**Exams**

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<td>Beigl</td>
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<td>WT 21/22</td>
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**Legend:** 📜 Online, 📜 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Prerequisites**

none
3.150 Course: Hybrid and Electric Vehicles [T-ETIT-100784]

Responsibility: 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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<td>Hybrid and Electric Vehicles</td>
<td>2 SWS</td>
<td>Lecture</td>
<td>Doppelbauer</td>
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<td>2306323</td>
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<td>1 SWS</td>
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Exams

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Prerequisites

none
3 COURSES

3.151 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

<table>
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Events

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<td>ST 2021 2157432</td>
<td>Hydraulic Fluid Machinery</td>
<td>4 SWS Lecture / Pritz</td>
</tr>
<tr>
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<td></td>
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<tr>
<td>ST 2021 76-T-MACH-105326</td>
<td>Hydraulic Fluid Machinery</td>
<td>Pritz</td>
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<tr>
<td>WT 21/22 76-T-MACH-105326</td>
<td>Hydraulic Fluid Machinery</td>
<td>Pritz</td>
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Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
oral exam, 40 min.

Prerequisites
None.

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

Hydraulic Fluid Machinery
2157432, SS 2021, 4 SWS, Language: German, Open in study portal

 Lecture (V)
Blended (On-Site/Online)

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
3.152 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

<table>
<thead>
<tr>
<th>Type</th>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral examination</td>
<td>4</td>
<td>Grade to a third</td>
<td>Each summer term</td>
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Events

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<thead>
<tr>
<th>Events</th>
<th>Credits</th>
<th>Lecture</th>
<th>Duration</th>
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<tbody>
<tr>
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<td>2 SWS</td>
<td>Lecture / Online</td>
<td>approximately 30 minutes</td>
<td>Jordan</td>
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Exams

<table>
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<tr>
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<th>Credits</th>
<th>Lecture</th>
<th>Duration</th>
<th>Responsible</th>
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<tbody>
<tr>
<td>ST 2021 76-T-MACH-105416</td>
<td>2 SWS</td>
<td>Lecture / Online</td>
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<td>Jordan</td>
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</table>

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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:

Hydrogen Technologies
2170495, SS 2021, 2 SWS, Language: German, Open in study portal

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
### 3.153 Course: Industrial Aerodynamics [T-MACH-105375]

**Responsible:** Prof. Dr.-Ing. Thomas Breitling  
Prof. Dr.-Ing. Bettina Frohnapfel  

**Organisation:** KIT Department of Mechanical Engineering

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

**Type**  
Oral examination

**Credits**  
4

**Grading scale**  
Grade to a third

**Recurrence**  
Each winter term

**Version**  
1

<table>
<thead>
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<th>Events</th>
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<th>Type</th>
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<tbody>
<tr>
<td>WT 21/22 2153425</td>
<td>2 SWS</td>
<td>Industrial aerodynamics</td>
<td>Each winter term</td>
<td>Grade to a third</td>
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</table>

**Event Details:**  
**Type:** Oral examination  
**Credits:** 4  
**Grading scale:** Grade to a third  
**Recurrence:** Each winter term

**Version:** 1

---

**Competence Certificate**  
oral exam - 30 minutes

**Prerequisites**  
none

---

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

**Industrial aerodynamics**  
2153425, WS 21/22, 2 SWS, Language: German, Open in study portal

**Blended (On-Site/Online)**

---

**Content**

This compact lecture deals with flows and aeroacoustics with significance in vehicle development. A special focus is set on the optimization of external vehicle aerodynamics and the presentation of modern industrial wind tunnel technology. The second major thematic block includes both, aeroacoustic basics principles and practical examples of aeroacoustics, especially in the field of automotive technology. These fields are explained in their phenomenology, the corresponding theories are discussed and the tools for measurement and simulation are introduced and demonstrated. This lecture focusses on industry relevant methods for analyses and descriptions of forces, aeroacoustic sound fields, flow structures and turbulence. In addition, an overview of numerical methods for industrial applications is given. The integration and interconnection of the methods in the development processes are discussed exemplary.

An excursion to the Mercedes-Benz AG wind tunnel and the research and development centers is planned.

- Introduction
- Aerodynamics of bluff bodies
- Industrial flow measurement techniques and modern wind tunnel technology
- Overview of flow simulation in automotive industry
- Vehicle aerodynamics
- Passenger comfort of roadsters and cabriolets
- Soiling of road vehicles
- Aeroacoustics: basic principles and practical examples of aeroacoustics, especially in the field of automotive technology including aeroacoustic measurement techniques and numerical methods

Students can describe the different properties of aerodynamics and aeroacoustics of vehicles flows. They are qualified to analyze external flows around the vehicles and aeroacoustic sound fields of vehicles.

---

**Organizational issues**

Blockvorlesung - Die Anmeldung im Sekretariat ist bis zum 11.02.2022 erforderlich

---

**Literature**

Vorlesungsskript
### 3.154 Course: Industrial Circuitry [T-ETIT-100716]

**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>
<thead>
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#### Events

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<th>Lecture</th>
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#### Exams

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<td>Pfaff, Mayer</td>
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<td>Pfaff</td>
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</table>
Course: Information Systems and Supply Chain Management [T-MACH-102128]

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

<table>
<thead>
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Events

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<th>Room</th>
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<td>Information Systems in Logistics</td>
<td>2 SWS</td>
<td>Lecture</td>
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<tr>
<td></td>
<td></td>
<td>and Supply Chain Management</td>
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Exams

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<th>Type</th>
<th>Credits</th>
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<th>Lecturer</th>
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<td>Information Systems and Supply Chain Management</td>
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</table>

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate

The success control takes place in form of a written examination (60 min) during the semester break (according to §4(2), 1 SPO). If the number of participants is low, an oral examination (according to §4 (2), 2 SPO) may also be offered.

Prerequisites

none

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

Information Systems in Logistics and Supply Chain Management

2118094, SS 2021, 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

<table>
<thead>
<tr>
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<th>Version</th>
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<tbody>
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<td>Grade to a third</td>
<td>Each summer term</td>
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**Events**

| ST 2021 | 2130973 | Innovative Nuclear Systems | 2 SWS | Cheng |

**Exams**

| ST 2021 | 76-T-MACH-105404 | Innovative Nuclear Systems | Cheng |

**Legends:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗂 On-Site, ✗ Cancelled

**Competence Certificate**

oral exam, 20 min

**Prerequisites**

none

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

**Innovative Nuclear Systems**

2130973, SS 2021, 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

**Organizational issues**

Mo (26.07.2021), Di (27.07.2021), Mi (28.07.2021), 09:00 bis 17:00
### Course: Innovative Project [T-MACH-109185]

**Responsible:** apl. Prof. Dr. Andreas Class  
Prof. Dr. Orestis Terzidis

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
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<th>SWS</th>
<th>Language</th>
<th>Location</th>
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<tr>
<td>WT 21/22</td>
<td>2169466</td>
<td>Innovative Project</td>
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**Exams**

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<th>Code</th>
<th>Type</th>
<th>Language</th>
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<tbody>
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<td>76-T-MACH-109185</td>
<td>Innovative Project</td>
<td>Class</td>
<td></td>
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</tbody>
</table>

**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.

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

**Innovative Project**

2169466, WS 21/22, 3 SWS, Language: English, Open in study portal Blended (On-Site/Online)
Content
The lecture will be executed with the partner university INP Grenoble. Participants need to bring their own laptop with Skype installed. Teams of 2-3 students.

- Understand the physics of the technology of the invention considered in the project
- Understand the claims of the patent considered in the project
- Apply a structured technology application selection methodology.
- Students understand the methodology of TAS, which provides the background to become a TAS coach.
- Students are enabled to prepare a proposal for funding.

The TAS (technology application selection) methodology provides tools that help to successfully advance an invention with a low technology readiness level to a higher technology readiness level. Skills that are typically provided by a classical engineering education supports both the early phase of an invention where a deep basic understanding is required and the industrial exploration building on a first prototype. The gap that arises between the invention and its later industrialized application is rarely addressed, so that many inventions will not make it to the market. In the course, we practice bridging the technology gap for the case of a real invention provided by an industry partner or University. We experiment with teams consisting of team members located at different universities and from different disciplines.

The scenario addressed is an inventor who calls some of his friends within her/his personal network. The group will work remotely via video conference employing a structured TAS process. Creativity will be fertilized by teamwork and linking the invention to a selection of potential technologies. In an in-depth analysis of these links, each group narrows down their pool of ideas to one candidate. Finally, the group will try to convince the fellow teams (and the inventor) to support their idea. For this purpose, a pitch talk is prepared and delivered in front of all teams leading to a unique vote of all teams for one technology application. In addition, the students prepare fictive proposals for start-up based on their TAS.

Organizational issues
please contact the lecturer and cc to heide.hofmann@kit.edu
3.159 Course: Integrated Information Systems for Engineers [T-MACH-102083]

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

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

Type
Oral examination

Credits
4

Grading scale
Grade to a third

Recurrence
Each summer term

Version
2

Events

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<th>Credits</th>
<th>Grade to a third</th>
<th>Recurrence</th>
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<td>3 SWS</td>
<td>Grade to a third</td>
<td>Each summer term</td>
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Exams

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<th>Credits</th>
<th>Grade to a third</th>
<th>Recurrence</th>
<th>Version</th>
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<td>3 SWS</td>
<td>Grade to a third</td>
<td>Each summer term</td>
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</table>

Prerequisites

None

Competence Certificate

Oral examination 20 min.

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

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
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
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- 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
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

<table>
<thead>
<tr>
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<td>8</td>
<td>Grade to a third</td>
<td>Each summer term</td>
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Events

| ST 2021 | 2150660 | Integrated Production Planning in the Age of Industry 4.0 | 6 SWS | Lecture / Practice (VÜ) | Lanza |

Exams

| ST 2021 | 76-T-MACH-108849 | Integrated Production Planning in the Age of Industry 4.0 | Lanza |

Legend: 📱 Online, 🧪 Blended (On-Site/Online), 🗣 On-Site, ☑ Cancelled

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 2021, 6 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ) Online
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

Organizational issues
Vorlesungstermine dienstags 14.00 Uhr und donnerstags 14.00 Uhr, Übungstermine donnerstags 15.45 Uhr. Bekanntgabe der konkreten Übungstermine erfolgt in der ersten Vorlesung

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

**Responsible:** Karl-Hubert Schlichtenmayer  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-104849 - Major Field Automotive Engineering

<table>
<thead>
<tr>
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<th>Credits</th>
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<th>Grade</th>
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**Exams**  
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<td>Integrative Strategies in Production and Development of High Performance Cars</td>
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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ☑ Cancelled

**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**  
2150601, SS 2021, 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
**Organizational issues**
Die Vorlesung wird wöchentlich dienstags, 10:00 – 11:30 Uhr per Zoom stattfinden. Alle weiteren Informationen inkl. Link zur Zoom-Vorlesung finden Sie im IILAS-Kurs.

**Literature**
**Medien:**
Skript zur Veranstaltung wird über [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/).
3.162 Course: Intellectual Property Rights and Strategies in Industrial Companies [T-MACH-105442]

**Responsible:** Prof. Dr.-Ing. Albert Albers  
Prof. Dr.-Ing. Sven Matthiesen  
Dipl.-Ing. Frank Zacharias

**Organisation:** KIT Department of Mechanical Engineering

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

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

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<tr>
<th>ST 2021</th>
<th>2147160</th>
<th>Patents and Patentstrategies in innovative companies</th>
<th>2 SWS</th>
<th>Zacharias</th>
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<tr>
<td>WT 21/22</td>
<td>2147161</td>
<td>Intellectual Property Rights and Strategies in Industrial Companies</td>
<td>2 SWS</td>
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**Exams**

<table>
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<tr>
<th>ST 2021</th>
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<th>Intellectual Property Rights and Strategies in Industrial Companies</th>
<th>Zacharias, Albers</th>
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<td>WT 21/22</td>
<td>76-T-MACH-105442</td>
<td>Intellectual Property Rights and Strategies in Industrial Companies</td>
<td>Zacharias, Albers</td>
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</tbody>
</table>

**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**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 2021, 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

Organizational issues
Weitere Informationen siehe IPEK-Homepage.
https://www.ipek.kit.edu/2976_2858.php
**3.163 Course: Introduction into Mechatronics [T-MACH-100535]**

**Responsible:** Moritz Böhland  
apl. Prof. Dr. 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>3 SWS</td>
<td>Lecture / Online</td>
<td>Reischl, Böhland</td>
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<td>Reischl</td>
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Legend: 📚 Online, 🧬 Blended (On-Site/Online), 🗣 On-Site, ☑️ Cancelled

**Competence Certificate**

Oral exam (Duration: 2h)

**Prerequisites**

none

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

**Introduction into Mechatronics**  
2105011, WS 21/22, 3 SWS, Language: German, Open in study portal  
**Lecture (V)**  
Blended (On-Site/Online)

**Content**

**Content:**

- Introduction  
- Structure of mechatronic systems  
- Mathematical treatment of mechatronic systems  
- Sensors and actuators  
- Measurements: acquisition and interpretation  
- Modelling of mechatronic systems  
- Control and feedback control systems  
- Information processing

**Learning objectives:**

The student has knowledge about the specific challenge of interdisciplinary collaboration within the framework of mechatronics. He is able to explain the origin, necessity and methodic implementation of interdisciplinary collaboration, to name the main difficulties as well as the special features within the development of mechatronic products from the point of view of development methodic.

The student has fundamental knowledge of modeling mechanical, hydraulically and electrically part systems and about suitable optimization methods.

The student knows the difference in use of the term "system" in mechatronic and mechanical use.

**Literature**

3.164 Course: Introduction into the Multi-Body Dynamics [T-MACH-105209]

**Responsible:** Prof. Dr.-Ing. Wolfgang Seemann

**Organisation:** KIT Department of Mechanical Engineering

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

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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**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 2021, 3 SWS, Language: German, Open in study portal

**Lecture (V)**

Blended (On-Site/Online)

**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
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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Exams

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<td>76-T-MACH-100287</td>
<td>Introduction to Ceramics</td>
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Competence Certificate
The assessment consists of an oral exam (30 min) taking place at a specific date.
The re-examination is offered at a specific date.

Prerequisites
None

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

Introduction to Ceramics
2125757, WS 21/22, 3 SWS, Language: German, [Open in study portal]

Lecture (V)
Blended (On-Site/Online)

Literature

- Kingery, Bowen, Uhlmann, "Introduction To Ceramics", Wiley
- Y.-M. Chiang, D. Birnie III and W.D. Kingery, "Physical Ceramics", Wiley
- S.J.L. Kang, "Sintering, Densification, Grain Growth & Microstructure", Elsevier
3.166 Course: Introduction to Engineering Mechanics I: Statics [T-MACH-108808]

**Responsible:** Prof. Dr.-Ing. Alexander Fidlin  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-104853 - Major Field Theoretical Foundations of Mechanical Engineering

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**Events**

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<td>Lecture / 🎫</td>
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<td>and Strength of Materials</td>
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**Exams**

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<td>Introduction to Engineering Mechanics I: Statics</td>
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<td>and Strength of Materials</td>
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<td>Fidlin</td>
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**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 2021, 2 SWS, Language: German, [Open in study portal](#)

**Content**

Statics: force · moment · general equilibrium conditions · center of mass · inner force in structure · plane frameworks · theory of adhesion
### Course: Introduction to Engineering Mechanics I: Statics and Strength of Materials [T-MACH-102208]

**Responsible:** Prof. Dr.-Ing. Alexander Fidlin  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-104853 - Major Field Theoretical Foundations of Mechanical Engineering

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

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**Legend:** Online, Blended (On-Site/Online), On-Site, Cancelled

### 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 2021, 2 SWS, Language: German, Open in study portal

**Content**

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

**Responsible:** Simone Dürrschnabel  
**Organisation:** KIT Department of Mechanical Engineering

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

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

**Prerequisites**  
none
Course: Introduction to Microsystem Technology I [T-MACH-105182]

**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

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<td>Lecture / 🧩</td>
<td>Korvink, Badilita</td>
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**Exams**

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<td>Introduction to Microsystem Technology I</td>
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<td>Introduction to Microsystem Technology I</td>
<td>Lecture (V)</td>
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</table>

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

**Competence Certificate**

written examination (60 min)

**Prerequisites**

none

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

**Introduction to Microsystem Technology I**

2141861, WS 21/22, 2 SWS, Language: English, [Open in study portal](#)

**Lecture (V)**

Blended (On-Site/Online)

**Literature**

- Mikrosystemtechnik für Ingenieure, W. Menz und J. Mohr, VCH Verlagsgesellschaft, Weinheim 2005
- M. Madou  
  Fundamentals of Microfabrication  
  Taylor & Francis Ltd.; Auflage: 3. Auflage, 2011
**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

**Events**

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<td>Introduction to Microsystem Technology II</td>
<td>Lecture / 🖥</td>
<td>2 SWS</td>
<td>Korvink, Badilita</td>
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<tr>
<td>WT 21/22</td>
<td>76-T-MACH-105183</td>
<td>Introduction to Microsystem Technology II</td>
<td>Lecture / 🖥</td>
<td>2 SWS</td>
<td>Korvink, Badilita</td>
</tr>
</tbody>
</table>

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

**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 2021, 2 SWS, Language: English, Open in study portal

**Content**

- Introduction in Nano- and Microtechnologies  
- Lithography  
- LiGA-technique  
- Mechanical microfabrication  
- Patterning with lasers  
- Assembly and packaging  
- Microsystems

**Organizational issues**

Topic: Grundlagen der Mikrosystemtechnik II (MST II) SS 21  
Time: Thursdays 14:00 - 15:30

Join Zoom Meeting  
https://kit-lecture.zoom.us/j/66193228123?pwd=eEpTTFJoNzY5ZktRMG5GTEg3bExmdz09  
Meeting ID: 661 9322 8123  
Passcode: 424794

**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: apl. Prof. Dr. Ron Dagan
Organisation: KIT Department of Mechanical Engineering

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

Type          Credits          Grading scale          Recurrence          Version
Oral examination  4              Grade to a third     Each summer term    1

Events

ST 2021  2190490  Introduction to Neutron Cross Section Theory and Nuclear Data Generation  2 SWS  Lecture / Blended Dagan

Exams

ST 2021  76-T-MACH-105466  Introduction to Neutron Cross Section Theory and Nuclear Data Generation  Dagan
WT 21/22  76-T-MACH-105466  Introduction to Neutron Cross Section Theory and Nuclear Data Generation  Dagan

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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 2021, 2 SWS, Language: German/English, Open in study portal

Content
Cross section characterization
Summary of basic cross section theory
Resonance cross section
Doppler broadening
Scattering kernels
Basic of slowing down theory
Unit cell based XS data generation
Cross sections Data libraries
Data Measurements

The students:
- Understand the special importance of cross sections in various domains of natural science (Reactor physics, Material research, Solar radiation etc.)
- Are familiar with the theoretical methods and experimental effort to generate cross sections data.

Regular attendance: 26 h
self study: 94 h
oral exam about 30 min.
Literature
Handbuch von Nuklearen Reaktoren Vol I . Y. Ronen CRC press 1986 (in English)
P. Tippler, R. Llewellyn Modern Physics 2008 (in English)
3.172 Course: Introduction to Nonlinear Vibrations [T-MACH-105439]

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

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

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Events

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<th>Type</th>
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<th>Lecturer</th>
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<tr>
<td>WT 21/22</td>
<td>2162247</td>
<td>Introduction to Nonlinear Vibrations</td>
<td>2</td>
<td>Lecture / 🔔</td>
<td>Fidlin</td>
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<tr>
<td>WT 21/22</td>
<td>2162248</td>
<td>Introduction into the nonlinear vibrations (Tutorial)</td>
<td>2</td>
<td>Practice</td>
<td>Fidlin, Yüzbasioglu</td>
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Exams

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<tr>
<td>ST 2021</td>
<td>76-T-MACH-105439</td>
<td>Introduction to Nonlinear Vibrations</td>
<td>2</td>
<td>Practice</td>
<td>Fidlin</td>
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</table>

Legend: 🖥 Online, 🔔 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

Competence Certificate
oral exam, 30 min.

Prerequisites
none

Recommendation
Vibration theory, Mathematical Methods of Vibration Theory, Dynamic Stability

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

**Introduction to Nonlinear Vibrations**
2162247, WS 21/22, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

Content

- dynamic systems
- basic ideas of asymptotic methods
- perturbation methods: Linstedt-Poincare, averaging, multiple scales
- limit cycles
- nonlinear resonance
- basics of the bifurcation analysis, bifurcation diagrams
- types of bifurcations
- discontinuous systems
- dynamic chaos
Literature


### Introduction into the nonlinear vibrations (Tutorial)

2162248, WS 21/22, 2 SWS, Language: German, Open in study portal

<table>
<thead>
<tr>
<th>Practice (Ü)</th>
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</thead>
</table>

Content

Exercises related to the lecture
3.173 Course: Introduction to Nuclear Energy [T-MACH-105525]

Responsible: Prof. Dr.-Ing. Xu Cheng
Organisation: KIT Department of Mechanical Engineering
Part of: M-MACH-104848 - Major Field Energy and Environmental Engineering

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

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<th>SWS</th>
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<th>Language</th>
<th>Exams</th>
<th>Lecture</th>
<th>Lecturer</th>
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<tr>
<td>WT 21/22</td>
<td>2189903</td>
<td>Introduction to Nuclear Energy</td>
<td>2</td>
<td>Lecture / Online</td>
<td>German</td>
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<td>Introduction to Nuclear Energy</td>
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<td>Cheng</td>
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</table>

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
oral exam, 30 min

Prerequisites
none

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

Content
This lecture is dedicated to students of mechanical engineering and other engineering Bachelor or Master degree courses. Goal of the lecture is the fundamental knowledge of nuclear energy and nuclear reactors. After the lecture the students understand the principle of the usage of nuclear energy, the structure and operation of nuclear power plants and nuclear safety measures. Furthermore, the students are capable of giving technical assessment of the usage of nuclear energy with respect to its safety and sustainability.
3.174 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

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<td>ST 2021</td>
<td>2550040</td>
<td>Introduction to Operations Research I</td>
<td>2</td>
<td>Lecture</td>
<td>Nickel</td>
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<td>WT 21/22</td>
<td>2530043</td>
<td>Introduction to Operations Research II</td>
<td>2</td>
<td>Lecture</td>
<td>Nickel</td>
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<td>WT 21/22</td>
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Exams

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<tbody>
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<td>7900237</td>
<td>Introduction to Operations Research I and II</td>
<td>Rebennack</td>
</tr>
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</table>

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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 2021, 2 SWS, Language: German, Open in study portal

Lecture (V)

Online

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.
Introduction to Operations Research II

Content

Integer and Combinatorial Programming: Basic notions, cutting plane methods, branch and bound methods, branch and cut methods, heuristics.

Nonlinear Programming: Basic notions, optimality conditions, solution methods for convex and nonconvex optimization problems.

Dynamic and stochastic models and methods: dynamical programming, Bellman method, lot sizing models, dymanical and stochastic inventory models, queuing theory.

Learning objectives:

The student

- names and describes basic notions of integer and combinatorial optimization, nonlinear programming, and dynamic programming,
- knows the indispensable methods and models for quantitative analysis,
- models and classifies optimization problems and chooses the appropriate solution methods to solve optimization problems independently,
- validates, illustrates and interprets the obtained solutions.

Literature

3.175 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

<table>
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<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
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<td>Grade to a third</td>
<td>Each summer term</td>
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Events

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<th>Lecture</th>
<th>Language</th>
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<tbody>
<tr>
<td>ST 2021 2162282</td>
<td>Introduction to the Finite Element Method</td>
<td>German, Open in study portal</td>
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Exams

<table>
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<th>Exams</th>
<th>Lecture</th>
<th>Language</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST 2021 76-T-MACH-105320</td>
<td>Introduction to the Finite Element Method</td>
<td>Böhlke, Langhoff</td>
</tr>
</tbody>
</table>

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
written exam (90 min)

prerequisites: passing the corresponding "Tutorial to Introduction to the Finite element method" (T-MACH-110330)

Prerequisites
Passing the "Tutorial to 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

Due to capacity reasons it is possible that not all students of this course can be admitted to the computer tutorials. Students of the bachelor's degree program in mechanical engineering who have chosen the Major Field Continuum Mechanics (SP-Nr 13) will be admitted to the computer tutorials in any case.

If additional places are available in the computer tutorials for this course, these will be allocated according to the BSc average grade.

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

Introduction to the Finite Element Method
2162282, SS 2021, 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
3.176 Course: Introduction to Theory of Materials [T-MACH-105321]

**Responsible:** apl. Prof. Marc Kamlah  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

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

| ST 2021 | 2182732 | Introduction to Theory of Materials | 2 SWS | Lecture / ✗ | Kamlah |

**Exams**

| ST 2021 | 76-T-MACH-105321 | Introduction to Theory of Materials | Kamlah |

Legend: 📱 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**

oral exam

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

**Introduction to Theory of Materials**  
2182732, SS 2021, 2 SWS, Language: German, Open in study portal

**Lecture (V)**

Cancelled

**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
3.177 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

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**Events**

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<td>3 SWS</td>
<td>Project (P / 🤝)</td>
<td>Ovtcharova, Maier</td>
<td></td>
</tr>
<tr>
<td>WT 21/22</td>
<td>2123352</td>
<td>IoT platform for engineering</td>
<td>3 SWS</td>
<td>/ 🤝</td>
<td>Ovtcharova, Maier</td>
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**Exams**

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<th>Code</th>
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<td>IoT platform for engineering</td>
<td>Ovtcharova</td>
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</tr>
</tbody>
</table>

Legend: 🖥 Online, 🤝 Blended (On-Site/Online), 🗝 On-Site, x Cancelled

**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**

<table>
<thead>
<tr>
<th>Code</th>
<th>Type</th>
<th>Credits</th>
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<tr>
<td>2123352</td>
<td>IoT platform for engineering</td>
<td>3 SWS</td>
<td>Project (P / 🤝)</td>
<td>Ovtcharova, Maier</td>
</tr>
</tbody>
</table>

**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

**Organizational issues**

Siehe Homepage zur Lehrveranstaltung

**Literature**

Keine / None

**IoT platform for engineering**

<table>
<thead>
<tr>
<th>Code</th>
<th>Type</th>
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<th>Grading scale</th>
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<td>IoT platform for engineering</td>
<td>3 SWS</td>
<td>/ 🤝</td>
<td>Ovtcharova</td>
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</tbody>
</table>

**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.

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- 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
### 3.178 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>
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**Events**

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<td>3 SWS</td>
<td>Lab Computer-aided methods for measurement and control</td>
<td>Practical course / On-Site, Wang</td>
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**Exams**

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</table>

**Legends:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**

Colloquia

**Prerequisites**

none

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

#### Lab Computer-aided methods for measurement and control

2137306, WS 21/22, 3 SWS, Language: German, Open in study portal

**Practical course (P)**  
On-Site

**Content**

**Lerninhalt (EN):**

1. Digital technology  
2. Digital storage oscilloscope and digital spectrum analyzer  
3. Supersonic computer tomography  
4. Lighting and image acquisition  
5. Digital image processing  
6. Image interpretation  
7. Control synthesis and simulation  
8. Robot: Sensors  
9. Robot: Actuating elements and path planning  

The lab comprises 9 experiments.

**Voraussetzungen:**

Basic studies and preliminary examination; basic lectures in automatic control

**Arbeitsaufwand (EN):** 120 hours

**Lernziele (EN):**

Powerful and cheap computation resources have led to major changes in the domain of measurement and control. Engineers in various fields are nowadays confronted with the application of computer-aided methods. This lab tries to give an insight into the modern domain of measurement and control by means of practically oriented and flexible experiments. Based on experiments on measurement instrumentation and digital signal processing, elementary knowledge in the domain of visual inspection and image processing will be taught. Thereby, commonly used software like MATLAB/Simulink will be used in both simulation and realization of control loops. The lab closes with selected applications, like control of a robot or supersonic computer tomography.

**Nachweis (EN):**

Colloquia
Literatur
Übungsanleitungen sind auf der Institutshomepage erhältlich.

Instructions to the experiments are available on the institute's website
3.179 Course: Laboratory Exercise in Energy Technology [T-MACH-105331]

**Responsible:** Prof. Dr.-Ing. Hans-Jörg Bauer  
Prof. Dr. Ulrich Maas  
Dr.-Ing. Heinrich Wirbser

**Organisation:** KIT Department of Mechanical Engineering

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

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

<table>
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<th>Code</th>
<th>Description</th>
<th>SWS</th>
<th>Type</th>
<th>On-Site</th>
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<tbody>
<tr>
<td>ST 2021</td>
<td>2171487</td>
<td>Laboratory Exercise in Energy Technology</td>
<td>3</td>
<td>Practical course</td>
<td>Bauer, Maas, Bykov</td>
</tr>
<tr>
<td>WT 21/22</td>
<td>2171487</td>
<td>Laboratory Exercise in Energy Technology</td>
<td>3</td>
<td>Practical course</td>
<td>Bauer, Maas, Bykov</td>
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**Exams**

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<th>SWS</th>
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<td>76-T-MACH-105331</td>
<td>Laboratory Exercise in Energy Technology</td>
<td>3</td>
<td>Practical course</td>
<td>Bauer, Maas, Wirbser</td>
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<td>WT 21/22</td>
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<td>Laboratory Exercise in Energy Technology</td>
<td>3</td>
<td>Practical course</td>
<td>Bauer, Maas, Wirbser</td>
</tr>
</tbody>
</table>

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🔴 On-Site, ✗ Cancelled

**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**

<table>
<thead>
<tr>
<th>Code</th>
<th>SWS</th>
<th>Language: German/English</th>
<th>Type</th>
<th>On-Site</th>
</tr>
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<tbody>
<tr>
<td>2171487</td>
<td>3</td>
<td>Open in study portal</td>
<td>Practical course</td>
<td>On-Site</td>
</tr>
</tbody>
</table>
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 assistents

Duration: 30 minutes

no tools or reference materials may be used

Organizational issues
Information zum Lehrlabor finden Sie auf der Instituts-homepage

Laboratory Exercise in Energy Technology
2171487, WS 21/22, 3 SWS, Language: German/English, Open in study portal

Practical course (P)
On-Site
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
  - Heat pump
  - 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

Organizational issues
Praktika finden in Präsenz statt, sofern die COVID-Inzidenzwerte es zulassen.
3.180 Course: Laboratory Laser Materials Processing [T-MACH-102154]

**Responsible:** Dr.-Ing. Johannes Schneider

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
<thead>
<tr>
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**Events**

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<th>Recurrence</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST 2021</td>
<td>2183640</td>
<td>Laboratory &quot;Laser Materials Processing&quot;</td>
<td>3 SWS</td>
<td>Practical course / Online</td>
<td>Schneider, Pfleging</td>
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<td>WT 21/22</td>
<td>2183640</td>
<td>Laboratory &quot;Laser Materials Processing&quot;</td>
<td>3 SWS</td>
<td>Practical course / Online</td>
<td>Schneider, Pfleging</td>
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**Exams**

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<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
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<tr>
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<td>Laboratory Laser Materials Processing</td>
<td></td>
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<td>Schneider</td>
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</table>

**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), ⚒ On-Site, ✗ Cancelled

**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 2021, 3 SWS, Language: German, Open in study portal

Practical course (P) Blended (On-Site/Online)
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.

Organizational issues
Bereits ausgebucht!
Anmeldung per Email an johannes.schneider@kit.edu
Das Praktikum findet in Kleingruppen am IAM-CMS (CS) bzw. IAM-AWP (CN) statt!
Die Termine werden zu Beginn des Semesters bekannt gegeben.

Literature
R. Poprawe: Lasertechnik für die Fertigung, 2005, Springer

Laboratory "Laser Materials Processing"
2183640, WS 21/22, 3 SWS, Language: German, Open in study portal

Practical course (P)
Blended (On-Site/Online)
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.
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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.

Organizational issues
Maximal 12 Teilnehmer/innen!
Aktuell sind bereit alle Plätze vergeben! Registrierung für Nachrückliste möglich per Email an johannes.schneider@kit.edu
Praktikum findet in Kleingruppen semesterbegleitend (dienstags bzw. mittwochs, ganztägig) bzw. als Blockpraktikum auf dem Campus Nord am IAM-AWP (Geb. 681) und auf dem Campus Süd am IAM-CMS (Geb. 30.48) statt!
Termine werden mit den Teilnehmern/innen direkt abgestimmt.

Literature
R. Poprawe: Lasertechnik für die Fertigung, 2005, Springer
### 3.181 Course: Laboratory Mechatronics [T-MACH-105370]

**Responsible:**
- Prof. Dr. Veit Hagenmeyer
- Prof. Dr.-Ing. Wolfgang Seemann
- Prof. Dr.-Ing. Christoph Stiller

**Organisation:**
KIT Department of Mechanical Engineering

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

<table>
<thead>
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<th>Version</th>
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<td>Each winter term</td>
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**Events**

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<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Laboratory mechatronics</td>
<td>3 SWS</td>
<td>Practical course / On-Site</td>
<td>Seemann, Stiller, Bühland, Chen, Burgert, Bitner</td>
<td></td>
</tr>
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</table>

**Legend:**
- Online
- Blended (On-Site/Online)
- On-Site
- Cancelled

**Competence Certificate**
The laboratory course is offered exclusively as ungraded course work. The assessment consists of a group colloquium at the beginning of the individual specialization phases (Part 1). In addition, a robot control system for a pick-and-place task must be successfully implemented in the group phase (Part 2).

**Prerequisites**
None

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

### Laboratory mechatronics

**2105014, WS 21/22, 3 SWS, Language: German, Open in study portal**

**Practical course (P) On-Site**

**Content**

**Part I**
- Control, programming and simulation of robots
- CAN-Bus communication
- Image processing / machine vision
- Dynamic simulation of robots in ADAMS

**Part II**
- Solution of a complex problem in team work

**Learning objectives:**
The student is able to ...
- use his knowledge about mechatronics and microsystems technology to solve a practical problem. The laboratory course comprises simulation, bus communication, measurement instrumentation, control engineering and programming.
- integrate the different subsystems from a manipulator to a working compound system in teamwork.

**Nachweis (EN):** certificate of successful attendance

**Voraussetzung (EN):** none

**Arbeitsaufwand (EN):**
- regular attendance: 33.5 h
- self-study: 88.5 h

**Organizational issues**
Das Praktikum ist anmeldepflichtig.
Die Anmeldungsmodalitäten/-fristen werden auf www.iai.kit.edu bekannt gegeben.
Siehe Internet / Aushang Raum 033 EG, im Gebäude 40.32.
Literature
Materialien zum Mechatronik-Praktikum
Manuals for the laboratory course on Mechatronics
3.182 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

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

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<th>2182642</th>
<th>Laser in automotive engineering</th>
<th>2 SWS</th>
<th>Lecture / 🖥</th>
<th>Schneider</th>
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**Exams**

<table>
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<th>76-T-MACH-105164</th>
<th>Laser in Automotive Engineering</th>
<th>Schneider</th>
</tr>
</thead>
</table>

**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🔐 On-Site, ✗ Cancelled

**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:

**V Laser in automotive engineering**  
2182642, SS 2021, 2 SWS, Language: German, Open in study portal  
Lecture (V) Online
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

Organizational issues
Bitte nutzen Sie die Vorlesungsaufzeichnung aus dem SS 19!
Bei Interesse bitte melden bei johannes.schneider@kit.edu!
Aktuelle Infos werden über ILIAS verteilt!

Literature
R. Poprawe: Lasertechnik für die Fertigung, 2005, Springer
3.183 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

<table>
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<th>Recurrence</th>
<th>Version</th>
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<td>Grade to a third</td>
<td>Each summer term</td>
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Events

| ST 2021 | 2110017 | Leadership and Conflict Management (in German) | 2 SWS | Lecture / X | Hatzl |

Legend: 🖥 Online, ⚡ Blended (On-Site/Online), 🗣 On-Site, x Cancelled

Competence Certificate
oral exam (approx. 30 min)

Prerequisites
none

Annotation
This lecture will also be offered once in winter term 20/21.

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

Leadership and Conflict Management (in German)
2110017, SS 2021, 2 SWS, Language: German, Open in study portal

Lecture (V) Cancelled

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

Organizational issues
Da das ganze Sommersemester 2021 komplett digital stattfinden soll, muss diese Präsenzveranstaltung leider abgesagt werden.

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

<table>
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<td>4</td>
<td>Grade to a third</td>
<td>Each winter term</td>
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**Events**

| WT 21/22 | 2145184 | Leadership and Product Development | 2 SWS | Lecture | Ploch |

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

**Prerequisites**
none

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

**Leadership and Product Development**
2145184, WS 21/22, 2 SWS, Language: German, [Open in study portal](#)

**Content**
Overview of leadership theories and their application
Selected management instruments and their use in organizations
Communication and leadership
change management
Management development and MD programmes
Assessment centres and management audits
Teamwork, team development and team roles
Coaching as an instrument of modern leadership
Intercultural competence and cross-cultural leadership
Management and ethics, corporate governance
Practical exercises and examples to deepen selected contents

**Organizational issues**
Vorlesungsanmeldung und Informationen zur Veranstaltung werden im ILIAS Kurs zur Verfügung gestellt.
Weitere Information siehe IPEK-Homepage

**Literature**
Vorlesungsumdruck
3.185 Course: Lightweight Engineering Design [T-MACH-105221]

Responsible: Prof. Dr.-Ing. Albert Albers
Prof. Dr.-Ing. Norbert Burkardt
Organisation: KIT Department of Mechanical Engineering

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

<table>
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Events

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<th>Credits</th>
<th>Lecture</th>
<th>Organisation</th>
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<td>2 SWS</td>
<td>/ Online</td>
<td>Albers, Burkardt</td>
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<tr>
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<td>Lecture</td>
<td>Albers, Burkardt</td>
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<td>WT 21/22</td>
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<td>Lecture</td>
<td>Albers, Burkardt</td>
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Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
Written examination (90 min)

Prerequisites
None

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

Lecture (V) Online

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 stiffing methods qualitatively and to evaluate their effectiveness.
- evaluate the potential of computer-aided engineering as well as the related limits and influences on manufacturing.
- reflect the basics of lightweight construction from a system view in the context of the product engineering process.
Organizational issues
Vorlesungsfolien können über die eLearning-Plattform ILIAS bezogen werden.
Die Prüfungsart wird gemäß der Prüfungsordnung zu Vorlesungsbeginn angekündigt:

- Schriftliche Prüfung: 90 min Prüfungsdauer
- Mündliche Prüfung: 20 min Prüfungsdauer
- Erlaubte Hilfsmittel: keine

Medien: Beamer
Arbeitsbelastung:
- Präsenzzeit: 21 h
- Selbststudium: 99 h

Lecture slides are available via eLearning-Platform ILIAS.
The type of examination (written or oral) will be announced at the beginning of the lecture:

- written examination: 90 min duration
- oral examination: 20 min duration
- auxiliary means: None

Media: Beamer
Workload:
- regular attendance: 21 h
- self-study: 99 h

Literature
Klein, B.: Leichtbau-Konstruktion. Vieweg & Sohn Verlag, 2007
3.186 Course: Liquid Transportation Fuels [T-CIWVT-111095]

<table>
<thead>
<tr>
<th>Organisation:</th>
<th>KIT Department of Chemical and Process Engineering</th>
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<tbody>
<tr>
<td>Part of:</td>
<td>M-MACH-105100 - Courses of the Department of Chemical and Process Engineering</td>
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**Events**

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<td>Liquid Transportation Fuels</td>
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<td>Lecture</td>
<td>Rauch</td>
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<tr>
<td>WT 21/22</td>
<td>22315</td>
<td>Übung zu 22314 Liquid Transportation Fuels</td>
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<td>Practice</td>
<td>Rauch</td>
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**Exams**

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<tr>
<th>Term</th>
<th>Code</th>
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<tr>
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<td>7230020</td>
<td>Liquid Transportation Fuels</td>
<td>Rauch</td>
</tr>
</tbody>
</table>

**Competence Certificate**

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

**Prerequisites**

None
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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<tr>
<th>Type</th>
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**Events**

<table>
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<tr>
<th>ST 2021</th>
<th>24613</th>
<th>Localization of Mobile Agents</th>
<th>3 SWS</th>
<th>Lecture / 🖥️</th>
<th>Zea Cobo, Li</th>
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**Exams**

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<th>7500004</th>
<th>Localization of Mobile Agents</th>
<th>Zea Cobo, Noack</th>
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<tbody>
<tr>
<td>WT 21/22</td>
<td>7500020</td>
<td>Localization of Mobile Agents</td>
<td>Zea Cobo</td>
</tr>
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</table>

Legend: 🖥️ Online, Blended (On-Site/Online), 🔔 On-Site, ✗ Cancelled

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

**Localization of Mobile Agents**

24613, SS 2021, 3 SWS, Language: German, Open in study portal

**Lecture (V)**

**Online**

**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.

**Organizational issues**

Prüfungsterminvorschläge und das Verfahren dazu sind auf der Webseite der Vorlesung zu finden.

**Literature**

Grundlegende Kenntnisse der linearen Algebra und Stochastik sind hilfreich.
### 3.188 Course: Logistics and Supply Chain Management [T-WIWI-102870]

**Responsible:** Prof. Dr. Frank Schultmann  
PD Dr. Marcus Wiens  
**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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### Events

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<tr>
<td>ST 2021</td>
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<td>Logistics and Supply Chain Management</td>
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<td>Lecture</td>
<td>Wiens, Schultmann</td>
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<tr>
<td>ST 2021</td>
<td>2581997</td>
<td>Übung zu Logistics and Supply Chain Management</td>
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<td>Practice</td>
<td>Diehlmann, Lüttenberg</td>
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### Exams

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**Competence Certificate**  
The assessment consists of an oral (30 minutes) or written exam (60 minutes) (following §4(2) of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date. Depending on the respective pandemic situation, the exam may be offered as an open book exam (alternative exam assessment, following §4(2), 3 of the examination regulation).

**Prerequisities**  
None

---

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

### Lecture (V)

**Logistics and Supply Chain Management**  
2581996, SS 2021, 2 SWS, Language: English, Open in study portal  
**Lecture (V) Online**

### Content

Students are introduced to the methods and tools of logistics and supply chain management. They students learn the key terms and components of supply chains together with key economic trade-offs. In detail, students gain knowledge of decisions in supply chain management, such as facility location, supply chain planning, inventory management, pricing and supply chain cooperation. In this manner, students will gain knowledge in analyzing, designing and steering of decisions in the domain of logistics and supply chain management.

- Introduction: Basic terms and concepts  
- Facility location and network optimization  
- Supply chain planning I: flexibility  
- Supply chain planning II: forecasting  
- Inventory management & pricing  
- Supply chain coordination I: the Bullwhip-effect  
- Supply chain coordination II: double marginalization  
- Supply chain risk management

### Literature

Wird in der Veranstaltung bekannt gegeben.
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

<table>
<thead>
<tr>
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Events

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<tr>
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<td>Machine Dynamics</td>
<td>2</td>
<td>Lecture</td>
<td>Proppe</td>
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<td>ST 2021</td>
<td>2161225</td>
<td>Machine Dynamics (Tutorial)</td>
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<td>Practice</td>
<td>Proppe, Fischer</td>
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Exam

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<th>Code</th>
<th>Course Name</th>
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<tbody>
<tr>
<td></td>
<td>76-T-MACH-105210</td>
<td>Machine Dynamics</td>
<td>Practice</td>
</tr>
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</table>

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
written exam, 180 min.

Prerequisites
none

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

**Machine Dynamics**

2161224, SS 2021, 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 2021, 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

<table>
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<td>Machine Dynamics II</td>
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Exams

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<td>Machine Dynamics II</td>
<td>Proppe</td>
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</table>

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🌊 On-Site, ☑️ Cancelled

Competence Certificate
oral exam, 30 min.

Prerequisites
none

Recommendation
Machine Dynamics

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

Machine Dynamics II
2162220, SS 2021, 2 SWS, Language: English, Open in study portal

Content
Students are able to develop and analyze detailed models in machine dynamics that encompass continuum models, fluid structure interaction, and stability analyses.

- hydrodynamic bearings
  - rotating shafts in hydrodynamic bearings
  - belt drives
  - vibration of turbine blades

Literature

Machine Dynamics II
2162220, WS 21/22, 2 SWS, Language: English, Open in study portal

Content
hydrodynamic bearings
  - rotating shafts in hydrodynamic bearings
  - belt drives
  - vibration of turbine blades

Literature
3.191 Course: Machine Tools and High-Precision Manufacturing Systems [T-MACH-110962]

**Responsible:** Prof. Dr.-Ing. Jürgen Fleischer

**Organisation:** KIT Department of Mechanical Engineering

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

<table>
<thead>
<tr>
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**Exams**

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<th>Recurrence</th>
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<td>Machine Tools and High-Precision Manufacturing Systems</td>
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<td>Fleischer</td>
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**Exams**

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<tr>
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<td>76-T-MACH-110962</td>
<td>Machine Tools and High-Precision Manufacturing Systems</td>
<td>Fleischer</td>
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</tbody>
</table>

**Competence Certificate**

Oral exam (40 minutes)

**Prerequisites**

- T-MACH-102158 - Machine Tools and Industrial Handling must not be commenced.
- T-MACH-109055 - Machine Tools and Industrial Handling must not be commenced.
- T-MACH-110963 - Machine Tools and High-Precision Manufacturing Systems must not be commenced.

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

**Machine Tools and High-Precision Manufacturing Systems**

<table>
<thead>
<tr>
<th>Credits</th>
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<th>Version</th>
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</thead>
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<td>Machine Tools and Industrial Handling</td>
<td>Online, Blended (On-Site/Online)</td>
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Module Offers in Mechanical Engineering for Exchange Students, Date: 15/09/2021
Valid from Winter Term 2021/2022
Content
The lecture gives an overview of the construction, use and application of machine tools and high-precision manufacturing systems. In the course of the lecture a well-founded and practice-oriented knowledge for the selection, design and evaluation of machine tools and high-precision manufacturing systems is conveyed. First, the main components of the systems are systematically explained and their design principles as well as the integral system design are discussed. Subsequently, the use and application of machine tools and high-precision manufacturing systems will be demonstrated using typical machine examples. Based on examples from current research and industrial applications, the latest developments are discussed, especially concerning the implementation of Industry 4.0 and artificial intelligence.

Guest lectures from industry round off the lecture with insights into practice.

The individual topics are:
- Structural components of dynamic manufacturing Systems
- Feed axes: High-precision positioning
- Spindles of cutting machine Tools
- Peripheral Equipment
- Machine control unit
- Metrological Evaluation
- Maintenance strategies and condition Monitoring
- Process Monitoring
- Development process for machine tools and high-precision manufacturing Systems
- Machine examples

Learning Outcomes:
The students …

- are able to assess the use and application of machine tools and high-precision manufacturing systems and to differentiate between them in terms of their characteristics and design.
- can describe and discuss the essential elements of machine tools and high-precision manufacturing systems (frame, main spindle, feed axes, peripheral equipment, control unit).
- are able to select and dimension the essential components of machine tools and high-precision manufacturing systems.
- are capable of selecting and evaluating machine tools and high-precision manufacturing systems according to technical and economic criteria.

Workload:

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

WING/TWVL:
regular attendance: 63 hours
self-study: 207 hours

Organizational issues
Start: 18.10.2021
Vorlesungstermine montags und mittwochs, Übungstermine donnerstags.
Bekanntgabe der konkreten Übungstermine erfolgt in der ersten Vorlesung.

Lectures on Mondays and Wednesdays, tutorial on Thursdays.
The tutorial dates will announced in the first lecture.

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

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

<table>
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**Events**

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<th>Lecturer</th>
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<td>WT 21/22</td>
<td>2137308</td>
<td>Machine Vision</td>
<td>Lecture / Practice</td>
<td>Lauer, Kinzig</td>
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**Exams**

<table>
<thead>
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<td>Machine Vision</td>
<td>Lecture / Practice (VÜ)</td>
<td>Stiller, Lauer</td>
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</table>

Legend: 🌐 Online, 🧩 Blended (On-Site/Online), 🗓️ On-Site, ✗ Cancelled

**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:

**Content**

**Lernziele (EN):**  
Machine vision (or computer vision) describes all kind of techniques that can be used to extract information from camera images in an automated way. Considerable improvements of machine vision techniques throughout recent years, e.g. by the advent of deep learning, have caused growing interest in these techniques and enabled applications in various domains, e.g. robotics, autonomous driving, gaming, production control, visual inspection, medicine, surveillance systems, and augmented reality. The participants should gain an overview over the basic techniques in machine vision and obtain hands-on experience.

Nachweis: written exam, 60 min.  
Arbeitsaufwand: 240 hours  
Voraussetzungen: none

**Literature**

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

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

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<td>4 SWS</td>
<td>Bauer, Maas, Kubach, Pritz</td>
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<td>WT 21/22</td>
<td>2185000</td>
<td>Machines and Processes</td>
<td>4 SWS</td>
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**Exams**

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

**Competence Certificate**

written exam (duration: 120 min)

**Prerequisites**

Taking part at the exam is possible only when lab course has been successfully completed

**Modeled Conditions**

The following conditions have to be fulfilled:

1. The course T-MACH-105232 - Machines and Processes, Prerequisite must have been passed.

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

Organizational issues
Vorlesung/Übung findet in Präsenz statt, sofern es die COVID-Inzidenzwerte zulassen
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

<table>
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<tr>
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<th>Recurrence</th>
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Events

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<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Responsible</th>
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<tbody>
<tr>
<td>ST 2021</td>
<td>2187000</td>
<td>Machines and Processes (Lab Course)</td>
<td>Practical course / 🧩</td>
<td>1 SWS</td>
<td></td>
<td></td>
<td>Bauer, Kubach, Maas, Pritz</td>
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<tr>
<td>WT 21/22</td>
<td>2187000</td>
<td>Machines and Processes</td>
<td>Practical course / 🧩</td>
<td>1 SWS</td>
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Exams

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<td>Machines and Processes, Prerequisite</td>
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<td>Kubach, Maas, Bauer, Gabi</td>
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</table>

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ☑️ Cancelled

Competence Certificate
successful completed training course

Prerequisites
none

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

Machines and Processes (Lab Course)
2187000, SS 2021, 1 SWS, Language: German, Open in study portal
Practical course (P) Blended (On-Site/Online)
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.

Machines and Processes
2187000, WS 21/22, 1 SWS, Open in study portal

Content
Lab Course Experiment
### 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>Grade to a third</td>
<td>Each summer term</td>
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**Events**

| ST 2021 | 2190496 | Magnet Technology of Fusion Reactors | 2 SWS | Lecture / 🗣 Weiss, Wolf |

**Exams**

| ST 2021 | 76-T-MACH-105434 | Magnet Technology of Fusion Reactors | Fietz, Weiss |
| WT 21/22 | 76-T-MACH-105434 | Magnet Technology of Fusion Reactors | Weiss |

**Competition 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 2021, 2 SWS, Language: German/English, Open in study portal  
**Lecture (V)**  
**On-Site**
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
### Course: Magnetohydrodynamics [T-MACH-105426]

**Responsible:** apl. 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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<td>Grade to a third</td>
<td>Each winter term</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/Err) must not be started or completed. The partial services T-MACH-108845 "Magnetohydrodynamics" (Nat/Inf/Err) and T-MACH-105426 "Magnetohydrodynamics" are mutually exclusive.

**Recommendation**  
Fluid Mechanics (T-MACH-105207)  
Mathematical Methods in Fluid Mechanics (T-MACH-105295)

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

**Magnetohydrodynamics**  
2153429, WS 21/22, 2 SWS, Language: German/English, Open in study portal

**Content**

- Introduction  
- Basics of electro and fluid dynamics  
- Exact solutions, Hartmann flow, pump, generator, channel flows  
- Inductionless approximation  
- Developing flows, change of cross-section, variable magnetic fields  
- Alfvén waves  
- Stability, transition to turbulence  
- Liquid dynamos

Educational objective: The students can describe the fundamentals of magnetohydrodynamics. They are qualified to explain the interrelations of electro and fluid dynamics so as to analyze magnetohydrodynamic flows in engineering applications or for phenomena in geo and astrophysics.

**Literature**

R. Moreau, 1990, Magnetohydrodynamics, Kluwer Academic Publisher  
### 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

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<td>Lecture / 🗣</td>
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<td>ST 2021</td>
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<td>Übung zu Management Accounting 1 (Bachelor)</td>
<td>2</td>
<td>Practice / 🗣</td>
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<td>ST 2021</td>
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**Exams**

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<th>Type</th>
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<td>Management Accounting 1 (Bachelor)</td>
<td>Wouters</td>
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<tr>
<td>ST 2021</td>
<td>79-2579900-M</td>
<td>Management Accounting 1 (Mastervorzug und Master)</td>
<td>Wouters</td>
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**Competence Certificate**

Depending on further pandemic developments, the examination will be offered either as a 120-minute written examination (written examination according to SPO § 4 Abs. 2, Pkt. 1) or as an open-book examination (alternative exam assessment according to SPO § 4 Abs. 2, Pkt. 3).

**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:**

<table>
<thead>
<tr>
<th>Event Code</th>
<th>Title</th>
<th>Type</th>
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<tbody>
<tr>
<td>ST 2021</td>
<td>Management Accounting 1</td>
<td>Lecture / 🗣</td>
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</table>

**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)

<table>
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<th>V</th>
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### Content

- see Module Handbook

### Übung zu Management Accounting 2 (Bachelor)

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### Content

- see Module Handbook
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

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<td>Lindstädt</td>
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**Exams**

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<th>Title</th>
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<td>Lindstädt</td>
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<td>WT 21/22</td>
<td>7900199</td>
<td>Management and Strategy</td>
<td>Lindstädt</td>
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</table>

**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 2021, 2 SWS, Language: German, Open in study portal

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled
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:
Depending on further pandemic developments, the examination will be offered in the summer semester 2021 either as an open-book examination (examination performance of a different kind according to SPO § 4 para. 2, item 3), or as a 60-minute written examination (written examination according to SPO § 4 para. 2, item 1).

It is expected that the exam will take place at the beginning of the semester's lecture-free period.

The examination is offered every semester and can be repeated at any regular 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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#### Events

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<td>Manufacturing Technology</td>
<td>6</td>
<td>Lecture / Practice ( / $\odot$)</td>
<td>Schulze, Gerstenmeyer</td>
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<td>ST 2021</td>
<td>76-T-MACH-102105</td>
<td>Manufacturing Technology</td>
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<td>Schulze</td>
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</table>

**Legend:**  
- 🖥 Online  
- $\odot$ Blended (On-Site/Online)  
- 🗞 On-Site  
- ❌ Cancelled

#### Competence Certificate

**Written Exam** (180 min)

**Prerequisites**

none

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

<table>
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<th>Title</th>
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<td>Manufacturing Technology</td>
<td>2149657, WS 21/22</td>
<td>6 SWS, Language: German</td>
<td></td>
<td>Lecture / Practice (VÜ)</td>
<td>Blended (On-Site/Online)</td>
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</table>
Content
The objective of the lecture is to look at manufacturing technology within the wider context of production engineering, to provide an overview of the different manufacturing processes and to impart detailed process knowledge of the common processes. The lecture covers the basic principles of manufacturing technology and deals with the manufacturing processes according to their classification into main groups regarding technical and economic aspects. The lecture is completed with topics such as process chains in manufacturing.

The following topics will be covered:

- Quality control
- Primary processing (casting, plastics engineering, sintering, additive manufacturing processes)
- Forming (sheet-metal forming, massive forming, plastics engineering)
- Cutting (machining with geometrically defined and geometrically undefined cutting edges, separating, abrading)
- Joining
- Coating
- Heat treatment and surface treatment
- Process chains in manufacturing

This lecture provides an excursion to an industry company.

Learning Outcomes:
The students ...

- are capable to specify the different manufacturing processes and to explain their functions.
- are able to classify the manufacturing processes by their general structure and functionality according to the specific main groups.
- have the ability to perform a process selection based on their specific characteristics.
- are enabled to identify correlations between different processes and to select a process regarding possible applications.
- are qualified to evaluate different processes regarding specific applications based on technical and economic aspects.
- are experienced to classify manufacturing processes in a process chain and to evaluate their specific influence on surface integrity of workpieces regarding the entire process chain.

Workload:
regular attendance: 63 hours
self-study: 177 hours

Organizational issues
Start: 18.10.2021

Vorlesungstermine montags und dienstags, Übungstermine mittwochs.
Bekanntgabe der konkreten Übungstermine erfolgt in der ersten Vorlesung.

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

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

**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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<td>Material flow in logistic systems</td>
<td>15 SWS</td>
<td>Furmans, Klein, Fleischmann</td>
</tr>
</tbody>
</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).

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

**Material flow in logistic systems**

2117051, WS 21/22, 15 SWS, Language: German, Open in study portal
Course: Material Flow in Logistic Systems [T-MACH-102151]

Content

Learning Content:
- Elements of material flow systems (conveyor elements, fork, join elements)
- Models of material flow networks using graph theory and matrices
- Queueing theory, calculation of waiting time, utilization
- Warehousing and order-picking
- Shuttle systems
- Sorting systems
- Simulation
- Calculation of availability and reliability
- Value stream analysis

After successful completion of the course, you are able (alone and in a team) to:
- Accurately describe a material handling system in a conversation with an expert.
- Model and parameterize the system load and the typical design elements of a material handling system.
- Design a material handling system for a task.
- Assess the performance of a material handling system in terms of the requirements.
- Change the main lever for influencing the performance.
- Expand the boundaries of today’s methods and system components conceptually if necessary.

Literature:
Arnold, Dieter; Furmans, Kai: Materialfluss in Logistiksystemen; Springer-Verlag Berlin Heidelberg, 7. Auflage 2019

Description:
This course is separated into 5 topic blocks which are structured in the following parts:
- self-study phase
- exercise
- plenary
- case study (group work)
- colloquium
- review of case study

The groups for the case study will be formed at the beginning of the course (first week). The results of the group work during the lecture period are presented and evaluated in writing. During the colloquiums, the result of the case study is presented and the understanding of the group work and the models dealt with in the course are tested in an oral defense. The participation in the colloquiums is compulsory and will be controlled. For the written submission and the presentation the group receives a common grade, in the oral defense each group member is evaluated individually.

After the lecture period, there is the final case study. This case study contains the curriculum of the whole semester. The students work individually on this case study which takes place at a predefined place and time (duration: 4h).

We strongly recommend to attend the introductory session on 20th of October 2021. In this session, the teaching concept of “Materialfluss in Logistiksysteme” is explained and outstanding issues are clarified.

The course registration including the group allocation with ILIAS is mandatory. The registration will be open for several days after the introductory session (registration duration: 20.10.2021 14:00 Uhr - 26.10.2021 14:00 Uhr)

Workload:
- Regular attendance: 35 h
- Self-study: 135 h
- Group work: 100 h

Competence Certificate:
The assessment (Prüfungsleistung anderer Art) consists of the following assignments:
- 40% assessment of the final case study as individual performance,
- 60% semester evaluation which includes working on 5 case studies and defending those (For both assessment types, the best 4 of 5 tries count for the final grade.):
  - 40% assessment of the result and the presentation of the case studies as group work,
  - 20% assessment of the oral examination during the colloquiums as individual performance.
**3.201 Course: Materials Characterization [T-MACH-107684]**

**Responsible:** Dr.-Ing. Jens Gibmeier
apl. Prof. Dr. Reinhard Schneider

**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

**Grading scale**
Grade to a third

**Recurrence**
Each summer term

**Version**
4

**Events**

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<td>2 SWS</td>
<td>Lecture / 🖥</td>
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**Exams**

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<th>Credits</th>
<th>Type</th>
<th>Language</th>
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<tbody>
<tr>
<td>ST 2021</td>
<td>Materials Characterization</td>
<td></td>
<td></td>
<td></td>
<td>Gibmeier</td>
</tr>
</tbody>
</table>

**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, 🗑 Cancelled

**Competence Certificate**

Oral exam, about 25 minutes

**Prerequisites**

Successful participation in Übungen zu Werkstoffanalytik is the condition for the admittance to the oral exam in Werkstoffanalytik.

T-MACH-110945 – Exercises for Materials Characterization has not been started.

T-MACH-110946 – Materials Characterization has not been started.

**Modeled Conditions**

The following conditions have to be fulfilled:

1. The course T-MACH-107685 - Exercises for Materials Characterization must have been passed.

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

**Materials Characterization**

2174586, SS 2021, 2 SWS, Language: German, Open in study portal

**Lecture (V) Online**

**Content**

The following methods will be introduced within this lecture:

- microscopic methods: optical microscopy, electron microscopy (SEM/TEM), atomic force microscopy
- material and microstructure analyses by means of X-ray, neutron and electron beams
- analysis methods at SEM/TEM (e.g. EELS)
- spectroscopic methods (e.g. EDS / WDS)

**Learning Objectives:**

The students have fundamental knowledge about methods of material analysis. They have a basic understanding to transfer this fundamental knowledge on problems in engineering science. Furthermore, the students have the ability to describe technical material by its microscopic and submicroscopic structure.

**Organizational Issues**


The lecture will be online (asynchronous). The lecture notes, supplementary material and the recording of lecture slides with audio track will be managed via ILIAS. The registration will be possible without restriction until 30.04.2021. Subsequently, registration is only possible by direct contacting Dr.-Ing. Jens Gibmeier. In summer term 2021 the lecture will be in German. The English course will be offered in winter term 2021 (starting in October 2021)
Literature
Vorlesungsskript (wird zu Beginn der Veranstaltung ausgegeben).
Literatur wird zu Beginn der Veranstaltung bekanntgegeben.
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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<th>Grading scale</th>
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<th>2182740</th>
<th>Materials modelling: dislocation based plasticity</th>
<th>2 SWS</th>
<th>Lecture / 🖥 Online</th>
<th>Weygand</th>
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Exams

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<th>Materials Modelling: Dislocation Based Plasticity</th>
<th>Weygand</th>
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<tr>
<td>WT 21/22</td>
<td>76-T-MACH-105369</td>
<td>Materials Modelling: Dislocation Based Plasticity</td>
<td>Weygand</td>
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</table>

Legend: 🖥 Online, Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

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 2021, 2 SWS, Language: German, Open in study portal

Lecture (V) Online

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
Organizational issues

- Kursbeitritt erfolgt bis zum 13.4.2021 (erste Vorlesung) ohne Passwort.
- Die Veranstaltung wird in MSTeams online gehalten
- Die Vorlesungsfolien und eine Audiobesprechung der wichtigsten Elemente der Vorlesung werden über ILIAS zugänglich gemacht.

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>
<th>ST 2021</th>
<th>2174574</th>
<th>Materials of Lightweight Construction</th>
<th>2 SWS</th>
<th>Lecture</th>
<th>Liebig, Elsner</th>
</tr>
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**Exams**

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<tr>
<th>ST 2021</th>
<th>76-T-MACH-105211</th>
<th>Materials of Lightweight Construction</th>
<th>Liebig</th>
</tr>
</thead>
</table>

**Legend:** ⏯ Online, 🧩 Blended (On-Site/Online), ⚡ On-Site, ✗ Cancelled

**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 of Lightweight Construction**

2174574, SS 2021, 2 SWS, Language: German, [Open in study portal](#)
Content

Introduction
Constructive, production-orientied and material aspects of lightweight construction

Aluminium-based alloys
Aluminium wrought alloys
Aluminium cast alloys
Magnesium-based alloys
Magnesium wrought alloys
Magnesium cast alloys
Titanium-based alloys
Titanium wrought alloys
Titanium cast alloys
High-strength steels
High-strength structural steels,
Heat-treatable steels, press-hardening and hardenable steels
Composites - mainly PMC
Matrices
Reinforcements
Basic mechanical principles of composites
Hybrid composites
Special materials for lightweight design
Beryllium alloys
Metallic Glasses
Applications

Learning objectives:
The students are capable to name different lightweight materials and can describe their composition, properties and fields of application. They can describe the hardening mechanisms of lightweight materials and can transfer this knowledge to applied problems.
The students can apply basic mechanical models of composites and can depict differences in the mechanical properties depending on composition and structure. The students can describe the basic principle of hybrid material concepts and can judge their advantages in comparison to bulk materials. The students can name special materials for lightweight design and depict differences to conventional materials. The students have the ability to present applications for different lightweight materials and can balance reasons for their use.

Requirements:
Werkstoffkunde I/II (recommended)

Workload:
The workload for the lecture “Materials for Lightweight Construction” is 120 h per semester and consists of the presence during the lectures (24 h), preparation and rework time at home (48 h) and preparation time for the oral exam (48 h).

Examination:
Oral examination, Duration approx. 25 min

Literature
Literaturhinweise, Unterlagen und Teilmanuskript in der Vorlesung
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

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<td>ST 2021 2174598 Metals</td>
<td>4 SWS</td>
<td>Each winter term</td>
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<tr>
<td>ST 2021 2174599 Exercises in Metals</td>
<td>1 SWS</td>
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<tr>
<td>WT 21/22 2177010 Materials Physics</td>
<td>3 SWS</td>
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**Exams**

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<tr>
<td>ST 2021 76-T-MACH-100285 Materials Physics and Metals</td>
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**Type**

Oral examination

**Credits**

13

**Grading scale**

Grade to a third

**Recurrence**

Each winter term

**Version**

2

**Competence Certificate**

Oral exam, about 45 minutes

**Prerequisites**

none

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

**Metals**

2174598, SS 2021, 4 SWS, Language: German, [Open in study portal](http://www.iam.kit.edu/wk/lehrveranstaltungen.php)

**Lecture (V)**

Blended (On-Site/Online)

**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

**Organizational issues**


Die Vorlesung wird zu den angegebenen Zeiten online stattfinden. Bitte melden Sie sich für eine Teilnahme in ILIAS an.

**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. Rössler, H. Harders, M. Bäker, Mechanisches Verhalten der Werkstoffe, Vieweg+Teubner Wiesbaden, 2008  
J. Freudenberger: [http://www.ifw-dresden.de/institutes/imw/lectures/lectures/pwe](http://www.ifw-dresden.de/institutes/imw/lectures/lectures/pwe)
### 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

### Organizational issues
Weitere Informationen finden Sie hier: https://www.iam.kit.edu/wk/lehre.php

### Literature
  [http://dx.doi.org/10.1007/978-3-642-36603-1](http://dx.doi.org/10.1007/978-3-642-36603-1)
  [http://www.ifw-dresden.de/institutes/imw/lectures/pwe](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=KITSRC309606810)
  [http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC052463656](http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC052463656)
  [http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC27759961X](http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC27759961X)
  [http://dx.doi.org/10.1007/978-3-662-47952-0](http://dx.doi.org/10.1007/978-3-662-47952-0)
  [http://dx.doi.org/10.1007/978-3-642-22561-1](http://dx.doi.org/10.1007/978-3-642-22561-1)
  [http://dx.doi.org/10.1007/978-3-642-17717-0](http://dx.doi.org/10.1007/978-3-642-17717-0)
  [http://dx.doi.org/10.1007/978-3-658-13795-3](http://dx.doi.org/10.1007/978-3-658-13795-3)
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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<th>Recurrence</th>
<th>Version</th>
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<td>Grade to a third</td>
<td>Each winter term</td>
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**Events**

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<th>Events</th>
<th>Code</th>
<th>Title</th>
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<th>Recurrence</th>
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<td>WT 21/22</td>
<td>2173540</td>
<td>Materials Processing Technology</td>
<td>Lecture / Practice (VÜ)</td>
<td>3 SWS</td>
<td>Liebig, Binder</td>
<td>Each winter term</td>
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**Exams**

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<th>Exams</th>
<th>Code</th>
<th>Title</th>
<th>Type</th>
<th>Credits</th>
<th>Grade to a third</th>
<th>Recurrence</th>
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<td>76-T-MACH-100295</td>
<td>Materials Processing Technology</td>
<td>Liebig, Binder</td>
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</table>

**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, 🗑 Cancelled

**Competence Certificate**

Oral exam (lecture + lab course), approx. 25 min, lab course "Materials Processing" has to be finished successfully.

**Prerequisites**

Lab course "Materials Processing" has to be passed successfully in advance.

**Annotation**

Lecture: lecture notes, slides + beamer, blackboard  
Lab course: experimental equipment, paper, pencil, lab course notes, calculator

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

**Materials Processing Technology**

<table>
<thead>
<tr>
<th>Code</th>
<th>WS 21/22</th>
<th>Credits</th>
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<tbody>
<tr>
<td>2173540</td>
<td>3 SWS</td>
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</tbody>
</table>
Content

Introduction

Polymer:
Raw materials, materials laws and models, rheology, moulding, forming, joining

Ceramics:
raw materials, powder synthesis, additives, moulding and forming of glass, moulding, abrasive techniques, changing properties, final processing

Metals:
raw materials, materials processing, moulding, forming, cutting, joining

Semiconductors:
raw materials, moulding, changing properties

Summary

Objectives:
The students are able to name the different materials processing techniques and can describe their basic principles and allocate them to the different classes of materials processing methods. They can choose specific processing techniques based on given problems and consider constraints derived from their basic knowledge in materials science. The students are able to carry out simple experiments with lab scale equipment. They can correlate the processing parameters with resulting material properties by analyzing the materials using adequate testing methods which have to be chosen, evaluated and documented suitable to the problems given.

Requirements:
none, Recommendations: Module "Basics in Materials Science" should be passed

Workload:
The workload for the lecture “materials processing technology” is 180 h per semester and consists of the presence during the lectures (36 h) including tutorials, presence during the lab course (12 h), preparation and rework time at home (72 h) and preparation time for the oral exam (60 h).

Literature

Literaturhinweise, Unterlagen und Teilmanuskript in der Vorlesung

Presentation slides and additional lecture notes are handed out during the lecture, additional literature recommendations given
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

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Events

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<tr>
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<td>2173553</td>
<td>Materials Science and Engineering III</td>
<td>4</td>
<td>Lecture / 📚</td>
<td>Heilmaier, Guth</td>
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<td>WT 21/22</td>
<td>2173554</td>
<td>Exercises in Materials Science and Engineering III</td>
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Exams

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<td>Materials Science III</td>
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<td>Lecture (V) Blended (On-Site/Online)</td>
<td>Heilmaier, Guth</td>
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</table>

Competence Certificate
Oral exam, about 35 minutes

Prerequisites
T-MACH-110818 - Plasticity of Metals and Intermetallics has not been started

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

Materials Science and Engineering III
2173553, WS 21/22, 4 SWS, Language: German, Open in study portal

V

Content
Properties of pure iron; thermodynamic foundations of single-component and of binary systems; nucleation and growth; diffusion processes in crystalline iron; the phase diagram Fe-Fe3C; effects of alloying on Fe-C-alloys; nonequilibrium microstructures; multicomponent iron-based alloys; heat treatment technology; hardenability and hardenability tests.

Learning objectives:
The students are familiar with the thermodynamic foundations of phase transformations, the kinetics of phase transformations in the solid states (nucleation and growth phenomena), the mechanisms of microstructure formation and microstructure-property relationships and can apply them to metallic materials. They can assess the effects of heat treatments and of alloying on the microstructure and the properties of iron-based materials (steels in particular). The can select steels for structural applications in mechanical engineering and subject them to appropriate heat treatments.

Requirements:
Basic knowledge in materials science and engineering (Werkstoffkunde I/II)

Workload:
regular attendance: 53 hours
self-study: 187 hours

Literature
Vorlesungsskript; Übungsaufgaben; Bhadeshia, H.K.D.H. & Honeycombe, R.W.K.
Steels – Microstructure and Properties
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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**Events**

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<td>2161206</td>
<td>Mathematical Methods in Dynamics</td>
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<td>Lecture / 🖥</td>
<td>Proppe</td>
</tr>
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<td>WT 21/22</td>
<td>2161206</td>
<td>Mathematical Methods in Dynamics</td>
<td>2 SWS</td>
<td>Lecture / 🖥</td>
<td>Proppe</td>
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<tr>
<td>WT 21/22</td>
<td>2161207</td>
<td>Übungen zu Mathematische Methoden der Dynamik</td>
<td>1 SWS</td>
<td>Practice / 🧩</td>
<td>Proppe, Oestringer</td>
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**Exams**

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<td>76-T-MACH-105293</td>
<td>Mathematical Methods in Dynamics</td>
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</table>

**Competence Certificate**

written examination, 180 min.

**Prerequisites**

none

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

**Mathematical Methods in Dynamics**

2161206, SS 2021, 2 SWS, Language: German, Open in study portal

**Content**

The students know precisely the mathematical methods of dynamics. They are able to use the basic mathematical methods for modelling the dynamical behaviour of elastic and rigid bodies. The students also have a basic understanding of the description of kinematics and kinetics of bodies. They also master the alternative formulations based on weak formulations and variational methods and the approximate solution methods for numerical calculations of the moving behaviour of elastic bodies.

Dynamics of continua:
Concept of continuum, geometry of continua, kinematics and kinetics of continua

Variational principles:
Principle of virtual work, variational calculations, Principle of Hamilton

Approximate solution methods:
Methods of weighted residuals, method of Ritz
Literature
Vorlesungsskript (erhältlich im Internet)

J.E. Marsden, T.J.R. Hughes: Mathematical foundations of elasticity, New York, Dover, 1994
P. Haupt: Continuum mechanics and theory of materials, Berlin, Heidelberg, 2000
M. Riemer: Technische Kontinuumsmechanik, Mannheim, 1993

Mathematical Methods in Dynamics
2161206, WS 21/22, 2 SWS, Language: German, Open in study portal

Content
Dynamics of continua:
Concept of continuum, geometry of continua, kinematics and kinetics of continua

Dynamics of rigid bodies:
Kinematics and kinetics of rigid bodies

Variational principles:
Principle of virtual work, variational calculations, Principle of Hamilton

Approximate solution methods:
Methods of weighted residuals, method of Ritz

Applications

Literature
Vorlesungsskript (erhältlich im Internet)

J.E. Marsden, T.J.R. Hughes: Mathematical foundations of elasticity, New York, Dover, 1994
P. Haupt: Continuum mechanics and theory of materials, Berlin, Heidelberg, 2000
M. Riemer: Technische Kontinuumsmechanik, Mannheim, 1993

Übungen zu Mathematische Methoden der Dynamik
2161207, WS 21/22, 1 SWS, Language: German, Open in study portal

Content
Exercises related to the lecture
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

<table>
<thead>
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<th>Recurrence</th>
<th>Version</th>
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<tr>
<td>ST 2021</td>
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<td></td>
<td>Each summer term</td>
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<tr>
<td>ST 2021</td>
<td>1 SWS</td>
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**Exams**

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<tr>
<td>WT 21/22</td>
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<tr>
<td>WT 21/22</td>
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</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:**

**Mathematical Methods in Fluid Mechanics**

2154432, SS 2021, 2 SWS, Language: German/English, Open in study portal

**Lecture (V)**

Online

**Content**

The students can 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 simplify the Navier-Stokes equations for specific flow problems. They are able to employ mathematical method in fluid mechanics effectively in order to solve the resulting conservation equations analytically, if possible, or to enable simpler numerical access to the problem. They can describe the limits of applicability of the assumptions made to model the flow behavior.
Literature

Tutorial in Mathematical Methods of Fluid Mechanics
2154433, SS 2021, 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)

Organizational issues
Die Übungen zu Mathematische Methoden der Strömungslehre finden gemeinsam mit der englischen Übung statt.

Literature

Mathematical Methods in Fluid Mechanics
2154540, SS 2021, SWS, Language: English, Open in study portal

Content
The students can 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.

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The students can 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.
### 3.209 Course: Mathematical Methods in Micromechanics [T-MACH-110378]

**Responsible:** Prof. Dr.-Ing. Thomas Böhlke  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-104847 - Major Field Fundamentals of Engineering

<table>
<thead>
<tr>
<th>Type</th>
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<td>Grade to a third</td>
<td>Each summer term</td>
<td>1 terms</td>
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**Events**

| ST 2021 | 2162280 | Mathematical Methods in Micromechanics | 2 SWS | Lecture / Blended | Böhlke, Kehrer |

**Exams**

| ST 2021 | 76-T-MACH-110401 | Mathematical Methods in Micromechanics | 2 SWS | | Böhlke |

**Legend:** ![Online](image), ![Blended (On-Site/Online)](image), ![On-Site](image), ![Cancelled](image)

**Competence Certificate**

Written exam (180 min). Additives as announced.  
Prerequisite to registration to the exam: Passing the tutorial to Mathematical Methods in Micromechanics (T-MACH-110379)

**Prerequisites**

Passing the tutorial to Mathematical Methods in Micromechanics (T-MACH-110379)

**Modeled Conditions**

The following conditions have to be fulfilled:

1. The course T-MACH-110379 - Tutorial Mathematical Methods in Micromechanics must have been passed.

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

### Mathematical Methods in Micromechanics

2162280, SS 2021, 2 SWS, Language: German, [Open in study portal](link)

**Lecture (V)**

Blended (On-Site/Online)

**Content**

Fundamentals of linear isotropic and anisotropic thermoelasticity theory,  
Description of microstructures,  
Micro-macro relations of linear thermoelasticity theory,  
Approximations and bounds for the effective thermoelastic material behavior,  
Microstructure Sensitive Design of materials,  
Selected problems in the context of homogenization of nonlinear material properties

**Organizational issues**

Siehe Aushang am Institut bzw. Informationen auf der [webseite](link)

**Literature**

- Vorlesungsskript  
- Klingbeil, E.: Variationsrechnung, BI Wissenschaftsverlag, 1977  
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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<thead>
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**Events**

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<th>SWS</th>
<th>Type</th>
<th>Teacher</th>
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<tr>
<td>ST 2021</td>
<td>2162241</td>
<td>Mathematical methods of vibration theory</td>
<td>2</td>
<td>Lecture / 📚</td>
<td>Seemann</td>
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<tr>
<td>ST 2021</td>
<td>2162242</td>
<td>Mathematical methods of vibration theory (Tutorial)</td>
<td>2</td>
<td>Practice / 📚</td>
<td>Seemann, Burgert</td>
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**Exams**

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<tr>
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<th>Code</th>
<th>Title</th>
<th>SWS</th>
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<td>76-T-MACH-105294</td>
<td>Mathematical Methods of Vibration Theory</td>
<td>2</td>
<td>Practice / 📚</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 2021, 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 2021, 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:** Dr.-Ing. Marion Baumann  
Prof. Dr.-Ing. Kai Furmans

**Organisation:** KIT Department of Mechanical Engineering

**Part of:**  
- M-MACH-104847 - Major Field Fundamentals of Engineering  
- M-MACH-104878 - Specification in Mechanical Engineering  
- M-MACH-105134 - Elective Module Mechanical Engineering

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**Events**

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<th>Recurrence</th>
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<tr>
<td>WT 21/22</td>
<td>2117059</td>
<td>Mathematical models and methods for Production Systems</td>
<td>4 SWS</td>
<td>Lecture / 🧩</td>
<td>Grade to a third</td>
<td>Each winter term</td>
<td>Baumann, Furmans</td>
</tr>
</tbody>
</table>

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗞 On-Site, ✗ Cancelled

**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:

**Mathematical models and methods for Production Systems**

2117059, WS 21/22, 4 SWS, Language: English, [Open in study portal](#)

**Lecture (V)**

Blended (On-Site/Online)

**Content**

**Media:**  
black board, lecture notes, presentations

**Learning Content:**

- single server systems: M/M1, M/G/1: priority rules, model of failures  
- networks: open and closed approximations, exact solutions and approximations  
- application to flexible manufacturing systems, AGV (automated guided vehicles) - systems  
- modeling of control approaches like constant work in process (ConWIP) or kanban  
- discrete-time modeling of queuing systems

**Learning Goals:**

Students are able to:

- Describe queueing systems with analytical solvable stochastic models,  
- Derive approaches for modeling and controlling material flow and production systems based on models of queueing theory,  
- Use simulation and exakt methods.

**Recommendations:**

- Basic knowledge of statistic  
- recommended compulsory optional subject: Stochastics  
- recommended lecture: Materials flow in logistic systems (also parallel)

**Workload:**

regular attendance: 42 hours  
self-study: 198 hours
Literature
3.212 Course: Mathematical Models and Methods in Combustion Theory [T-MACH-105419]

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

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<thead>
<tr>
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<th>Credits</th>
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<th>Recurrence</th>
<th>Version</th>
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<tbody>
<tr>
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<td>Grade to a third</td>
<td>Each winter term</td>
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**Events**

<table>
<thead>
<tr>
<th>Termine und Raum</th>
<th>Lecture (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2165525</td>
<td>Blended (On-Site/Online)</td>
</tr>
</tbody>
</table>

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

**Prerequisites**  
none

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

**Mathematical models and methods in combustion theory**  
2165525, WS 21/22, 2 SWS, Language: German, [Open in study portal]

**Content**  
The lecture shall introduce the basics of the mathematical modeling and the analysis of reacting flow systems. The fundamental models of combustion processes are outlined together with asymptotical methods, which deliver reasonable approximate solutions for numerous combustion processes. Many examples of simplified models for the description of auto-ignition, explosions, flame quenching and detonations will be presented and discussed. The main analytical methods will be illustrated using these simple examples.

**Organizational issues**  
Termine und Raum: siehe Aushang und Internetseite des Instituts.

**Literature**  
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

<table>
<thead>
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<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
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</thead>
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<td>Grade to a third</td>
<td>Each summer term</td>
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**Events**

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<td>Measurement II</td>
<td>2 SWS</td>
<td>Lecture / 🖥</td>
<td>Stiller, Bieder</td>
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**Exams**

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<th>Type</th>
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<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
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<tbody>
<tr>
<td>ST 2021</td>
<td>Measurement II</td>
<td></td>
<td></td>
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</tbody>
</table>

**Competition Certificate**  
written exam  
60 min.  
2 DIN A4 Self-created formula sheets allowed

**Prerequisites**  
none

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

**Measurement II**  
2138326, SS 2021, 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

<table>
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<th>Events</th>
<th>ST 2021</th>
<th>2138328</th>
<th>Measurement Instrumentation Lab</th>
<th>2 SWS</th>
<th>Practical course / On-Site</th>
<th>Stiller, Wang</th>
</tr>
</thead>
</table>

| Exams | ST 2021 | 76-T-MACH-105300 | Measurement Instrumentation Lab |       | Stiller |

Legend: 🖥️ Online, 🧩 Blended (On-Site/Online), 🗣️ On-Site, ✗ Cancelled

Competence Certificate
Non graded colloquia

Prerequisites
none

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

Measurement Instrumentation Lab  
2138328, SS 2021, 2 SWS, Language: German, Open in study portal

Practical course (P) On-Site

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: Hon.-Prof. Dr. Bernd-Steffen von Bernstorff
Organisation: KIT Department of Mechanical Engineering

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

Type: Oral examination
Credits: 4
Grading scale: Grade to a third
Recurrence: Each winter term
Version: 2

Events

<table>
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<tr>
<th>Events</th>
<th>Credits</th>
<th>Content</th>
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<tbody>
<tr>
<td>Mechanics and Strengths of Polymers</td>
<td>2 SWS</td>
<td>Lecture / von Bernstorff</td>
</tr>
</tbody>
</table>

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
Oral exam, about 25 minutes

Prerequisites
none

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

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

Mechanics and Strengths of Polymers
2173580, WS 21/22, 2 SWS, Language: German, Open in study portal

Content
Molecular structure and morphology of polymers, temperature- and time dependency of mechanical behavior, viscoelasticity, time/temperature- superposition principle, yielding, crazing and fracture of polymers, failure criterions, impact and dynamic loading, corresponding principle, tough/brittle-transition, introduction to the principles of fiber reinforcement and multiple cracking in composites

learning objectives:
The students are prepared to

- repeat the calculus on strength and design of engineering parts exposed to complex loadings,
- estimate the influence of time and temperature on the strength of polymeric materials,
- relate the strength of materials to their molecular structure, morphology and processing parameters and
- derive failure mechanisms for homogenous polymers and composite materials therefrom.

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

workload:
The workload for the lecture Mechanics and Strengths of Polymers is 120 h per semester and consists of the presence during the lecture (28 h) as well as preparation and rework time at home (92 h).

Literature
Literaturliste, spezielle Unterlagen und ein Teilmanuskript werden in der Vorlesung ausgegeben
3.216 Course: Mechanics in Microtechnology [T-MACH-105334]

Responsible: Prof. Dr. Christian Greiner
Dr. Patric Gruber

Organisation: KIT Department of Mechanical Engineering

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

Type
Oral examination

Credits
4

Grading scale
Grade to a third

Recurrence
Each winter term

Version
1

Events

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<tr>
<th>WT 21/22</th>
<th>2181710</th>
<th>Mechanics in Microtechnology</th>
<th>2 SWS</th>
<th>Lecture / 🕵️‍♂️</th>
<th>Gruber, Greiner</th>
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Exams

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<th>76-T-MACH-105334</th>
<th>Mechanics in Microtechnology</th>
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<th>Gruber, Greiner</th>
</tr>
</thead>
</table>

Legend: Online, 🕵️‍♂️ Blended (On-Site/Online), 🗣️ On-Site, ✗ Cancelled

Competence Certificate

Oral examination, ca. 30 min

Prerequisites

none

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

Mechanics in Microtechnology

2181710, WS 21/22, 2 SWS, Language: German, Open in study portal

Lecture (V) Blended (On-Site/Online)

Content

1. Introduction: Application and Processing of Microsystems
2. Scaling Effects
3. Fundamentals: Stress and Strain, (anisotropic) Hooke's Law
4. Fundamentals: Mechanics of Beams and Membranes
5. Thin Film Mechanics: Origin and Role of Mechanical Stresses
6. Characterization of Mechanical Properties of Thin Films and Small Structures: Measurement of Stresses and Mechanical Parameters such as Young's Modulus and Yield Strength; Thin Film Adhesion and Stiction
7. Transduction: Piezo-resistivity, Piezo-electric Effect, Electrostatics,...
8. Aktuation: Inverse Piezo-electric Effect, Shape Memory, Electromagnetic Actuation,...

The students know and understand size and scaling effects in micro- and nanosystems. They understand the impact of mechanical phenomena in small dimensions. Based on this they can judge how they determine material processing as well as working principles and design of microsensors and microactuators.

regular attendance: 22,5 hours
self-study: 97,5 hours
oral exam ca. 30 minutes

Literature

Foliens
2. L.B. Freund and S. Suresh: "Thin Film Materials"
3.217 Course: Mechano-Informatics and Robotics [T-INFO-101294]

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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<td>Grade to a third</td>
<td>Each winter term</td>
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Events

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<td>Mechano-Informatics and Robotics</td>
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<td>Nachprüfung: Mechano-Informatics and Robotics</td>
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<td>WT 21/22</td>
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<td>Mechano-Informatics and Robotics</td>
<td>Asfour</td>
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Below you will find excerpts from events related to this course:

Mechano-Informatics and Robotics

2400077, WS 21/22, 2 SWS, Language: German/English, Open in study portal

Lecture (V) Blended (On-Site/Online)

Content

The lecture addresses various engineering and algorithmic aspects and topics in robotics which are illustrated and explained based on examples originating from current research conducted in the field of humanoid robotics. First, this lecture gives an introduction into the mathematical fundamentals which are needed to describe a robotic system as well as the basic algorithms commonly applied in motion planning. Subsequently, models and methods are introduced with which dynamical systems can be formalized and which can be used to encode and represent robot actions. To do so, we will discuss linear time-invariant systems in state.

Learning Objectives:

Based on the example of robotics students understand the synergistic effects and interdisciplinarity of mechatronics and informatics, the embedded systems, the control, and the methods and the algorithms. They are acquainted with the basic terminology and the methods which are common in robotics, signal processing, action representation, machine learning and cognitive systems. They are capable of applying fundamental state-of-the-art methods and tools for the development and programming of robots. Based on examples originating from current research conducted in the fields of humanoid robotics, the students interactively learn how to identify and formalize problems and tasks and how to develop solutions in an analytical and goal-directed way.

Organizational issues

Zugehörige Veranstaltungen: Empfehlung - Basispraktikum Mobile Roboter

Die Erfolgskontrolle erfolgt in Form einer schriftlichen Prüfung in englischer Sprache im Umfang von i.d.R. 60 Minuten nach § 4 Abs. 2 Nr. 1 SPO.

Arbeitsaufwand:

2h Präsenz
+ 2*2h = 4h Vor/Nachbereitung
+ 30h Prüfungsvorbereitung
120h
3.218 Course: Mechatronical Systems and Products [T-MACH-105574]

**Responsible:** Prof. Dr.-Ing. Sören Hohmann  
Prof. Dr.-Ing. Sven Matthiesen

**Organisation:** KIT Department of Mechanical Engineering

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

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

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<td>2303003</td>
<td>Exercise for 2303161 Mechatronical Systems and Products</td>
<td>1 SWS</td>
<td>Practice / 📀</td>
<td>Matthiesen, Hohmann, N.N.</td>
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<td>WT 21/22</td>
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<td>Lecture / 📆</td>
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**Exams**

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<td>Mechatronical Systems and Products</td>
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<td>Matthiesen</td>
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**Competence Certificate**

written examination (duration: 60min)

**Prerequisites**

Successful participation in the workshop Mechatronical 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.
# 3.219 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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<td>Medical Imaging Techniques I</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
3.220 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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**Events**

| ST 2021 | 2305262 | Medical Imaging Techniques II | 2 SWS | Lecture / 🖥️ | Dössel |

**Exams**

| ST 2021 | 7305262 | Medical Imaging Techniques II | Dössel |

Legend: 🖥️ Online, 🧩 Blended (On-Site/Online), 🔢 On-Site, ❌ Cancelled

**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.
### 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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**Exams**

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Legend: Online, Blended (On-Site/Online), On-Site, Cancelled
3.222 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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<th>2 SWS</th>
<th>Lecture / Online</th>
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**Exams**

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<th>Metal Forming</th>
<th>Herlan</th>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ☑ Cancelled

**Competence Certificate**

Oral Exam (20 min)

**Prerequisites**

none

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

**Metal Forming**

2150681, SS 2021, 2 SWS, Language: German, Open in study portal

Lecture (V) Online
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

Organizational issues
Vorlesungstermine freitags, wöchentlich.
Die konkreten Termine werden in der ersten Vorlesung bekannt gegeben und auf der Institutshomepage und ILIAS veröffentlicht.

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

**Responsible:** Prof. Dr.-Ing. Martin Heilmaier
Fabian Mühl

**Organisation:** KIT Department of Mechanical Engineering

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

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<td>Each term</td>
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<td>Practical course /</td>
<td>Heilmaier, Mühl</td>
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**Exams**

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<td>Heilmaier</td>
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</table>

**Competence Certificate**

Colloquium for every experiment, about 60 minutes, protocol

**Prerequisites**

none

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

**Content**

**Organizational issues**


**Literature**

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


Literaturliste wird zu jedem Versuch ausgegeben

Module Offers in Mechanical Engineering for Exchange Students , Date: 15/09/2021
Valid from Winter Term 2021/2022
Metallographic Lab Class
2175590, WS 21/22, 3 SWS, Language: German, Open in study portal

Content
Light microscope in metallography
- Metallographic sections of metallic materials
- Investigation of the microstructure of unalloyed steels and cast iron
- Microstructure development of steels with accelerated cooling from the austenite area
- Investigation of microstructures of alloyed steels
- Investigation of failures quantitative microstructural analysis
- Microstructural investigation of technically relevant non-ferrous metals
- Application of Scanning electron microscope

Learning objectives:
The students in this lab class gain are able to perform standard metallographic preparations and are able to apply standard software for quantitative microstructural analyses. Based on this the student can interpret unetched as well as etched microstructures with respect to relevant microstructural features. They can draw concluding correlations between heat treatments, ensuing microstructures and the resulting mechanical as well as physical properties of the investigated materials.

Requirements:
Material Science I/II

Workload:
The workload for the Metallographic Lab Class is 120 h per semester and consists of the presence during the lab course (25 h) as well as preparation and rework time at home (95 h).

Organizational issues
Der Anmeldezeitraum für das WS 21/22 ist Anfang September!

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

Literaturliste wird zu jedem Versuch ausgegeben
3.224 Course: Metals [T-MACH-105468]

**Type**
Oral examination

**Credits**
6

**Grading scale**
Grade to a third

**Recurrence**
Each summer term

**Version**
1

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### Events

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<td>Exercises</td>
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**Competence Certificate**
Oral exam, about 20 minutes

**Prerequisites**
none

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

#### Lecture (V)
Blended (On-Site/Online)

**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

---

**Organizational issues**
Die Vorlesung wird zu den angegebenen Zeiten online stattfinden. Bitte melden Sie sich für eine Teilnahme in ILIAS an.

**Literature**
G. Gottstein, Physikalische Grundlagen der Materialkunde, Springer 2007
E. Hombogen, 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)
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

Organizational issues
Weitere Informationen finden Sie hier: https://www.iam.kit.edu/wk/lehre.php

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=KITSRC0309606810
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC052463656
http://services.bibliothek.kit.edu/primo/start.php?recordid=KITSRC277759961X
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)
3.225 Course: Methods and Processes of PGE - Product Generation Development [T-MACH-109192]

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

**Organisation:**
KIT Department of Mechanical Engineering

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

**Event Details:**

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

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**Exams**

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<td>Product Development - Methods of Product Development</td>
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<td>ST 2021</td>
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Content

Note:
This lecture is the basis for the main subject Integrated Product Development, which is offered as a specialisation.

Recommendations:
none

Workload:
regular attendance: 39 h
self-study: 141 h

Examination:
Written exam
Duration: 120 minutes (+10 minutes reading time)

Auxiliaries:
• Calculator
• German dictionary (books only)

Course content:
Basics of Product Development: Basic Terms, Classification of the Product
Development into the industrial environment, generation of costs / responsibility for costs
Concept Development: List of demands / Abstraction of the Problem Definition / Creativity Techniques / Evaluation and selection of solutions
Drafting: Prevailing basic rules of Design / Design Principles as a problem oriented accessory
Rationalization within the Product Development: Basics of Development
Management/ Simultaneous Engineering and Integrated Product Development/Development of Product Lines and Modular Construction Systems
Quality Assurance in early Development Phases: Methods of Quality Assurance in an overview/QFD/FMEA

Learning objectives:
The students are able to...

• classify product development in companies and differentiate between different types of product development.
• name the relevant influencing factors of a market for product development.
• name, compare and use the central methods and process models of product development within moderate complex technical systems.
• explain problem solving techniques and associated development methods.
• explain product profiles and to differentiate and choose suitable creative techniques of solution/idea generation finding on this basis.
• use design guidelines to create simple technical systems and to explain these guidelines.
• name and compare quality assurance methods; to choose and use suitable methods for particular applications.
• explain the 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
3.226 Course: Methods of Signal Processing [T-ETIT-100694]

Responsible: Prof. Dr.-Ing. Michael Heizmann
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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Exams

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Prerequisites
none
### 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>
<thead>
<tr>
<th>Type</th>
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**Events**

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<th>2141501</th>
<th>Micro Magnetic Resonance</th>
<th>2 SWS</th>
<th>Seminar / 🧩</th>
<th>MacKinnon, Badilita, Jouda, Korvink</th>
</tr>
</thead>
</table>

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), ⚫ On-Site, ✗ Cancelled

**Competence Certificate**

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

**Prerequisites**

none

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

<table>
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**Events**

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<td>ST 2021 2142881</td>
<td>2 SWS</td>
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**Exams**

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<tr>
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<td>2 SWS</td>
<td>Microactuators</td>
<td>Kohl</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 2021, 2 SWS, Language: German, Open in study portal

**Lecture (V) Online**

**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:

  - Micro electromechanical 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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**Events**

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**Exams**

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<td>2 SWS</td>
<td>Lecture</td>
<td>Microenergy Technologies</td>
<td>76-T-MACH-105557</td>
<td>Kohl</td>
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</tbody>
</table>

Legend: 🌐 Online, 🎨 Blended (On-Site/Online), 🗿 On-Site, ☠ Cancelled

**Competence Certificate**

Oral examination (90 Min.)

**Prerequisites**

none

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

**Microenergy Technologies**  
2142897, SS 2021, 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"  
Course: Microsystem Simulation [T-MACH-108383]

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

<table>
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<td>Each summer term</td>
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Competence Certificate
written exam

Prerequisites
none
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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Events

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<td>Mobile Machines</td>
<td>4 SWS</td>
<td>Lecture / Online</td>
<td>Geimer, Lehr</td>
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Exams

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<td>Geimer</td>
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Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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 of the structure of mobile machines
- Practical insight in the development techniques

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

V Mobile Machines
2114073, SS 2021, 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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<td>Übungen zu Modellbildung und Simulation</td>
<td>2 SWS</td>
<td>Grade to a third</td>
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**Exams**  
ST 2021 76-T-MACH-105297 Modeling and Simulation  
Geimer, Furmans, Proppe

**Legend:** Online, Blended (On-Site/Online), On-Site, Cancelled

**Competence Certificate**  
The assessment consists of a 180 minutes written examination.

**Prerequisites**  
none

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

**Modelling and Simulation**  
2185227, WS 21/22, 2 SWS, Language: German, [Open in study portal]

**Content**  
Introduction: Overview, concept formation, simulation studies, time/event-discrete models, event-oriented/process orientated/transaction-oriented view, typical model classes (operation/maintenance, storekeeping, loss-susceptible systems)

Time-continuous models with concentrated parameters, model characteristics and model analysis  
Numerical treatment of ordinary differential equations and differential-algebraic sets of equations coupled simulations with concentrated parameters

Time-continuous models with distributed parameters, description of systems by means of partial differential equations, model reduction, numerical solution procedures for partial differential equations

**Organizational issues**  
Vorlesung findet in Präsenz statt, sofern es die COVID-Inzidenzwerte zulassen.

**Literature**  
Keine.
3.233 Course: Modeling of Thermodynamical Processes [T-MACH-105396]

**Responsible:** Prof. Dr. Ulrich Maas  
Dr.-Ing. Robert Schießl

**Organisation:** KIT Department of Mechanical Engineering

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

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**Exams**

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<td>Lecture / 🕒</td>
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</table>

**Competence Certificate**

Oral exam, approx. 30 min

**Prerequisites**

none

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

**V** Modeling of Thermodynamical Processes  
2167523, SS 2021, 3 SWS, Language: German, Open in study portal  
Lecture (V) Online

**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

**V** Modeling of Thermodynamical Processes  
2167523, WS 21/22, 3 SWS, Language: German, Open in study portal  
Lecture (V) Blended (On-Site/Online)

**Content**

- Principles of modelling: Representation of physical systems by equations
- Numerical solution strategies for nonlinear equation systems
- Constrained Optimization
- Ordinary and partial differential equations
- Application to various problems in thermodynamics (engine processes, determination of equilibrium states, unsteady processes in inhomogeneous systems)
**Literature**

Vorlesungsskript

Numerical Recipes C, FORTRAN; Cambridge University Press

R.W. Hamming; Numerical Methods for scientists and engineers; Dover Books On Engineering; 2nd edition; 1973

J. Kopitz, W. Polifke; Wärmeübertragung; Pearson Studium; 1. Auflage
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>Each term</td>
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**Events**

- **WT 21/22 6221911**
  - Modelling of Turbulent Flows - RANS and LES
  - 4 SWS
  - Lecture / Practice (Uhlmann)

**Exams**

- **ST 2021 8244110842**
  - Modeling of Turbulent Flows - RANS and LES
  - Uhlmann

**Competence Certificate**

oral exam, appr. 45 min.

**Prerequisites**

none

**Recommendation**

none

**Annotation**

none
### 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

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

- **ST 2021**  
  2183703 Modelling and Simulation  
  2+1 SWS Lecture / Practice (L) Nestler

- **WT 21/22**  
  2183703 Numerical methods and simulation techniques  
  3 SWS Lecture / Practice (L) Nestler

**Exams**

- **ST 2021**  
  76-T-MACH-100300 Modelling and Simulation Nestler

- **WT 21/22**  
  76-T-MACH-100300 Modelling and Simulation Nestler

**Legend:** Online, Blended (On-Site/Online), On-Site, Cancelled

**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 2021, 2+1 SWS, Language: German, Open in study portal

**Lecture / Practice (VÜ)**  
Online
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

Organizational issues
Die Termine für die Übungen werden in der Vorlesung und im Ilias bekannt gegeben.

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

<table>
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<tbody>
<tr>
<td>ST 2021</td>
<td></td>
<td></td>
<td>Each winter term</td>
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</table>

**Competence Certificate**
oral exam 30 min

**Prerequisites**
none

**Recommendation**
materials science  
fundamental mathematics

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

**Modelling of Microstructures**
2183702, WS 21/22, 3 SWS, Language: German, [Open in study portal](#)  
Lecture / Practice (VÜ)  
Online
Content

- Brief Introduction in thermodynamics
- Statistical interpretation of entropy
- Gibbs free energy and phase diagrams
- Free energy functional
- Phasefield equation
- Gibbs-Thomson-equation
- Driving forces
- Grand chemical potential functional and the evolution equations
- For compare: Free energy functional with driving forces

The student can

- explain the thermodynamic and statistical foundations for liquid-solid and solid-solid phase transition processes and apply them to construct phase diagrams.
- describe the specific characteristics of dendritic, eutectic and peritectic microstructures.
- explain the mechanisms of grain and phase boundary motion induced by external fields
- use the phase-field method for simulation of microstructure formation processes using modeling approaches and challenges of current research
- has experiences in computing and conduction simulations of microstructure formation from an integrated computer lab.

knowledge in materials science and in fundamental mathematics recommended

regular attendance: 22,5 hours lecture, 11,5 hours exercises
self-study: 116 hours

We regularly hand out exercise sheets. The individual solutions will be corrected.

oral exam ca. 30 min

Literature

4. Gaskell, D.R., Introduction to the thermodynamics of materials
5. Übungsblätter
Course: Modern Control Concepts I [T-MACH-105539]

**Responsible:** apl. Prof. Dr. Lutz Groell
appl. Prof. Dr. Jörg Matthes

**Organisation:** KIT Department of Mechanical Engineering

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

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

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<th>Type</th>
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<td>2 SWS</td>
<td>Matthes, Groell</td>
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**Exams**

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<td>Modern Control Concepts I</td>
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**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 2021, 2 SWS, Language: German, [Open in study portal](#)

**Literature**


**Tutorial on Modern Control Concepts I**

2106020, SS 2021, 2 SWS, Language: German, [Open in study portal](#)

**Content**

**Learning Content:**

1. Introduction (system classes, nomenclature)
2. Equilibria
3. Linearization (software based, Hartman-Grobman-Theorem)
4. Parameter identification of linear dynamic models (SISO+MIMO)
5. PID-controller (realization, design-hints, Anti-Windup-mechanisms)
6. Concept of 2DOF-Controllers (structure, reference signal design)
7. State space (geometric view)
8. Controller with state feedback and integrator expansion
   (LQ-design, Eigenvalue placement, decoupling design)
9. Observer (LQG-design, disturbance observer, reduced observer)

**Recommendations:**

Attendance of the following lectures is recommended:

- Grundlagen der Mess- und Regelungstechnik

Alternatively: Comparable courses of the faculty of electrical engineering
Literature

• Rugh, W.: Linear System Theory. Prentice Hall, 1996
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

<table>
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<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
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<tbody>
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<td>Grade to a third</td>
<td>Each term</td>
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**Events**

<table>
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<tr>
<th>Events</th>
<th>Code</th>
<th>Name</th>
<th>Credits</th>
<th>Type</th>
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<tbody>
<tr>
<td>ST 2021</td>
<td>2115808</td>
<td>Motor Vehicle Laboratory</td>
<td>2 SWS</td>
<td>Practical course / 🖥️</td>
<td>Frey</td>
</tr>
<tr>
<td>WT 21/22</td>
<td>2115808</td>
<td>Motor Vehicle Laboratory</td>
<td>2 SWS</td>
<td>Practical course / 🖏️</td>
<td>Frey, Böse, Vollat</td>
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**Exams**

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<tr>
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<td>76-T-MACH-105222</td>
<td>Motor Vehicle Laboratory</td>
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</table>

Legend: 🖥️ Online, 🧩 Blended (On-Site/Online), 🖏️ On-Site, ✗ Canceled

**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 2021, 2 SWS, Language: German, Open in study portal

Practical course (P) Online

**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.
Organizational issues
Genauer Ort und Termine sowie weitere Infos siehe Institutshomepage.

Einteilung in
- Gruppe A: Mo 14:00 - 15:30
- Gruppe B: Mo 16:00 - 17:30
- Gruppe C: Di 09:00 - 10:30
- Gruppe D: Di 11:00 - 12:30
- Gruppe E: Di 14:00 - 15:30
- Gruppe F: Di 16:00 - 17:30

Literature

Motor Vehicle Laboratory
2115808, WS 21/22, 2 SWS, Language: German, Open in study portal

Content
1. Determination of the driving resistances of a passenger vehicle on a roller dynamometer; measurement of the engine performance of the test vehicle
2. Investigation of a twin-tube and a single-tube shock absorber
3. Behavior of car tyres under longitudinal forces and lateral forces
4. Investigation of acoustic behaviour of vehicles
5. Rolling resistance, energy dissipation and high-speed strength of car tires
6. Investigation of the moment transient characteristic of a Visco clutch

Learning Objectives:
The students have deepened their knowledge on motor vehicles acquired in lectures and can apply it practically. They have an overview of the applied measuring technique and can execute and analyse measurements for the handling of given problem definitions. They are ready to analyze and to judge measurement results.

Organizational issues
Genaue Termine und weitere Hinweise: siehe Institutshomepage.

Einteilung:
- Gruppe A: Mo 14:00-15:30
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- Gruppe C: Di 09:00-10:30
- Gruppe D: Di 11:00-12:30
- Gruppe E: Di 14:00-15:30
- Gruppe F: Di 16:00-17:30

Literature
### 3.239 Course: Multi-Scale Plasticity [T-MACH-105516]

**Responsible:** Prof. 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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**Events**

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<td>Multi-scale Plasticity</td>
<td>2 SWS</td>
<td>Lecture</td>
<td>Greiner, Schulz</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, X Cancelled

---

**Competence Certificate**

Presentation (40%) and 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

---

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

### Multi-scale Plasticity

2181750, WS 21/22, 2 SWS, Language: German, [Open in study portal](#)  
Blended (On-Site/Online)

---

**Content**

This module will attempt to provide an overview of complex subjects in the field of material mechanics. For this purpose, important scientific papers will be presented and discussed. This will be done by having students read and critique one paper each week in a short review. In addition, each week will include presentation from one of the participants which aim to advocate or criticise each piece of work using the short reviews. He will also be the discussion leader, while students discuss the content, ideas, evaluation, and open research questions of the paper. Using a professional conference management system (HotCRP), the student assume the role of reviewers and gain insight into the work of researchers.

The student will:

- Can explain the physical foundations of plasticity as well as results of latest research.
- Can independently read and evaluate scientific research papers.
- Can present specific, technical information in structured, precise, and readable manner.
- Can argue for and/or against a particular approach or idea using the knowledge acquired within the lecture.

Preliminary knowledge in mathematics, physics, mechanics, and materials science recommended.

Regular attendance: 22.5 hours  
Self-study: 97.5 hours

Exam: Presentation (40%), oral examination (30 min, 60%)

The maximum number of students is 14 per semester.

---

**Organizational issues**

Termine werden bekannt gegeben. Seminarraum des IAM-CMS (Geb. 10.91, Raum 227/3) Anmeldung per Email an katrin.schulz@kit.edu bis zum 08.10.2021
3.240 Course: Nanotechnology for Engineers and Natural Scientists [T-MACH-105180]

**Responsible:** Prof. Dr. Martin Dienwiebel
apl. Prof. Dr. Hendrik Hölscher
Stefan Walheim

**Organisation:** KIT Department of Mechanical Engineering

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

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<td>2 SWS</td>
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**Exams**

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<td>2 SWS</td>
<td>Hölscher</td>
<td>Each summer term</td>
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</table>

**Competence Certificate**

written exam 90 min

**Prerequisites**

none

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

**Nanotechnology for Engineers and Natural Scientists**

2142861, SS 2021, 2 SWS, Language: German, Open in study portal

**Content**

Nanotechnology deals with the fabrication and analysis of nanostructures. The topics of the lecture include

- the most common measurement principles of nanotechnology especially scanning probe methods
- the analysis of physical and chemical properties of surfaces
- interatomic forces and their influence on nanostructures
- methods of micro- and nanofabrication and lithography
- basic models of contact mechanics and nanotribology
- important functional characteristics of nanodevices

Basic knowledge in mathematics and physics is assumed

The successfull attendance of the lecture is controlled by a 30 minutes oral exam.

**Organizational issues**


Für die mündlichen Prüfungen werden zwei Termine angeboten werden (voraussichtlich in der ersten Woche nach Vorlesungsende im Sommersemester und in der ersten Woche vor Vorlesungsbeginn im Wintersemester).

**Literature**

Alle Folien und Originalliteratur werden auf ILIAS zur Verfügung gestellt.
3.241 Course: Neutron Physics of Fusion Reactors [T-MACH-105435]

Responsible: Dr. Ulrich Fischer
Organisation: KIT Department of Mechanical Engineering

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

**Type**
Oral examination

**Credits**
4

**Grading scale**
Grade to a third

**Recurrence**
Each winter term

**Version**
1

### Events

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<th>Credits</th>
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<td>Neutron physics of fusion reactors</td>
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<td>Neutron physics of fusion reactors</td>
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<td>Fischer</td>
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</table>

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

### Competence Certificate
oral exam of about 30 minutes

### Prerequisites
none

### Annotation
none

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

### Neutron physics of fusion reactors

<table>
<thead>
<tr>
<th>Event ID</th>
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<td>Neutron physics of fusion reactors</td>
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<td>2 SWS</td>
<td>Lecture</td>
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</table>

Open in study portal

**Lecture (V)**
On-Site

### Content
Nuclear interaction processes and energy release
Chain reaction and criticality
Neutron transport, Boltzmann equation
Diffusion approximation, Monte Carlo method
Neutronic reactor design

The aim of this lecture is to provide the neutron physics principles required for analysis of nuclear fission and fusion reactors. First of all, the basic nuclear interaction processes are presented which are important for the physical behaviour of the reactors. Next the neutron transport phenomenon in matter is described by means of the Boltzmann transport equation. Suitable mathematical solution methods are presented such as the diffusion approximation for nuclear fission reactors and the Monte Carlo method for fusion reactors. The knowledge acquired will eventually be used to solve neutron physics problems related to the design and optimization of the reactors.

oral exam, duration: approximately 30 minutes, no tools or reference materials may be used during the exam
regular attendance: 21 h
self-study: 42 h

Admission to Campus North is required, please register to attend the lecture at: il-sekretariat@inr.kit.edu

### Literature
K. H. Beckurts, K. Wirtz, Neutron Physics, Springer Verlag, Berlin, Germany (1964)
3.242 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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**Events**

| ST 2021          | 2142551 | NMR micro probe hardware conception and construction | 2 SWS | Practical course / Blended (On-Site/Online) | Korvink, Jouda |

**Exams**

| ST 2021          | 76-T-MACH-108407 | NMR micro probe hardware conception and construction | Korvink |

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗷 On-Site, ✗ Cancelled

**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 2021, 2 SWS, Language: English, [Open in study portal](#)  
Practical course (P)  
Blended (On-Site/Online)

**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.

**Organizational issues**

Blockveranstaltung am CN, Bau 301, Raum 322, Anmeldung an Mazin.Jouda@kit.edu
3.243 Course: Nonlinear Continuum Mechanics [T-MACH-111026]

Responsible: Prof. Dr.-Ing. Thomas Böhlke
Organisation: Part of: M-MACH-104878 - Specification in Mechanical Engineering
M-MACH-105134 - Elective Module Mechanical Engineering

Type
Oral examination

Credits
3

Grading scale
Grade to a third

Recurrence
Each summer term

Version
1

Events
ST 2021 2162344 Nonlinear Continuum Mechanics 2 SWS Lecture / Blended (On-Site/Online) Böhlke

Exams
ST 2021 76-T-MACH-111026 Nonlinear Continuum Mechanics Böhlke

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
oral examination (approx. 25 min)

Prerequisites
Passing the "Tutorial Nonlinear Continuum Mechanics" (T-MACH-111027) is a prerequisite for taking part in the exam.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-111027 - Tutorial Nonlinear Continuum Mechanics must have been passed.

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

Nonlinear Continuum Mechanics
2162344, SS 2021, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

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

Organizational issues
Siehe Aushang am Institut bzw. Informationen auf der website

Literature
- Vorlesungsskript
3.244 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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**Events**

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<th>Course Name</th>
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<td>WT 21/22</td>
<td>2141865</td>
<td>Novel actuators and sensors</td>
<td>2 SWS</td>
<td>Lecture / Online Kohl, Sommer</td>
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**Exams**

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<tr>
<td>ST 2021</td>
<td>76-T-MACH-102152</td>
<td>Novel Actuators and Sensors</td>
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<td>Sommer, Kohl</td>
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<tr>
<td>WT 21/22</td>
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<td>Novel Actuators and Sensors</td>
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<td>Kohl, Sommer</td>
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</table>

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

**Competence Certificate**

written exam, 60 minutes

**Prerequisites**

none

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

**Novel actuators and sensors**

2141865, WS 21/22, 2 SWS, Language: German, Open in study portal

**Literature**

- Vorlesungsskript "Neue Aktoren" und Folienkript "Sensoren"
- Donald J. Leo, Engineering Analysis of Smart Material Systems, John Wiley & Sons, Inc., 2007
3.245 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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<tr>
<td><strong>WT 21/22</strong></td>
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</table>

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ☐ Cancelled

Competence Certificate
oral exam, approx. 20 min.

Prerequisites
none

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

**Nuclear Fusion Technology**
2189920, WS 21/22, 2 SWS, Language: English, Open in study portal

Content
This lecture is dedicated to Master students of mechanical engineering and other engineering studies. Goal of the lecture is the understanding of the physics of fusion, the components of a fusion reactor and their functions. The technological requirements for using fusion technology for future commercial production of electricity and the related environmental impact are also addressed. The students are capable of giving technical assessment of the usage of the fusion energy with respect to its safety and sustainability. The students are qualified for further training in fusion energy field and for research-related professional activity.

- nuclear fission & fusion
- neutronics for fusion
- fuel cycles, cross sections
- gravitational, magnetic and inertial confinement
- fusion experimental devices
- energy balance for fusion systems; Lawson criterion and Q-factor
- materials for fusion reactors
- plasma physics, confinement
- plasma heating
- timeline of the fusion technology
- ITER, DEMO
- safety and waste management
T 3.246 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

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Events

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<th>Expansion</th>
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<tbody>
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<td>2189921</td>
<td>Nuclear Power and Reactor Technology</td>
<td>Grade to a third</td>
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<td>Grade to a third</td>
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Legend: 🏪 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ☠ Cancelled

Competence Certificate
oral exam, approx. 20 min.

Prerequisites
None

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

V Nuclear Power and Reactor Technology
2189921, WS 21/22, 3 SWS, Language: English, Open in study portal Lecture (V) Online

Content
This lecture is dedicated to Master students of mechanical engineering and other engineering studies. Goal of the lecture is the understanding of reactor technology and of the major physical processes in converting nuclear power into electrical energy. The students acquire comprehensive knowledge on the physics of nuclear fission reactors: neutron flux, cross sections, fission, breeding processes, chain reaction, critical size of a nuclear system, moderation, reactor dynamics, transport- and diffusion-equation for the neutron flux distribution, power density distributions in reactor, one-group, two-group and multi-group theories for the neutron spectrum. Students are able to analyze and understand the obtained results. The students are capable of understanding the advantages and disadvantages of different reactor technologies - LWR, heavy water reactors, nuclear power systems of generation IV - by using the delivered knowledge on reactor physics, thermal-hydraulics, reactor design, control, safety and requirements of the front-end and back-end of the fuel cycle. The students are qualified for further training in nuclear energy and safety field and for (also research-related) professional activity in the nuclear industry.

• nuclear fission & fusion,
• radioactive decay, neutron excess, fission, fast and thermal neutrons, fissile and fertile nuclei, enrichment, neutron flux, cross section, reaction rate, mean free path,
• chain reaction, critical size, moderation,
• reactor dynamics,
• transport- and diffusion-equation for the neutron flux distribution,
• power distributions in reactor,
• one-group and two-group theories,
• light-water reactors,
• reactor safety,
• design of nuclear reactors,
• breeding processes,
• nuclear power systems of generation IV
3.247 Course: Nuclear Power Plant Technology [T-MACH-105402]

**Responsible:** Dr. Aurelian Florin Badea  
Prof. Dr.-Ing. Xu Cheng  
Hon.-Prof. Dr. 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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<td>Each summer term</td>
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</table>

**Events**

| ST 2021 | 2170460 | Nuclear Power Plant Technology 2 SWS | Lecture / Online | Cheng, Schulenberg |

**Exams**

| ST 2021 | 76-T-MACH-105402 | Nuclear Power Plant Technology | Cheng, Schulenberg |

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

**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 2021, 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
3.248 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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<thead>
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**Events**

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<tbody>
<tr>
<td>WT 21/22 2153441 Numerical Fluid Mechanics</td>
<td>2 SWS</td>
<td>Lecture / 🧩</td>
<td>Gatti</td>
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**Exams**

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<th>Recurrence</th>
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<tbody>
<tr>
<td>WT 21/22 76T-Mach-105338 Numerical Fluid Mechanics</td>
<td></td>
<td>Gatti, Frohnapfel</td>
<td></td>
</tr>
</tbody>
</table>

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🔴 On-Site, ✗ Cancelled

**Competition Certificate**
oral exam - 30 minutes

**Prerequisites**
none

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

**V Numerical Fluid Mechanics**  
2153441, WS 21/22, 2 SWS, Language: German, [Open in study portal](#)  
Lecture (V)  
Blended (On-Site/Online)

**Content**
The course covers the following topics:
1. basic equations of computational fluid dynamics  
2. main discretization methods for fluid mechanics problems, with focus on finite differences and finite volumes  
3. boundary and initial conditions  
4. mesh generation and mesh treatment  
6. solution algorithms for linear and nonlinear systems of equations  
7. solution strategies for the incompressible Navier-Stokes equations  
8. introduction to the solution of the compressible Navier-Stokes equations  
9. examples of numerical simulation in practice

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

**Responsible:** Prof. Dr.-Ing. Bettina Frohnapfel  
**Organisation:** KIT Department of Mechanical Engineering

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

**Type**  
Completed coursework  
**Credits** 4  
**Grading scale** pass/fail  
**Recurrence** Each summer term  
**Version** 1

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| ST 2021 | 2154405 | **Numerical Fluid Mechanics with Python** | 2 SWS | Practical course /  
|  |  |  |  |
| Exams |  |  |  |
| ST 2021 | 76-T-MACH-110838 | **Numerical Fluid Mechanics with Python** | 2 SWS |  
|  |  |  | Frohnapfel, Gatti |

| Legend: | Online, | Blended (On-Site/Online), | On-Site, | Cancelled |

**Competence Certificate**  
ungraded homework

**Prerequisites**  
none

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

#### Numerical Fluid Mechanics with Python

2154405, SS 2021, 2 SWS, Language: German, [Open in study portal](#)

**Practical course (P)**  
Online

**Content**  
Numerical Fluid Mechanics with Phyton

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

**Organizational issues**  
Die Teilnehmerzahl ist begrenzt, bitte im Sekretariat des ISTM bis zum 23.07.21 per E-Mail anmelden.

**Literature**


3.250 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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<th>0187400</th>
<th>Numerische Mathematik für die Fachrichtungen Informatik und Ingenieurwesen</th>
<th>2 SWS</th>
<th>Lecture / 🖥</th>
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<td>0187500</td>
<td>Übungen zu 0187400</td>
<td>1 SWS</td>
<td>Practice / 🖥</td>
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**Exams**

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<th>Numerical Mathematics for Students of Computer Science</th>
<th>Jahnke</th>
</tr>
</thead>
</table>

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), ⚖ On-Site, ✗ Cancelled

**Prerequisites**

None
### 3.251 Course: Numerical Simulation of Multi-Phase Flows [T-MACH-105420]

**Responsible:** Dr. Martin Wörner  
**Organisation:** KIT Department of Mechanical Engineering  

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

**Type** | **Credits** | **Grading scale** | **Recurrence** | **Version**  
--- | --- | --- | --- | ---  
Oral examination | 4 | Grade to a third | Each summer term | 1

#### Events

| Events | Credits | Lectures | Type |  
|---|---|---|---|---  
| ST 2021 | 2 | Lecture | Wörner  

#### Exams

| Exams | Credits | Lectures | Type |  
|---|---|---|---|---  
| ST 2021 | 2 | Lecture | Frohnapfel

**Legend:** 🔄 Online, 🕵️‍♂️ Blended (On-Site/Online), 🗣️ On-Site, ❌ Cancelled

**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 2021, 2 SWS, Language: German, Open in study portal**

**Lecture (V)** | **Online**

**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)

**Organizational issues**  
Mündliche Prüfung, Dauer: 30 Minuten, Hilfsmittel: keine  
Oral examination (in German or English language), Duration: 30 minutes, Auxiliary means: none

**Literature**

3.252 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

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Events

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<th>Lecture / Grötzbach</th>
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<tbody>
<tr>
<td>WT 21/22</td>
<td>2153449</td>
<td>Numerical Simulation of Turbulent Flows</td>
<td>3 SWS</td>
<td>Lecture / Grötzbach</td>
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</table>

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
oral

Duration: 30 minutes

no auxiliary means

Prerequisites
none

Recommendation
Basics in fluid mechanics

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

Content
The students are qualified to describe the fundamentals of direct numerical simulation (DNS) and large eddy simulation (LES) of turbulent flows. They understand the principle differences between these simulation methods and the respective properties of the conventional turbulence modelling approaches basing on Reynolds Averaged Navier-Stokes equations (RANS). They can describe subgrid scale models, peculiarities of wall and inlet/outlet modelling, suitable numerical solution schemes and evaluation methods. They have obtained the knowledge and understanding required to identify the best modelling approach (among the available methods) for the problem at hand, thus being able to solve given thermal and fluid dynamical problems appropriately.

The lecture series will introduce in following subjects of the turbulence simulation method:
- Appearance of turbulence and deduction of requirements and limits of the simulation method.
- Conservation equations for flows with heat transfer, filtering them in time or space.
- Some subgrid scale models for small scale turbulence and their physical justification.
- Peculiarities in applying boundary and initial conditions.
- Suitable numerical schemes for integration in space and time.
- Statistical and graphical methods to analyse the simulation results.
- Application examples for turbulence simulations in research and engineering

Organizational issues
Dauer der Vorlesung 3 h von 14:00 - 15:30 h und von 15:45 - 16:30 h./Duration of the lecture 3 h from 14:00 - 15:30 h and from 15:45 - 16:30 h.
Literature


G. Grötzbach, Script in English
3 COURSES

Course: Occupational Safety and Environmental Protection [T-MACH-105386]

T 3.253 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

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Events

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<td>ST 2021</td>
<td>2110037</td>
<td>Occupational Safety and Environmental Protection</td>
<td>2</td>
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<td>von Kiparski</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

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 2021, 2 SWS, Language: German, Open in study portal

Cancelled

Content
The participants have to solve a specific case study within the field of occupational safety and environmental protection. Therefore, they work in a team. The course work covers the information research as well as the presentation of the results.

Content:
- Occupational Safety and Safety Engineering
- Environmental Protection within a Production Enterprise
- Health Management

Structure:
- Terminology
- Basics of Occupational Safety and Environmental Protection
- Case Study
- Moderated Processing of a Case Stuy within a Small Group

Organizational issues
Die Vorlesung "Industrieller Arbeits- und Umweltschutz" wird aufgrund der momentanen Situation für dieses Sommersemester nochmal abgesagt.

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

Module Offers in Mechanical Engineering for Exchange Students, Date: 15/09/2021
Valid from Winter Term 2021/2022
3.254 Course: Organ Support Systems [T-MACH-105228]

**Responsible:** apl. Prof. Dr. Christian Pylatiuk  
**Organisation:** KIT Department of Mechanical Engineering

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

**Type** | **Credits** | **Grading scale** | **Recurrence** | **Version**  
---|---|---|---|---  
Written examination | 4 | Grade to a third | Each summer term | 1

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</table>
| ST 2021 | 2106008 | Organ support systems | 2 SWS | Lecture / 🖥 Pylatiuk  
| Exams | | | |  
| ST 2021 | 76-T-MACH-105228 | Organ Support Systems | | Pylatiuk  
| WT 21/22 | 76-T-MACH-105228 | Organ Support Systems | | Pylatiuk

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

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

**Prerequisites**  
none

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

**Organ support systems**  
2106008, SS 2021, 2 SWS, Language: German, Open in study portal

**Lecture (V)**  
Online

**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**

- E. Winternmantel, Suk-Woo Ha: Medizintechnik. Springer Verlag.
### 3.255 Course: Patent Law [T-INFO-101310]

**Responsible:** Markus Hössle  
Matthias Koch  

**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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**Exams**

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<th>Type</th>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled
### 3.256 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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<td>Each summer term</td>
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</table>

**Events**

- **ST 2021 2313737 Photovoltaics**  
  4 SWS  
  Lecture / 🖥  
  Powalla, Lemmer

- **ST 2021 2313738 Tutorial 2313737 Photovoltaik**  
  1 SWS  
  Practice / 🖥  
  Powalla, Lemmer

**Exams**

- **ST 2021 7313737 Photovoltaics**  
  Powalla, Lemmer

**Legend:** 🖥 Online, ⚽ Blended (On-Site/Online), ⚽️ On-Site, ✗ Cancelled

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

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**Events**

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<td>76-T-MACH-105537</td>
<td>Physical and Chemical Principles of Nuclear Energy in View of Reactor Accidents and Back-End of Nuclear Fuel Cycle</td>
<td>1 SWS</td>
<td>Lecture /</td>
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<tr>
<td></td>
<td>Dagan</td>
<td>Metz</td>
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**Exams**

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<tr>
<td>WT 21/22</td>
<td>76-T-MACH-105537</td>
<td>Physical and Chemical Principles of Nuclear Energy in View of Reactor Accidents and Back-End of Nuclear Fuel Cycle</td>
<td>Dagan</td>
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**Legend:** Online, Blended (On-Site/Online), On-Site, Cancelled

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

**Prerequisites**  
none

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

**V** Physical and chemical principles of nuclear energy in view of reactor accidents and back-end of nuclear fuel cycle  
2189906, WS 21/22, 1 SWS, Language: German, Open in study portal
3 COURSES

Content

- Relevant physical terms of nuclear physics
- Decay heat removal- Borst-Wheeler equation
- The accidents in TMI- Three Mile Island, and Fukushima.
- Fission, chain reaction and reactor control systems
- Basics of nuclear cross sections
- Principles of reactor dynamics
- Reactor poisoning
- The Idaho and Chernobyl accidents
- Principles of the nuclear fuel cycle
- Reprocessing of irradiated fuel elements and vitrification of fission product solutions
- Interim storage of nuclear residues in surface facilities
- Multi barrier concepts for final disposal in deep geological formations
- The situation in the repositories Asse II, Konrad and Morsleben

The students

- understand the physical explanations of the known nuclear accidents
- can perform simplified calculations to demonstrate the accidents outcome.
- Define safety relevant properties of low/ intermediate / high level waste products
- Are able to evaluate principles and implications of reprocessing, storage and disposal options for nuclear waste.

Regular attendance: 14 h
self study 46 h
oral exam about 20 min.

Organizational issues
Die Veranstaltung wird nur online gehalten, falls durch Corona Einschränkungen vorgegeben werden.

Literature
AEA öffentliche Dokumentation zu den nuklearen Ereignissen
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)
R.C. Ewing: The nuclear fuel cycle: a role for mineralogy and geochemistry. Elements vol. 2, p.331-339, 2006 (in English)
J. Bruno, R.C. Ewing: Spent nuclear fuel. Elements vol. 2, p.343-349, 2006 (in English)
3.258 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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**Events**

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<td>Physical basics of laser technology</td>
<td>3 SWS</td>
<td>Each winter term</td>
<td>Schneider</td>
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**Exams**

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Legend: 📱 Online, ⏱ Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**

oral examination (30 min)

no tools or reference materials

**Prerequisites**

It is not possible to combine this brick with brick Laser Application in Automotive Engineering [T-MACH-105164] and brick Physical Basics of Laser Technology [T-MACH-109084]

**Modeled Conditions**

The following conditions have to be fulfilled:

1. The course T-MACH-105164 - Laser in Automotive Engineering must not have been started.

**Recommendation**

Basic knowledge of physics, chemistry and material science

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

**Physical basics of laser technology**  
2181612, WS 21/22, 3 SWS, Language: German, [Open in study portal](#)
**Content**

Based on the description of the physical basics about the formation and the properties of laser light the lecture goes through the different types of laser beam sources used in industry these days. The lecture focuses on the usage of lasers especially in materials engineering. Other areas like measurement technology or medical applications are also mentioned.

- physical basics of laser technology
- laser beam sources (solid state, diode, gas, liquid and other lasers)
- beam properties, guiding and shaping
- lasers in materials processing
- lasers in measurement technology
- lasers for medical applications
- safety aspects

The lecture is complemented by a tutorial.

The student

- can explain the principles of light generation, the conditions for light amplification as well as the basic structure and function of different laser sources.
- can describe the influence of laser, material and process parameters for the most important methods of laser-based materials processing and choose laser sources suitable for specific applications.
- can illustrate the possible applications of laser sources in measurement and medicine technology
- can explain the requirements for safe handling of laser radiation and for the design of safe laser systems.

Basic knowledge of physics, chemistry and material science is assumed.

regular attendance: 33,5 hours
self-study: 116,5 hours

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

It is allowed to select only one of the lectures "Laser in automotive engineering" (2182642) or "Physical basics of laser technology" (2181612) during the Bachelor and Master studies.

**Organizational issues**

Termine für die Übung werden in der Vorlesung bekannt gegeben!

**Literature**

T. Graf: Laser - Grundlagen der Laserstrahlerzeugung 2015, Springer Vieweg
R. Poprawe: Lasertechnik für die Fertigung, 2005, Springer
3.259 Course: Physical Measurement Technology [T-MACH-111022]

Responsible: Dr. Dominique Buchenau
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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Legend: 📱 Online, 🧩 Blended (On-Site/Online), ⚡ On-Site, ✗ Cancelled

Competence Certificate

Oral exam of about 25 minutes

Prerequisites

none

Annotation

none

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

物理测量技术

2189490, WS 21/22, 2 SWS, Language: German/English, Open in study portal

Lecture (V) Online
Content

Qualification targets:

Acquisition of knowledge:

- fundamentals of electrical measurement technology
- conversion principles of physical quantities into electrical signals
- conversion and processing of non-electrical quantities
- characteristics and transmission properties of sensors
- basics of analog and digital data acquisition & processing
- fundamentals of optical measurement methods

Skills:

- handling with electrical measuring instruments
- application and handling of simple measurement circuits
- measurement data acquisition and processing, representation of functional dependencies
- analysis of measuring tasks, selection of measuring methods and instruments
- assessment of measurement errors, reduction of systematic errors

Expertise:

- problem analysis and development of suitable solutions
- planning and design of measuring systems
- planning and installation of automated measurement equipment
- assessment of the quality of measurement procedures and results

Structure of Content:

- general introduction
- evaluation of measurement data
- important concepts of measurement techniques
- sensor concepts according to physical effects
- special concepts of physical measurement technology
- D/A and A/D conversion of electrical signals
- digital and analog modulation techniques

Usability:

Suitable for Bachelor program with the following specialisations:

- mechanical engineering
- physical engineering science
- production engineering / Transportation
- information technology in mechanical engineering

The acquired know-how is relevant for all engineering disciplines, especially in the following areas: precision engineering, mechatronics, medical technology, measurement and automation technology etc.

Work input:

Total extent approx. 120 h / thereof 30 h in classroom lecture and exercise

Examination:

The lecture will be concluded by an oral exam of about 25 minutes.

Literature

- Hecht, E., Optik, Oldenbourg-Verlag, 2005, ISBN 3-486-27359-0
3.260 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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**Competence Certificate**

Oral exam, about 25 minutes

**Prerequisites**

none

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

**Polymer Engineering I**

2173590, WS 21/22, 2 SWS, Language: German, [Open in study portal]

**Lecture (V)**

Blended (On-Site/Online)

**Content**

1. Economical aspects of polymers  
2. Introduction of mechanical, chemical and electrical properties  
3. Processing of polymers (introduction)  
4. Material science of polymers  
5. Synthesis

**Learning objectives:**

The field of Polymer Engineering includes synthesis, material science, processing, construction, design, tool engineering, production technology, surface engineering and recycling. The aim is, to equip the students with knowledge and technical skills, and to use the material “polymer” meeting its requirements in an economical and ecological way.

The students

- are able to describe and classify polymers based on the fundamental synthesis processing techniques
- can find practical applications for state-of-the-art polymers and manufacturing technologies
- are able to apply the processing techniques, the application of polymers and polymer composites regarding to the basic principles of material science
- can describe the special mechanical, chemical and electrical properties of polymers and correlate these properties to the chemical bindings.
- can define application areas and the limitation in the use of polymers

**Requirements:**

none

**Workload:**

Regular attendance: 21 hours  
Self-study: 99 hours
Organizational issues

Literature
Literaturhinweise, Unterlagen und Teilmanuskript werden in der Vorlesung ausgegeben.
3.261 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

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Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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 2021, 2 SWS, Language: German, Open in study portal

Lecture (V) Online

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
- 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.
Course: Polymers in MEMS A: Chemistry, Synthesis and Applications [T-MACH-102192]

**Responsible:** Dr.-Ing. Bastian Rapp  
**Organisation:** KIT Department of Mechanical Engineering

**Part of:**  
- M-MACH-104850 - Major Field Mechatronics and Microsystem Technology  
- M-MACH-105134 - Elective Module Mechanical Engineering

**Type:**  
Oral examination

**Credits:** 4

**Grading scale:**  
Grade to a third

**Recurrence:**  
Each winter term

**Version:** 1

### Events

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<td>Polymers in MEMS A: Chemistry, Synthesis and Applications</td>
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<td>Rapp, Worgull</td>
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</table>

**Competence Certificate**

Oral examination

**Prerequisites**

none

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

**Polymers in MEMS A: Chemistry, Synthesis and Applications**

2141853, WS 21/22, 2 SWS, Language: German, [Open in study portal](#)  
Blended (On-Site/Online)

**Organizational issues**

Findet als Blockveranstaltung am Semesterende statt.
### Course: Polymers in MEMS B: Physics, Microstructuring and Applications [T-MACH-102191]

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<th>Dr.-Ing. Matthias Worgull</th>
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#### Events

| WT 21/22 | 2141854 | Polymers in MEMS B: Physics, Microstructuring and Applications | 2 SWS | Lecture / 🧩 | Worgull |

**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🔴 On-Site, ✗ Cancelled

**Competence Certificate**

Oral examination

**Prerequisites**

none

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

**Polymers in MEMS B: Physics, Microstructuring and Applications**

2141854, WS 21/22, 2 SWS, Language: German, [Open in study portal](#)

Lecture (V)  
Blended (On-Site/Online)
3.264 Course: Polymers in MEMS C: Biopolymers and Bioplastics [T-MACH-102200]

Responsible: Dr.-Ing. Bastian Rapp
Dr.-Ing. Matthias Worgull

Organisation: KIT Department of Mechanical Engineering

Part of: M-MACH-104850 - Major Field Mechatronics and Microsystem Technology
M-MACH-105134 - Elective Module Mechanical Engineering

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Events

| ST 2021 | 2142855 | Polymers in MEMS C - Biopolymers and Bioplastics | 2 SWS | Worgull |

Exams

| ST 2021 | 76-T-MACH-102200 | Polymers in MEMS C: Biopolymers and Bioplastics | Worgull, Rapp |

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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 2021, 2 SWS, Language: German, Open in study portal Blended (On-Site/Online)

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 build 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, PD Dr.-Ing. Matthias Worgull (matthias.worgull@kit.edu). Preregistration is not necessary.
Organizational issues
Für weitere Rückfragen, wenden Sie sich bitte an PD Dr.-Ing. Matthias Worgull (matthias.worgull@kit.edu). Eine Voranmeldung ist nicht notwendig.

Literature
Zusätzliche vorlesungsbegleitende Literatur ist nicht notwendig.
3.265 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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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ⚹ Cancelled

**Competence Certificate**

written examination: 60 min duration

**Prerequisites**

None

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

**Powertrain Systems Technology B: Stationary Machinery**

2145150, WS 21/22, 2 SWS, Language: German, Open in study portal

**Lecture (V)**

On-Site

**Content**

Students acquire the basic skills needed to develop future energy-efficient and safe drive system solutions for use in industrial environments. The course considers holistic development methods and evaluations of drive systems. The focal points can be divided into the following chapters:

- Powertrain System
- Operator System
- Environment System
- System Components
- Development Process

**Recommendations:**

- Powertrain Systems Technology A: Automotive Systems

**Literature**

VDI-2241: "Schaltare fremdbetätigte Reibkupplungen und -bremsen", VDI Verlag GmbH, Düsseldorf  
### 3.266 Course: Practical Course Combustion Technology [T-CIWVT-108873]

**Responsible:** Dr.-Ing. Stefan Raphael Harth  
**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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#### Exams

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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

### Competence Certificate

The examination is an oral examination with a duration of 20 minutes (section 4 subsection 2 number 2 SPO).

### 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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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**

Colloquium and laboratory report for the respective experiments.

**Prerequisites**

none

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

**Practical Course Technical Ceramics**

2125751, WS 21/22, 2 SWS, Language: German, [Open in study portal]

**Organizational issues**

Elektronisch über das ILIAS-Portal

**Literature**


Richerson, D. R.: Modern Ceramic Engineering, CRC Taylor & Francis, 2006
3.268 Course: Practical Training in Basics of Microsystem Technology [T-MACH-102164]

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

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

<table>
<thead>
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<th>Type</th>
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<th>Recurrence</th>
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**Events**

<table>
<thead>
<tr>
<th>Term</th>
<th>Event Code</th>
<th>Course Title</th>
<th>SWS</th>
<th>Type</th>
<th>Notes</th>
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<tbody>
<tr>
<td>ST 2021</td>
<td>2143875</td>
<td>Introduction to Microsystem Technology - Practical Course</td>
<td>2</td>
<td>Practical course / Online</td>
<td>Last</td>
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<tr>
<td>ST 2021</td>
<td>2143877</td>
<td>Introduction to Microsystem Technology - Practical Course</td>
<td>2</td>
<td>Practical course / Online</td>
<td>Last</td>
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<td>WT 21/22</td>
<td>2143875</td>
<td>Introduction to Microsystem Technology - Practical Course</td>
<td>2</td>
<td>Practical course / On-Site</td>
<td>Last</td>
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<tr>
<td>WT 21/22</td>
<td>2143877</td>
<td>Introduction to Microsystem Technology - Practical Course</td>
<td>2</td>
<td>Practical course / On-Site</td>
<td>Last</td>
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**Exams**

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<th>Course Title</th>
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<tbody>
<tr>
<td>ST 2021</td>
<td>76-T-MACH-102164</td>
<td>Practical Training in Basics of Microsystem Technology</td>
<td>Last</td>
</tr>
<tr>
<td>WT 21/22</td>
<td>76-T-MACH-102164</td>
<td>Practical Training in Basics of Microsystem Technology</td>
<td>Last</td>
</tr>
</tbody>
</table>

**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 2021, 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.

**Organizational issues**


Teilnahmeanfragen an Frau Nowotny, marie.nowotny@kit.edu

**Literature**

Menz, W., Mohr, J.: Mikrosystemtechnik für Ingenieure, VCH-Verlag, Weinheim, 1997

Unterlagen zum Praktikum zur Vorlesung 'Grundlagen der Mikrosystemtechnik'
Introduction to Microsystem Technology - Practical Course
2143877, SS 2021, 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"
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5. Optical waveguides
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Organizational issues
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Menz, W., Mohr, J.: Mikrosystemtechnik für Ingenieure, VCH-Verlag, Weinheim, 1997
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Introduction to Microsystem Technology - Practical Course
2143877, WS 21/22, 2 SWS, Language: German, Open in study portal

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Menz, W., Mohr, J.: Mikrosystemtechnik für Ingenieure, VCH-Verlag, Weinheim, 1997
Unterlagen zum Praktikum zur Vorlesung 'Grundlagen der Mikrosystemtechnik'

Introduction to Microsystem Technology - Practical Course
2143875, WS 21/22, 2 SWS, Language: German, Open in study portal

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

<table>
<thead>
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**Events**

| ST 2021 | 2162208 | Schwingungstechnisches Praktikum | Practical course / Fidlin, Bitner |

| ST 2021 | 76-T-MACH-105373 | Practical Training in Measurement of Vibrations | Fidlin |

**Exams**

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), ☞ On-Site, ❌ Cancelled

**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

<table>
<thead>
<tr>
<th>Type</th>
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Events

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<th>Recurrence</th>
<th>Version</th>
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<td>WT 21/22</td>
<td>193010</td>
<td>Basic principles of powder metallurgical and ceramic processing</td>
<td>2 SWS</td>
<td>Lecture / 🧩 Schell</td>
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Exams

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<th>Grade to a third</th>
<th>Recurrence</th>
<th>Version</th>
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<td>76-T-MACH-102111</td>
<td>Principles of Ceramic and Powder Metallurgy Processing</td>
<td>Schell</td>
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<tr>
<td>WT 21/22</td>
<td>76-T-MACH-102111</td>
<td>Principles of Ceramic and Powder Metallurgy Processing</td>
<td>Schell</td>
<td></td>
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</tr>
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</table>

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 👤 On-Site, ☓ Cancelled

Competence Certificate
The assessment consists of an oral exam (20-30 min) taking place at the agreed date. The re-examination is offered upon agreement.

Prerequisites
none

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

**Basic principles of powder metallurgical and ceramic processing**
2193010, WS 21/22, 2 SWS, Language: German, Open in study portal

Lecture (V)
Blended (On-Site/Online)

Literature

- R.M. German. "Powder metallurgy and particulate materials processing. Metal Powder Industries Federation, 2005
### Course: Principles of Medicine for Engineers [T-MACH-105235]

**Responsible:** apl. Prof. Dr. Christian Pylatiuk  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-105134 - Elective Module Mechanical Engineering

<table>
<thead>
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<th>Type</th>
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**Events**

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<th>2105992</th>
<th>Principles of Medicine for Engineers</th>
<th>2 SWS</th>
<th>Lecture / Online</th>
<th>Pylatiuk</th>
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**Exams**

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<tr>
<td>WT 21/22</td>
<td>76-T-MACH-105235</td>
<td>Principles of Medicine for Engineers</td>
<td>Pylatiuk</td>
</tr>
</tbody>
</table>

**Competence Certificate**

Written examination (Duration: 45min)

**Prerequisites**

none

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

#### Principles of Medicine for Engineers

**2105992, WS 21/22, 2 SWS, Language: German, [Open in study portal](#)**

**Lecture (V) Online**

**Content**

- **Content:**
  - Introduction: Definitions of "health" and "disease". History of medicine and paradigm shift towards evidence based medicine and personalized medicine.  
  - Special topics: nervous system, saltatory conduction, musculoskeletal system, cardio-circulatory system, narcosis, pain, respiratory system, sensory organs, gynaecology, digestive organs, surgery, nephrology, orthopaedics, immune system, genetics.

**Learning objectives:**

Students have fundamental knowledge about functionality and anatomy of organs within different medical disciplines. The students further know about technical methods in diagnosis and therapy, common diseases, their relevance and costs. Finally the students are able to communicate with medical doctors in a way, in which they prevent misunderstandings and achieve a more realistic idea of each others expectations.

**Literature**

- Adolf Faller, Michael Schünke: Der Körper des Menschen. Thieme Verlag.  
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

<table>
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<td>Each term</td>
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**Exams**  
ST 2021 7700067 Probability Theory and Statistics Müller-Harknett

**Competence Certificate**  
Written exam (90 min.)

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

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

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

**Type**
Oral examination

**Credits**
4

**Grading scale**
Grade to a third

**Recurrence**
Each winter term

**Version**
1

### Events

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<th>2161501</th>
<th>Process Simulation in Forming Operations</th>
<th>2 SWS</th>
<th>Lecture / 📝</th>
<th>Helm</th>
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</table>

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 📈 On-Site, ✗ Cancelled

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

**Prerequisites**
none

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

**Process Simulation in Forming Operations**
2161501, WS 21/22, 2 SWS, Language: German, Open in study portal

**Lecture (V)**
Blended (On-Site/Online)

**Content**
Based on basics of continuum mechanics, material theory and numerics the lecture gives an introduction into the simulation of forming operations for metals

- plasticity for metallic materials: dislocations, twinning, phase transformations, anisotropy, hardening
- classification of forming operations and discussion of selected topics
- basics of tensor algebra and tensor analysis
- continuum mechanics: kinematics, finite deformations, balance laws, thermodynamics
- material theory: basics, modelling concepts, plasticity and visco plasticity, yield functions (von Mises, Hill, ...), kinematic and isotropic hardening, damage
- thermomechanical coupling
- modelling of contact
- finite element method: explicit and implicit formulations, types of elements, numerical integration of material models
- process simulation of selected problems of sheet metal forming
3.274 Course: Product and Innovation Management [T-WIWI-109864]

Responsibilities: Prof. Dr. Martin Klarmann
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>Product and Innovation Management</td>
<td>2 SWS</td>
<td>Lecture / K</td>
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<tbody>
<tr>
<td>ST 2021</td>
<td>7900024</td>
<td>Product and Innovation Management</td>
<td>K</td>
<td></td>
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</table>

Competence Certificate
The assessment of success takes place through a written exam (according to SPO § 4 Abs. 2, Pkt. 1) with additional aids in the sense of an open book exam.
In the winter term 2021/22, the written exam will either take place in the lecture hall or online, depending on further pandemic developments. Further details will be announced during the lecture.

Prerequisites
None

Annotation
For further information please contact Marketing & Sales Research Group (marketing.iism.kit.edu).

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

Product and Innovation Management
2571154, SS 2021, 2 SWS, Language: English, Open in study portal

Content
This course addresses topics around the management of new as well as existing products. After the foundations of product management, especially the product choice behavior of customers, students get to know in detail different steps of the innovation process. Another section regards the management of the existing product portfolio.

Students
- know the most important terms of the product and innovation concept
- understand the models of product choice behavior (e.g., the Markov model, the Luce model)
- are familiar with the basics of network theory (e.g. the Triadic Closure concept)
- know the central strategic concepts of innovation management (especially the market driving approach, pioneer and successor, Miles/Snow typology, blockbuster strategy)
- master the most important methods and sources of idea generation (e.g. open innovation, lead user method, crowdsourcing, creativity techniques, voice of the customer, innovation games, conjoint analysis, quality function deployment, online toolkits)
- are capable of defining and evaluating new product concepts and know the associated instruments like focus groups, product testing, speculative sales, test market simulation Assessor, electronic micro test market
- have advanced knowledge about market introduction (e.g. adoption and diffusion models Bass, Fourt/Woodlock, Mansfield)
- understand important connections of the innovation process (cluster formation, innovation culture, teams, stage-gate process)

The assessment is carried out (according to §4(2), 3 SPO) in the form of a written open book exam.
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

Type: Oral examination
Credits: 4
Grading scale: Grade to a third
Recurrence: Each winter term
Version: 1

Events

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<td>Lecture / 🧩</td>
<td>2 SWS</td>
<td>Grade to a third</td>
<td>Each winter term</td>
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</table>

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🔴 On-Site, ✗ Cancelled

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.

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

Product- and Production-Concepts for modern Automobiles
2149670, WS 21/22, 2 SWS, Language: German

Lecture (V)
Blended (On-Site/Online)
Content
The lecture illuminates the practical challenges of modern automotive engineering. As former leaders of the automotive industry, the lecturers refer to current aspects of automotive product development and production.

The aim is to provide students with an overview of technological trends in the automotive industry. In this context, the course also focuses on changes in requirements due to new vehicle concepts, which may be caused by increased demands for individualisation, digitisation and sustainability. The challenges that arise in this context will be examined from both a production technology and product development perspective and will be illustrated with practical examples thanks to the many years of industrial experience of both lecturers.

The topics covered are:

- General conditions for vehicle and body development
- Integration of new drive technologies
- Functional requirements (crash safety etc.), also for electric vehicles
- Development Process at the Interface Product & Production, CAE/Simulation
- Energy storage and supply infrastructure
- Aluminium and lightweight steel construction
- FRP and hybrid parts
- Battery, fuel cell and electric motor production
- Joining technology in modern car bodies
- Modern factories and production processes, Industry 4.0.

Learning Outcomes:
The students...

- are able to name the presented general conditions of vehicle development and are able to discuss their influences on the final product using practical examples.
- are able to name the various lightweight approaches and identify possible areas of application.
- are able to identify the different production processes for manufacturing lightweight structures and explain their functions.
- are able to perform a process selection based on the methods and their characteristics.

Workload:
regular attendance: 25 hours
self-study: 95 hours

Organizational issues
Termine werden über Ilias bekannt gegeben.
Bei der Vorlesung handelt es sich um eine Blockveranstaltung. Eine Anmeldung über Ilias ist erforderlich.
The lecture is a block course. An application in Ilias is mandatory.

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/).
# 3.276 Course: Product Development - Dimensioning of Components [T-MACH-105383]

**Responsible:**
- Dr.-Ing. Stefan Dietrich
- Prof. Dr.-Ing. Volker Schulze

**Organisation:**
KIT Department of Mechanical Engineering

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

### Events

<table>
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### Exams

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<th>Product Development - Component Dimensioning</th>
<th>3 / 1 SWS</th>
<th>Lecture / Practice</th>
<th>Schulze, Dietrich</th>
</tr>
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</table>

| ST 2021 | 76-T-MACH-105383 | Product Development - Dimensioning of Components | Schulze |

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

**Prerequisites**
- none

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

### 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]

Responsible: Prof. Dr.-Ing. Sama Mbang
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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Exams

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<td>Lecture / Online</td>
<td>Lecture / Online</td>
<td>Each summer term</td>
<td>2</td>
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</table>

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

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)

Organizational issues
Blockveranstaltung

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

<table>
<thead>
<tr>
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<td>3</td>
<td>Grade to a third</td>
<td>Each winter term</td>
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</tbody>
</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

<table>
<thead>
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**Events**

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<tr>
<td>ST 2021</td>
<td>2110032</td>
<td>Production Planning and Control</td>
<td>2 SWS</td>
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<td>Rinn</td>
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<td>WT 21/22</td>
<td>2110032</td>
<td>Production Planning and Control</td>
<td>2 SWS</td>
<td>/ O</td>
<td>Rinn</td>
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</table>

**Legend:** Online, Blended (On-Site/Online), On-Site, Cancelled

**Competence Certificate**

Written exam 60 minutes (if the number of participants is low, the examination is oral, 20 minutes)

**Prerequisites**

Timely pre-registration in ILIAS, since participation is limited.

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

#### Production Planning and Control

**2110032, SS 2021, 2 SWS, Language: German, Open in study portal**  
**Cancelled**

**Content**

1. Goals and recommendations for production planning and control
2. Strategies for work control
3. Case study: Manufacturing of bicycles
4. FASI-Plus: Simulation of a bicycle factory for the production planning and control
5. Simulation of the order processing
6. Decision making about order control and procurement of purchased parts
7. Evaluation of the simulation protocols
8. Realisation of production planning and control

**Requirements:**

- Compact course
- Limited number of participants; seats are assigned according the date of registration
- Registration via ILIAS is required
- Compulsory attendance during the whole lecture

**Recommendations:**

- Knowledge in Production Management/Industrial Engineering is required
- Knowledge of Work Science and Economics is helpful
- Knowledge of Informatics is not required, but helpful

**Learning targets:**

- Lerninhalte zum Thema "Produktionsmanagement" vertiefen
- Kenntnisse über die Produktionsplanung und -steuerung erweitern
- Grundlegende Techniken der Modellierung und Simulation von Produktionssystemen verstehen

**Organizational issues**

The lecture "Produktionsplanung und -steuerung" will be postponed due to the current situation for the summer semester and will be rescheduled for the next winter semester.

**Literature**

The script and literature notes are available on ILIAS for download.

---

Module Offers in Mechanical Engineering for Exchange Students, Date: 15/09/2021  
Valid from Winter Term 2021/2022  

423
Production Planning and Control
2110032, WS 21/22, 2 SWS, Language: German, Open in study portal

Content
1. Goals and recommendations for production planning and control
2. Strategies for work control
3. Case study: Manufacturing of bicycles
4. FASI-Plus: Simulation of a bicycle factory for the production planning and control
5. Simulation of the order processing
6. Decision making about order control and procurement of purchased parts
7. Evaluation of the simulation protocols
8. Realisation of production planning and control

Requirements:
- Compact course
- Limited number of participants; seats are assigned according to the date of registration
- Registration via ILIAS is required
- Compulsory attendance during the whole lecture

Recommendations:
- Knowledge in Production Management/Industrial Engineering is required
- Knowledge of Work Science and Economics is helpful
- Knowledge of Informatics is not required, but helpful

Learning targets:
- Lerninhalte zum Thema "Produktionsmanagement" vertiefen
- Kenntnisse über die Produktionsplanung und -steuerung erweitern
- Grundlegende Techniken der Modellierung und Simulation von Produktionssystemen verstehen

Organizational issues
- Anwesenheitspflicht in Einführungsveranstaltung und Blockvorlesung.
- Teilnehmerzahl ist beschränkt.
- Für eine verbindliche Kursteilnahme ist die Prüfungsanmeldung bis zwei Wochen vor Veranstaltungsbeginn im ifab-Sekretariat nachzuweisen.
- Die Prüfung ist schriftlich, außer es sind zuwenig Teilnehmer, dann mündlich
- Die Vorlesung hat einen Arbeitsaufwand von 120 h (=4 LP).

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

<table>
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**Events**

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**Exams**

<table>
<thead>
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<th>Version</th>
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</thead>
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<tr>
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<td>Production Techniques Laboratory</td>
<td>Deml, Furmans, Ovtcharova, Schulze</td>
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<td></td>
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</table>

**Legend:** 
- ![Online](https://example.com/icon-online)  
- ![Blended](https://example.com/icon-blended)  
- ![On-Site](https://example.com/icon-onsite)  
- ![Cancelled](https://example.com/icon-cancelled)

**Competence Certificate**

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

**Elective Subject:** Participate in practice 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**

STS 2021, SS 2021, 4 SWS, Language: German, Open in study portal

**Practical course (P)**

Online

Module Offers in Mechanical Engineering for Exchange Students, Date: 15/09/2021
Valid from Winter Term 2021/2022
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.

Organizational issues
Anwesenheitspflicht, Teilnehmerzahl begrenzt. Anmeldung über ILIAS
Arbeitsaufwand von 120 h (=4 LP).
Nachweis: bestanden / nicht bestanden
Regelmäßige Teilnahme an Praktikumsversuchen und erfolgreiche Eingangskolloquien.

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

<table>
<thead>
<tr>
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**Exams**

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<td>Deml, Stowasser</td>
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**Competence Certificate**

oral exam (approx. 30 min)

The exam is offered in German only!

**Prerequisites**

none

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

---

## 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 etc.)  
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.

**Organizational issues**

Da das ganze Sommersemester 2021 komplett digital stattfinden soll, muss diese Präsenzveranstaltung leider abgesagt werden.
**Literature**

Das Skript und Literaturhinweise stehen auf ILIAS zum Download zur Verfügung.
3.282 Course: Project Management [T-WIWI-103134]

**Responsible:** Prof. Dr. Frank Schultmann

**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>2581963</td>
<td>Project Management</td>
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<td>Schultmann, Volk, Wiens, Rosenberg, Gehring</td>
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<td>2581964</td>
<td>Übung zu Project Management</td>
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**Exams**

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<td>7981963</td>
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</table>

**Competence Certificate**

The assessment consists of a written exam (60 minutes) (following §4(2) of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date. Depending on the respective pandemic situation, the exam may be offered as an open book exam (examination of another type, following §4(2), 3 of the examination regulation).

**Prerequisites**

None

**Recommendation**

None

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

**Project Management**

2581963, WS 21/22, 2 SWS, Language: English, Open in study portal

**Content**

1. Introduction
2. Principles of Project Management
3. Project Scope Management
4. Time Management and Resource Scheduling
5. Cost Management
6. Quality Management
7. Risk Management
8. Stakeholder
9. Communication, Negotiation and Leadership
10. Project Controlling
11. Agile Project Management

**Literature**

Wird in der Veranstaltung bekannt gegeben.
3.283 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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<td>Each winter term</td>
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Competence Certificate
oral exam (20 min)
Aids: None

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

<table>
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<td>Project Micro-Manufacturing: Design and Manufacturing of a Microsystem</td>
<td>3 SWS</td>
<td>/ X</td>
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</table>

**Legend:** 🗣 On-Site, 🕵 Blended (On-Site/Online), 🖥 Online, ✗ Canceled

**Competence Certificate**
Alternative test achievement (graded):

- presentation (about 15 min) with weighting 40%
- scientific colloquium (about 15 min) with weighting 40%
- Project work (graded) with weighting 20%

**Prerequisites**
None

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

**Project Micro-Manufacturing: Design and Manufacturing of a Microsystem**  
2149680, WS 21/22, 3 SWS, Language: German, Open in study portal  
Cancelled

**Content**
The course "Project micro manufacturing: design and manufacturing of a micro system" combines the basics of micro manufacturing with project work. The project work will be done in cooperation with an industry partner. The students learn the basics of micro milling, micro electric discharge machining, micro laser ablation, micro powder injection molding and micro quality assurance. Furthermore they get to know the CAD-CAM process chain. That is the manufacturing of a production out of a CAD model. The students develop ideas and concepts matching the given task and present the results to the industry partner. Then they create parts that are designed for manufacturability out of their concepts. Those parts are manufactured at the wbk and finally assembled to a prototype.

**Learning Outcomes:**
The students …

- are able to describe the micro manufacturing processes as well as their characteristics and applications.
- can choose suitable manufacturing processes for a given product.
- are able to describe the process along the CAD-CAM process chain from scratch to manufacturing.
- can explain how the development process for a micro product looks like.
- are able to describe how design for manufacturability works for micro products and where the differences to macroscopic scale are.

**Workload:**
regular attendance: 31,5 hours  
self-study: 148,5 hours

**Organizational issues**
Die Veranstaltung wird im Wintersemester 2021/22 nicht angeboten!
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/).

**Responsible:** Dr.-Ing. Peter Oberle

**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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<tbody>
<tr>
<td>WT 21/22</td>
</tr>
<tr>
<td>Water Distribution Systems</td>
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</table>

**Competence Certificate**
project report, appr. 15 pages, and presentation, appr. 15 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
**3.286 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>
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**Events**

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<th>SWS</th>
<th>Type</th>
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<tr>
<td>ST 2021</td>
<td>2115817</td>
<td>Project Workshop: Automotive Engineering</td>
<td>3</td>
<td>Lecture / Online</td>
<td>Gauterin, Gießler, Frey</td>
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<tr>
<td>WT 21/22</td>
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<td>Project Workshop: Automotive Engineering</td>
<td>3</td>
<td>Lecture / On-Site</td>
<td>Gauterin, Gießler, Frey</td>
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**Exams**

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<th>Term</th>
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<th>SWS</th>
<th>Type</th>
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<td>Project Workshop: Automotive Engineering</td>
<td>3</td>
<td>Lecture</td>
<td>Gauterin</td>
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</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 2021, 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.

**Organizational issues**

- Begrenzte Teilnehmerzahl mit Auswahlverfahren, die Bewerbungen sind am Ende des vorhergehenden Semesters einzureichen.  
- Raum und Termine: s. Aushang
Project Workshop: Automotive Engineering
2115817, WS 21/22, 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.

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Learning Objectives:
During the Project Workshop Automotive Engineering a team of six persons will work on a task given by an German industrial partner using the instruments of project management. The task is relevant for the actual business and the results are intended to be industrialized after the completion of the project workshop.

The team will generate approaches in its own responsibility and will develop solutions for practical application. Coaching will be supplied by both, company and institute.

At the beginning in a start-up meeting goals and structure of the project will be specified. During the project workshop there will be weekly team meetings. Also a milestone meeting will be held together with persons from the industrial company. In a final presentation the project results will be presented to the company management and to institute representatives.

Organizational issues
Begrenzte Teilnehmerzahl mit Auswahlverfahren, in deutscher Sprache. Bewerbungen sind am Ende des vorhergehenden Semesters einzureichen.
Termin und Raum: siehe Institutshomepage.

Limited number of participants with selection procedure, in German language. Please send the application at the end of the previous semester.
Date and room: see homepage of institute.

Literature

Skripte werden beim Start-up Meeting ausgegeben.
The scripts will be supplied in the start-up meeting.
### 3.287 Course: Quality Management [T-MACH-102107]

**Responsible:** Prof. Dr.-Ing. Gisela Lanza  
**Organisation:** KIT Department of Mechanical Engineering

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

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

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<th>2149667</th>
<th>Quality Management</th>
<th>2 SWS</th>
<th>Lecture / 🧩</th>
<th>Lanza</th>
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**Exams**

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<th>76-T-MACH-102107</th>
<th>Quality Management</th>
<th>Lanza</th>
</tr>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**

Written Exam (60 min)

**Prerequisites**

none

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

**Quality Management**

2149667, WS 21/22, 2 SWS, Language: German, [Open in study portal]

Lecture (V) Blended (On-Site/Online)
Content
Based on the quality philosophies Total Quality Management (TQM) and Six Sigma, the lecture deals with the requirements of modern quality management. Within this context, the process concept of a modern enterprise and the process-specific fields of application of quality assurance methods are presented. The lecture covers the current state of the art in preventive and non-preventive quality management methods in addition to manufacturing metrology, statistical methods and service related quality management. The content is completed with the presentation of certification possibilities and legal quality aspects.

Main topics of the lecture:
- The term "Quality"
- Total Quality Management (TQM) and Six Sigma
- Universal methods and tools
- QM during early product stages – product definition
- QM during product development and in procurement
- QM in production – manufacturing metrology
- QM in production – statistical methods
- QM in service
- Quality management systems
- Legal aspects of QM

Learning Outcomes:
The students …
- are capable to comment on the content covered by the lecture.
- are capable of substantially quality philosophies.
- are able to apply the QM tools and methods they have learned about in the lecture to new problems from the context of the lecture.
- are able to analyze and evaluate the suitability of the methods, procedures and techniques they have learned about in the lecture for a specific problem.

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

Organizational issues
Start: 18.10.2021
Vorlesungstermine montags 10:00 Uhr
Übung erfolgt während der Vorlesung

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/).
3.288 Course: Rail System Technology [T-MACH-106424]

Responsible: Prof. Dr.-Ing. Marcus Geimer
Prof. Dr.-Ing. Peter Gratzfeld
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>Lecture / Online</td>
<td>Each term</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:

Rail System Technology

2115919, SS 2021, 2 SWS, Language: German, Open in study portal

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, comparison electric traction and diesel traction, dc and ac networks, system pantograph and contact wire, filling stations

Organizational issues

Die Vorlesung "Bahnsystemtechnik" findet im SS 2021 als asynchrone Online-Veranstaltung statt.

Literature

Eine Literaturliste steht den Studierenden auf der Ilias-Plattform zum Download zur Verfügung.

A bibliography is available for download (Ilias-platform).
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
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7. Traction power supply: power supply of rail vehicles, comparison electric traction and diesel traction, dc and ac networks, system pantograph and contact wire, filling stations

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: Rail Vehicle Technology [T-MACH-105353]

Responsible: Prof. Dr.-Ing. Marcus Geimer  
Prof. Dr.-Ing. Peter Gratzfeld

Organisation: KIT Department of Mechanical Engineering

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

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Exams

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

Competence Certificate

Oral examination

Duration: ca. 20 minutes

No tools or reference materials may be used during the exam.

Prerequisites

none

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

V Rail Vehicle Technology  
2115996, SS 2021, 2 SWS, Language: German, Open in study portal

Content

1. Vehicle system technology: structure and main systems of rail vehicles
2. Car body: functions, requirements, design principles, crash elements, coupling, doors and windows
3. Bogies: forces, running gears, bogies, Jakobs-bogies, active components, connection to car body, wheel arrangement
4. Drives: principles, electric drives (main components, asynchronous traction motor, inverter, with DC supply, with AC supply, without line supply, multisystem vehicles, dual mode vehicles, hybrid vehicles), non-electric drives
5. Brakes: basics, principles (wheel brakes, rail brakes, blending), brake control (requirements and operation modes, pneumatic brake, electropneumatic brake, emergency brake, parking brake)
6. Train control management system: definition of TCMS, bus systems, components, network architectures, examples, future trends

Organizational issues

Die Vorlesung "Schienenfahrzeugtechnik" findet im SS 2021 als asynchrone Online-Veranstaltung statt.

Literature

Eine Literaturliste steht den Studierenden auf der Ilias-Plattform zum Download zur Verfügung.

A bibliography is available for download (Ilias-platform).

V Rail Vehicle Technology  
2115996, WS 21/22, 2 SWS, Language: German, Open in study portal
Content

1. Vehicle system technology: structure and main systems of rail vehicles
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6. Train control management system: definition of TCMS, bus systems, components, network architectures, examples, future trends

Literature
Eine Literaturliste steht den Studierenden auf der Ilias-Plattform zum Download zur Verfügung.
A bibliography is available for download (Ilias-platform).
Course: Railways in the Transportation Market [T-MACH-105540]

3.290 Course: Railways in the Transportation Market [T-MACH-105540]

**Responsible:** Prof. Dr.-Ing. Marcus Geimer
Prof. Dr.-Ing. Peter Gratzfeld

**Organisation:** KIT Department of Mechanical Engineering

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

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<td>ST 2021</td>
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Legend: 🖥️ Online, 🧩 Blended (On-Site/Online), 🗣️ On-Site, ☑️ Cancelled

**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 2021, 2 SWS, Language: German, [Open in study portal](#)

**Content**
The lecture gives an overview about perspective, challenges and chances of rail systems in the national and European market. Following items will be discussed:

- Introduction and basics
- Rail reform in Germany
- Overview of Deutsche Bahn
- Regulation of railways
- Financing and development of rail infrastructure
- Group strategy “Strong Rail” and their building blocks: (climate, environment, digitalization, “Strong Rail” in Baden-Württemberg)
- Trends in the transportation market
- Field of actions in transport policy
- Intra- and intermodal competition
- Summary

**Learning Objectives:**

- To capture the entrepreneurial perspective on transport companies
- To appraise the intra- and intermodal competition
- To understand the regulative determinant
- To reflect trends in transportation market
- To comprehend strategic challenges, chances and fields of actions of transport companies
- To apply intermodal perspective
- To take important key figures of railways and transportation market
- To realize the relevance of sustainability and digitalization
Organizational issues
Die Blockvorlesung „Die Eisenbahn im Verkehrsmarkt“ findet am 10. / 11. / 12.06.2021 von 09:00 bis 16:00 Uhr online statt. Die Prüfung findet am 05.07.2021 in Präsenz statt.
Näheres siehe Homepage http://www.fast.kit.edu/bst/929.php

Literature
keine
3.291 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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**Legend:** 
- 🖥 Online, 🧩 Blended (On-Site/Online), 🔘 On-Site, ✗ Cancelled

**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 2021, 2 SWS, Language: German/English, Open in study portal

**Lecture (V)**

Online
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
- Methods for safety analysis and safety assessment
- Key physical phenomena during severe accidents determining radiological impact
- How to analyse reactor accidents with numerical simulation tools
- Discussion severe accidents e.g. the Fukushima accident

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

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

Organizational issues
Mündliche Prüfung (Oral examination)
Anmeldung im ILIAS (Registration through ILIAS)

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

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

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**Events**

| ST 2021 | 2166543 | Reduction methods for the modeling and the simulation of combustion processes | 2 SWS | Lecture /  
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**Exams**

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Legend:  
Online,  
Blended (On-Site/Online),  
On-Site,  
Cancelled

**Competence Certificate**  
Oral exam, approx. 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 2021, 2 SWS, Language: German/English, Open in study portal

Legend:  
Lecture (V),  
Blended (On-Site/Online)

**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.

**Organizational issues**  
Termin: Mi, 14:00-15:30. Für Änderungen siehe Aushang im ITT-Schaukasten und auf der Internetseite des Instituts.

**Literature**  
Course: Reliability Engineering 1 [T-MACH-107447]

3.293

Responsible: Dr.-Ing. Alexei Konnov
Organisation: KIT Department of Mechanical Engineering

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

Competence Certificate
written exam

Prerequisites
none

**Responsible:** PD Dr. Patrick Jochem  
**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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**Competence Certificate**  
The assessment consists of a written exam (60 minutes, in English, answers are possible in German or English) (following §4(2) of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date. Depending on the respective pandemic situation, the exam may be offered as an open book exam (alternative exam assessment, following §4(2), 3 of the examination regulation).

**Prerequisites**  
None.

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

**Renewable Energy – Resources, Technologies and Economics**  
2581012, WS 21/22, 2 SWS, Language: English, [Open in study portal](#)  
Lecture (V)

**Content**  
1. General introduction: Motivation, Global situation  
2. Basics of renewable energies: Energy balance of the earth, potential definition  
3. Hydro  
4. Wind  
5. Solar  
6. Biomass  
7. Geothermal  
8. Other renewable energies  
9. Promotion of renewable energies  
10. Interactions in systemic context  
11. Excursion to the "Energieberg" in Mühlburg

**Learning Goals:**  
The student

- understands the motivation and the global context of renewable energy resources,  
- gains detailed knowledge about the different renewable resources and technologies as well as their potentials,  
- understands the systemic context and interactions resulting from the increased share of renewable power generation,  
- understands the important economic aspects of renewable energies, including electricity generation costs, political promotion and marketing of renewable electricity,  
- is able to characterize and where required calculate these technologies.

**Organizational issues**  
Blockveranstaltung, freitags 14:00-17:00 Uhr, 29.10., 12.11., 26.11., 10.12., 14.01., 28.01., 11.02.
Literature
Weiterführende Literatur:

### 3.295 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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**Events**

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<td>Lecture / 🧩</td>
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**Exams**

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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🔗 On-Site, ✗ Cancelled
### 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

<table>
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**Events**

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**Exams**

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**Legend:**  
- Online  
- Blended (On-Site/Online)  
- On-Site  
- Cancelled

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

### Robotics II: Humanoid Robotics

#### 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.

#### Organizational issues

Die Erfolgskontrolle erfolgt in Form einer schriftlichen Prüfung im Umfang von i.d.R. 60 Minuten nach § 4 Abs. 2 Nr. 1 SPO.

Arbeitsaufwand: 90 h

Voraussetzungen: Der Besuch der Vorlesungen *Robotik I – Einführung in die Robotik* und *Mechano-Informatik in der Robotik* wird vorausgesetzt

Zielgruppe: Modul für Master Maschinenbau, Mechatronik und Informationstechnik, Elektrotechnik und Informationstechnik

#### Literature

Weiterführende Literatur

Wissenschaftliche Veröffentlichungen zum Thema, werden auf der VL-Website bereitgestellt.
3.297 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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**Events**

| ST 2021 | 2400067 | Robotics III - Sensors and Perception in Robotics | 2 SWS | Lecture / Online | Asfour |

**Exams**

| ST 2021 | 7500242 | Robotics III - Sensors and Perception in Robotics | Asfour |
| WT 21/22 | 7500207 | Robotics III - Sensors and Perception in Robotics | Asfour |

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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

**Robotsics III - Sensors and Perception in Robotics**  
2400067, SS 2021, 2 SWS, Language: German/English, [Open in study portal](#)

**Content**

The lecture supplements the lecture Robotics I with a broad overview of sensors used in robotics. The lecture focuses on visual perception, object recognition, simultaneous localization and mapping (SLAM) and semantic scene interpretation. The lecture is divided into two parts:

In the first part a comprehensive overview of current sensor technologies is given. A basic distinction is made between sensors for the perception of the environment (exteroceptive) and sensors for the perception of the internal state (proprioceptive).

The second part of the lecture concentrates on the use of exteroceptive sensors in robotics. The topics covered include tactile exploration and visual data processing, including advanced topics such as feature extraction, object localization, simultaneous localization and mapping (SLAM) and semantic scene interpretation.

**Learning 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.

**Organizational issues**

Die Erfolgskontrolle erfolgt in Form einer schriftlichen Prüfung im Umfang von i.d.R. 60 Minuten nach § 4 Abs. 2 Nr. 1 SPO.

**Modul für Master Maschinenbau, Mechatronik und Informationstechnik, Elektrotechnik und Informationstechnik**

Voraussetzungen: Der Besuch der Vorlesung Robotik I - Einführung in die Robotik wird vorausgesetzt

Zielgruppe: Die Vorlesung richtet sich an Studierende der Informatik, der Elektrotechnik und des Maschinenbaus sowie an alle Interessenten an der Robotik.

Arbeitsaufwand: 90 h

**Literature**

Eine Foliensammlung wird im Laufe der Vorlesung angeboten. Begleitende Literatur wird zu den einzelnen Themen in der Vorlesung bekannt gegeben.
3.298 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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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

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:

Safety Engineering
2117061, WS 21/22, 2 SWS, Language: German, Open in study portal

Content
Media
Presentations

Learning content
The course provides basic knowledge of safety engineering. In particular the basics of health at the working place, job safety in Germany, national and European safety rules and the basics of safe machine design are covered. The implementation of these aspects will be illustrated by examples of material handling and storage technology. This course focuses on: basics of safety at work, safety regulations, basic safety principles of machine design, protection devices, system security with risk analysis, electronics in safety engineering, safety engineering for storage and material handling technique, electrical dangers and ergonomics. So, mainly, the technical measures of risk reduction in specific technical circumstances are covered.

Learning goals
The students are able to:

- Name and describe relevant safety concepts of safety engineering,
- Discuss basics of health at work and labour protection in Germany,
- Evaluate the basics for the safe methods of design of machinery with the national and European safety regulations and
- Realize these objectives by using examples in the field of storage and material handling systems.

Recommendations
None

Workload
Regular attendance: 21 hours
Self-study: 99 hours

Note
Dates: See IFL-Homepage

Organizational issues
Termine: siehe ILIAS/IFL-Homepage

Literature
Defren/Wickert: Sicherheit für den Maschinen- und Anlagenbau, Druckerei und Verlag: H. von Ameln, Ratingen
### 3.299 Course: Scaling in Fluid Dynamics [T-MACH-105400]

**Responsible:** apl. 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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**Events**

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**Exams**

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<th>Scaling in Fluid Dynamics</th>
<th>Bühler</th>
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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 2021, 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.

**Organizational issues**

- per E-Mail an leo.buehler@kit.edu

**Literature**

- J. Zierep, 1982, Ähnlichkeitsgesetze und Modellregeln der Strömungsmechanik, Braun
3.300 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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**Events**

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</tbody>
</table>

**Legend:**  
🖥 Online, Blended (On-Site/Online), On-Site, X Cancelled

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

**Prerequisites**  
none

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

**Selected chapters of the combustion fundamentals**  
2167541, SS 2021, 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.

**Organizational issues**
Blockveranstaltung. Termine siehe Schaukasten und Internetseite des Instituts.

**Literature**
Vorlesungsunterlagen

**Selected chapters of the combustion fundamentals**  
2167541, WS 21/22, 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.

**Organizational issues**
Termine und Raum: siehe Aushang und Internetseite des Instituts.

**Literature**
Vorlesungsunterlagen
### 3.301 Course: Selected Problems of Applied Reactor Physics and Exercises [T-MACH-105462]

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

<table>
<thead>
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<th>Dagan, Metz</th>
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**Exams**

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Legend: 🖥️ Online, 🧩 Blended (On-Site/Online), 🗣️ On-Site, ❌ Cancelled

**Competence Certificate**

oral exam, approx. 1/2 hour

**Prerequisites**

none

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

#### Selected Problems of Applied Reactor Physics and Exercises

2190411, SS 2021, 2 SWS, Language: German/English, Open in study portal

**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)
3.302 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

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**Exams**

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<th>Seminar in Materials Science</th>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 👀 On-Site, ❌ Cancelled

**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 2021, 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 scientific 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.

**Organizational issues**

Das Materialwissenschaftliche Seminar wird auch in diesem Sommersemester online angeboten. Der Startpunkt für das Seminar erfolgt in einer Online-Vorbesprechung am 19.04.2021 mit der Bereitstellung aller notwendigen Informationen inklusive der vollständigen Liste der Seminarthemen als Foliensatz auf ILIAS. Die Vergabe der Seminarthemen in Form einer ILIAS-Umfrage erfolgen. Bei Fragen wenden Sie sich bitte jederzeit an patric.gruber@kit.edu oder stefan.wagner3@kit.edu.  
Der Kursbeitritt in ILIAS erfolgt selbstständig.

**Literature**

Themenspezifisch
### 3.303 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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Legend: 🔄 Online, 🧱 Blended (On-Site/Online), 🗓 On-Site, ⌧ Cancelled

**Competence Certificate**
The examination consists of a written journal article and an oral presentation of the student’s work, both given in English. The overall impression is rated.

**Prerequisites**
none
### 3.304 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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Legend: 🖥️ Online, 🌸 Blended (On-Site/Online), 🌞 On-Site, ⌚ Cancelled
### 3.305 Course: Signals and Systems [T-ETIT-109313]

| Responsible: | Prof. Dr.-Ing. Michael Heizmann |
| 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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**Exams**

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**Prerequisites**

none
### 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

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**Events**

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<td>Lecture / 📱</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ⌚ Cancelled

**Competence Certificate**

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

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

**Prerequisites**

Required for the participation in the examination is the preparation of a report during the semester. The partial service with the code T-MACH-108888 must have been passed.

**Modeled Conditions**

The following conditions have to be fulfilled:

1. The course T-MACH-108888 - Simulation of Coupled Systems - Advance must have been passed.

**Recommendation**

- Knowledge of ProE (ideally in actual version)
- Basic 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 2021, 2 SWS, Language: German, [Open in study portal](#)

**Lecture (V)**
Blended (On-Site/Online)

**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
3.307 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

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**Exams**

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<td>Simulation of Coupled Systems - Advance</td>
<td>Geimer</td>
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</table>

**Competence Certificate**
Preparation of semester report

**Prerequisites**
none
3.308 Course: Simulator Exercises Combined Cycle Power Plants [T-MACH-105445]

**Responsible:** Hon.-Prof. Dr. 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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**Legend:** Online, Blended (On-Site/Online), On-Site, Cancelled

**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:

**Simulator Exercises Combined Cycle Power Plants**
2170491, SS 2021, 2 SWS, Language: English, [Open in study portal](#)

**Practical course (P)**
On-Site

**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.
3.309 Course: Smoothed Particle Hydrodynamics (SPH) in Computational Fluid Dynamics [T-MACH-111396]

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

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🔊 On-Site, ✗ Cancelled

Competence Certificate
Successfull solution of tasks

Prerequisites
none

Recommendation
Prior knowledge of computational fluid dynamics, SPH method and LINUX.
### 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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**Exams**

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3.311 Course: Solar Thermal Energy Systems [T-MACH-106493]

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

<table>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

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

**Prerequisites**
none

**Recommendation**

**Literature**

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

<table>
<thead>
<tr>
<th>Events</th>
<th>Type</th>
<th>Credits</th>
<th>Module</th>
<th>Recurrence</th>
<th>Organisation</th>
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*Module Offers in Mechanical Engineering for Exchange Students, Date: 15/09/2021  
Valid from Winter Term 2021/2022*
Content
The course deals with fundamental aspects of solar energy
1. Introduction to solar energy – global energy panorama
2. Solar energy resource-
   - Structure of the sun, Black body radiation, solar constant, solar spectral distribution
   - Sun-Earth geometrical relationship
3. Passive and active solar thermal applications.
4. Solar thermal systems- solar collector-types, concentrating collectors, solar towers,
   - Heat losses, efficiency
5. Selected topics on thermodynamics and heat transfer which are relevant for solar systems.
6. Introduction to Solar induced systems: Wind, Heat pumps, Biomass, Photovoltaic
7. Energy storage

The course deals with fundamental aspects of solar energy. Starting from a global energy panorama the course deals with the sun as a thermal energy source. In this context, basic issues such as the sun's structure, blackbody radiation and solar–earth geometrical relationship are discussed. In the next part, the lectures cover passive and active thermal applications and review various solar collector types including concentrating collectors and solar towers and the concept of solar tracking. Further, the collector design parameters determination is elaborated, leading to improved efficiency. This topic is augmented by a review of the main laws of thermodynamics and relevant heat transfer mechanisms.

The course ends with an overview on energy storage concepts which enhance practically the benefits of solar thermal energy systems.

The students get familiar with the global energy demand and the role of renewable energies learn about improved designs for using efficiently the potential of solar energy gain basic understanding of the main thermal hydraulic phenomena which support the work on future innovative applications will be able to evaluate quantitatively various aspects of the thermal solar systems.

Total 120 h, hereof 30 h contact hours and 90 h homework and self-studies
oral exam about 30 min.

Organizational issues
Die Veranstaltung wird nur online gehalten, falls durch Corona Einschränkungen vorgegeben werden.

Literature
3.312 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

<table>
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**Events**

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**Exams**

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**Legend:**  
- 🖥 Online  
- 🧩 Blended (On-Site/Online)  
- 🗣 On-Site  
- ✗ Cancelled

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

**Prerequisites**  
The successful participation in Übungen zu Festkörperreaktionen / Kinetik von Phasenumwandlungen, Korrosion is the condition for the admittance to the oral exam in Festkörperreaktionen / Kinetik von Phasenumwandlungen, Korrosion.

T-MACH-110926 – Excerses for Solid State Reactions and Kinetics of Phase Transformations has not been started.  
T-MACH-110927 – Solid State Reactions and Kinetics of Phase has not been started.

**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

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

**Solid State Reactions and Kinetics of Phase Transformations**  
2193003, WS 21/22, 2 SWS, Language: German, Open in study portal
Content
Oral examination (about 30 min)
Teaching Content:
1. Crystal Defects and Mechanisms of Diffusion
2. Microscopic Description of Diffusion
3. Phenomenological Treatment
4. Diffusion Coefficients
5. Diffusion Problems; Analytical Solutions
6. Diffusion with Phase Transformation
7. Kinetics of Microstructural Transformations
8. Diffusion at Surfaces, Grain Boundaries and Dislocations

Recommendations:
knowledge of the course "Fundamentals in Materials Thermodynamics and Heterogeneous Equilibria" (Seifert); Basic course in materials science and Engineering; Basic course in mathematics; physical chemistry

regular attendance: 22 hours
self-study: 98 hours

The students acquire knowledge about:

- diffusion mechanisms
- Fick's laws
- basic solutions of the diffusion equation
- evaluation of diffusion experiments
- interdiffusion processes
- the thermodynamic factor
- parabolic growth of layers
- formation of pearlite
- microstructural transformations according to the models of Avrami and Johnson-Mehl
- TTT diagrams

Literature
Course: Strategic Product Development - Identification of Potentials of Innovative Products [T-MACH-105696]

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

Organisation: KIT Department of Mechanical Engineering

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

Type: Oral examination
Credits: 3
Grading scale: Grade to a third
Recurrence: Each summer term
Version: 2

Events

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Exams

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Legend: 🌐 Online, ⚙ Blended (On-Site/Online), 🗣 On-Site, 🗑 Canceled

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): Documentation and presentation of the overall results (15 minutes)

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-MACH-110396 - Strategic Product Development - Identification of Potentials of Innovative Products - Case Study must have been passed.

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

V Strategic product development - identification of potentials of innovative products
2146198, SS 2021, 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.

Organizational issues
Anmeldung erforderlich; Termine/ Ort und weitere Informationen siehe IPEK-Homepage
Course: Structural Analysis of Composite Laminates [T-MACH-105970]

Responsible: Dr.-Ing. Luise Kärger
Organisation: KIT Department of Mechanical Engineering

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

Type: Oral examination
Credits: 4
Grading scale: Grade to a third
Recurrence: Each winter term
Version: 1

Events

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗓 On-Site, ⌚ Cancelled

Competence Certificate
oral exam, 20 min

Prerequisites
none

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

Structural Analysis of Composite Laminates 2113106, WS 21/22, 2 SWS, Language: German, Open in study portal
Lecture / Practice (VÜ) Blended (On-Site/Online)

Content
To reduce fuel consumption and CO2 emissions, lightweight materials such as fiber-reinforced plastics (FRP) are increasingly being used in vehicle construction. The course is dedicated to the calculation of the material and structural behavior of FRP components with the following contents:

- Micromechanics and Homogenization of fibre-matrix-composite
- macromechanical behavior of individual layer
- Behaviour of multilayer laminate
- FE formulations
- Failure criteria
- damage analysis
- Dimensioning of FRP parts

Aim of this lecture: The students understand the mechanical correlation between fibre-matrix-configuration and macroscopic material behavior. They can formulate the stress-strain / force-strain relation of an individual layer and of a multilayer laminate by approaches of first and higher order. The students know and can interpret and apply failure criteria and approaches to model damage progression. They know simple dimension strategies to design FRP components.
Literature


### 3.315 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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**Events**

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<tr>
<td>ST 2021</td>
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<tr>
<td>WT 21/22</td>
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</tbody>
</table>

**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 💻 On-Site, ✗ Cancelled

**Competence Certificate**  
Oral examination, 20 min

**Prerequisites**  
none

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

**Structural Ceramics**  
2126775, SS 2021, 2 SWS, Language: German, Open in study portal

**Literature**


3.316 Course: Structural Materials [T-MACH-100293]

Responsible: Dr.-Ing. Stefan Guth  
Organisation: KIT Department of Mechanical Engineering  
Part of: M-MACH-104854 - Major Field Materials and Structures for High Performance Systems

<table>
<thead>
<tr>
<th>Events</th>
<th>2174580</th>
<th>Structural Materials</th>
<th>4 SWS</th>
<th>Lecture / Practice (VÜ) / Guth</th>
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<tbody>
<tr>
<td>Exams</td>
<td>76-T-MACH-100293</td>
<td>Structural Materials</td>
<td></td>
<td>Guth</td>
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</tbody>
</table>

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ☑️Cancelled

Competence Certificate  
Oral exam, about 25 minutes

Prerequisites  
none

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

**Structural Materials**  
2174580, SS 2021, 4 SWS, Language: German, [Open in study portal](#)  
Lecture / Practice (VÜ)  
Blended (On-Site/Online)

Content  
The lectures will be held online. Further information will be available on ILIAS.

Lectures and tutorialy on the topics:
- basic loading types and superimposed loadings
- high-temperature loading
- influence of notches
- uniaxial, multiaxial and superimposed cyclic loading
- notch fatigue
- structural durability
- impact of residual stresses
- basic principles of materials selection
- dimensioning of components

Learning objectives:
The students are able to select materials for mechanical design and to dimension structural components according to the state of the art. They are familiar with the most important engineering materials. They can assess these materials on base of their characteristic properties and and they can match property profiles and requirement profiles. The dimensioning includes complex situations, such as multiaxial loading, notched components, static and dynamic loading, components with residual stresses and loading at high homologous temperatures.

Requirements:
none

Workload:
Preence: 42h
Self study: 138h
### 3.317 Course: Superconducting Materials for Energy Applications [T-ETIT-106970]

<table>
<thead>
<tr>
<th>Responsible:</th>
<th>apl. Prof. Dr. Francesco Grilli</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organisation:</td>
<td>KIT Department of Electrical Engineering and Information Technology</td>
</tr>
<tr>
<td>Part of:</td>
<td>M-MACH-104882 - Courses of the Department of Electrical Engineering and Information Technology</td>
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<td>Grade to a third</td>
<td>Each summer term</td>
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</table>

### Exams

| ST 2021 | 7312682 | Superconductors for Energy Applications | Grilli |

### 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.
Course: Superhard Thin Film Materials [T-MACH-102103]

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

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

Type: Oral examination
Credits: 4
Grading scale: Grade to a third
Recurrence: Each winter term
Version: 3

Events

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<td>WT 21/22</td>
<td>2177618</td>
<td>Superhard Thin Film Materials</td>
<td>2 SWS</td>
<td>Lecture / On-Site</td>
<td>Ulrich</td>
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Exams

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<th>Recurrence</th>
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<td>76-T-MACH-102103</td>
<td>Superhard Thin Film Materials</td>
<td>Ulrich</td>
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</table>

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate
oral examination (ca. 30 Minuten)

Prerequisites
none

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

Superhard Thin Film Materials

2177618, WS 21/22, 2 SWS, Language: German, Open in study portal

Lecture (V) On-Site

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

Teaching Content:
Introduction
Basics
Plasma diagnostics
Particle flux analysis
Sputtering and ion implantation
Computer simulations

Properties of materials, thin film deposition technology, thin film analysis and modelling of superhard materials

Amorphous hydrogenated carbon
Diamond like carbon
Diamond
Cubic Boronitride

Materials of the system metall-boron-carbon-nitrogen-silicon

regular attendance: 22 hours
self-study: 98 hours

Superhard materials are solids with a hardness higher than 4000 HV 0,05. The main topics of this lecture are modelling, deposition, characterization and application of superhard thin film materials.

Recommendations: none
Organizational issues
Falls die Vorlesung online stattfinden muss, bitte um Anmeldung unter sven.ulrich@kit.edu bis zum 10.10.21.
Den entsprechenden MS Teams Link erhalten Sie dann per E-Mail am 11.10.21.

Literature
G. Kienel (Herausgeber): Vakuumbeschichtung 1 - 5, VDI Verlag, Düsseldorf, 1994

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

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<td>Grade to a third</td>
<td>Each summer term</td>
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</table>

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Competence Certificate

written exam (60 min)

Prerequisites

none

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

Sustainable Product Engineering

2146192, SS 2021, 2 SWS, Open in study portal

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.
Organizational issues
Die zusätzliche Vorlesungstermine für Blockvorlesung finden in Räumen des IPEKs statt.

26. Mai 2020 – Blockvorlesung von 9:00 bis 17:00 Uhr
16. Juni 2020 – Blockvorlesung von 9:00 bis 17:00 Uhr
22. Juni 2020 – Blockvorlesung 14:00 bis 17:00 Uhr

Weitere Info siehe IPEK-Homepage
https://www.ipek.kit.edu/70_2831.php
3.320 Course: System Dynamics and Control Engineering [T-ETIT-101921]

**Responsible:** Prof. Dr.-Ing. Sören Hohmann

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

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

### Type
- Written examination

### Credits
- 6

### Grading scale
- Grade to a third

### Recurrence
- Each winter term

### Version
- 2

#### Events

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<th>Systemdynamik und Regelungstechnik</th>
<th>2 SWS</th>
<th>Lecture</th>
<th>Hohmann</th>
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<tr>
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<td>2303156</td>
<td>Tutorien zu 2303155 Systemdynamik und Regelungstechnik</td>
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<td>Tutorial (</td>
<td>Schneider</td>
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<td>Übungen zu 2303155 Systemdynamik und Regelungstechnik</td>
<td>1 SWS</td>
<td>Practice</td>
<td>Schneider</td>
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</table>

#### Exams

| ST 2021 | 7303155 | System Dynamics and Control Engineering | | | Hohmann |

### Prerequisites

none
3.321 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 Microsystems Technology

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

**Events**

| ST 2021 | 2106033 | System Integration in Micro- and Nanotechnology I | 2 SWS | Lecture / 🖥 | Gengenbach |

**Exams**

| ST 2021 | 76-T-MACH-105555 | System Integration in Micro- and Nanotechnology | Gengenbach |

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), ☩ On-Site, ✗ Cancelled

**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 I**  
2106033, SS 2021, 2 SWS, Language: German, Open in study portal

**Content**

- Introduction to system integration (fundamentals)
- Brief introduction to MEMS processes
- Flexures
- Surfaces and plasma processes for surface treatment
- Adhesive bonding in engineering
- Mounting techniques in electronics
- Molded Interconnect devices (MID)
- Functional Printing
- Low temperature cofired ceramics in system integration
- 3D-Integration in semiconductor technology

**Learning objectives:**

The students acquire basic knowledge of challenges and system integration technologies from mechanical engineering, precision engineering and electronics.

**Literature**

- J. Franke, Räumliche elektronische Baugruppen (3D-MID), Carl Hanser-Verlag München, 2013
**3.322 Course: System Integration in Micro- and Nanotechnology 2 [T-MACH-110272]**

**Responsible:** Dr. Ulrich Gengenbach  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-104850 - Major Field Mechatronics and Microsystem Technology

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

**Competence Certificate**  
Oral exam, approx. 15 min.

**Prerequisites**  
None

**Annotation**  
Attention: The lecture and exam will be offered for the first time in WS20/21!

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

**System Integration in Micro- and Nanotechnology 2**  
2105040, WS 21/22, 2 SWS, Language: German, [Open in study portal](#)

**Content**  
Introduction to system integration (novel processes and applications)  
Assembly of hybrid microsystems  
Packaging processes  
Applications:  
- Micro process engineering  
- Lab-on-chip systems  
- Microoptical systems  
- Silicon Photonics  

Novel integration processes:  
- Direct Laser Writing  
- Self Assembly

**Learning objectives**  
The students acquire knowledge of novel system integration technologies and their application in microoptic and microfluidic systems.

**Literature**  
N.-T. Nguyen, Fundamentals and Applications of Microfluidics, Artech House  
G. T. Reed, Silicon Photonics: An Introduction, Wiley
3.323 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>ST 2021 2174576</td>
<td>Systematic Materials Selection</td>
<td>3 SWS</td>
<td>Lecture / Online</td>
<td>Dietrich</td>
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<tr>
<td>ST 2021 2174577</td>
<td>Übungen zu 'Systematische Werkstoffauswahl'</td>
<td>1 SWS</td>
<td>Practice / Online</td>
<td>Dietrich, Mitarbeiter</td>
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**Exams**

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<td>Systematic Materials Selection</td>
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<td>Dietrich</td>
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</tr>
</tbody>
</table>

**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 2021, 3 SWS, Language: German, Open in study portal
Content
Important aspects and criteria of materials selection are examined and guidelines for a systematic approach to materials selection are 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:
Wiling SPO 2007 (B.Sc.)
The course Material Science I [21760] has to be completed beforehand.

Wiling (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; Übungslätter; 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
### 3.324 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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#### Events

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<tr>
<td>ST 2021</td>
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<td>Systems Engineering for Automotive Electronics</td>
<td>2</td>
<td>Lecture/🖥</td>
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<td>ST 2021</td>
<td>2311644</td>
<td>Tutorial for 2311642 Systems Engineering for Automotive Electronics</td>
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#### Exams

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<td>Systems Engineering for Automotive Electronics</td>
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</tr>
</tbody>
</table>

**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), ⚡ On-Site, ✗ Cancelled

**Prerequisites**

none
### 3.325 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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**Events**

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<tbody>
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<td>ST 2021</td>
<td>2 SWS</td>
<td>Technical Design in Product Development</td>
<td>Schmid</td>
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<td>2 SWS</td>
<td>Technical Design in Product Development (Test Karlsruhe)</td>
<td>Schmid, Albers</td>
</tr>
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</table>

Legend: 🚬 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Canceled

**Competence Certificate**

Written exam (60 min)

Only dictionary is allowed

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

#### Technical Design in Product Development

2146179, SS 2021, 2 SWS, Language: German, Open in study portal

**Lecture (V) Online**

**Content**

**Introduction**

Relevant parameters on product value in Technical Design  
Design in Methodical Development and Engineering and for a differentiated validation of products  
Design in the concept stage of Product Development  
Design in the draft and elaboration stage of Product Development  
Best Practice

After listening the module "technical design" the students should have knowledge about the basics of technical oriented design as an integral part of the methodical product development

The students have knowledge about ...

- the interface between engineer and designer.  
- all relevant human-product requirements as f. exp. demographic/ geographic and psychographic features, relevant perceptions, typical content recognition as well as ergonomic bases.  
- the approaches concerning the design of a product, product program or product system with focus on structure, form-, color- and graphic design within the phases of the design process.  
- the design of functions and supporting structures as well as the important interface between human and machine.  
- relevant parameters of a good corporate design.

**Organizational issues**


**Erster Vorlesungstermin:** wird noch bekanntgegeben
Literature
Markus Schmid, Thomas Maier
Technisches Interface Design
Anforderungen, Bewertung, Gestaltung.
2017
Hartmut Seeger
Design technischer Produkte, Produktprogramme und -systeme
Industrial Design Engineering.
2., bearb. und erweiterte Auflage.
ISBN: 3540236538
September 2005 - gebunden - 396 Seiten

**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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<tr>
<td>WT 21/22</td>
<td>2157200</td>
<td>Technical energy systems for buildings 1: Processes &amp; components</td>
<td>Lecture / 📐</td>
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**Exams**

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<td>76-T-MACH-105559</td>
<td>Technical Energy Systems for Buildings 1: Processes &amp; Components</td>
<td>Schmidt</td>
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</table>

**Competence Certificate**

oral exam, approx. 30 minutes

**Prerequisites**

none

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

**Technical energy systems for buildings 1: Processes & components**

Lecture (V)  
Blended (On-Site/Online)

2157200, WS 21/22, 2 SWS, Language: German, Open in study portal

**Content**

Introduction to heating and cooling technologies for buildings, solar energy utilization in buildings (solar radiation, solar thermal energy, photovoltaics) and to energy storage in buildings (thermal and electric storage technologies). Topics covered:

- Burners, condensing and non-condensing boilers  
- Cogeneration units for use in buildings  
- Heat transformation: Fundamentals, vapor compression, absorption, adsorption  
- Solar energy: Radiation, solar thermal collectors, photovoltaics  
- Energy storage in buildings: thermal and electric storage

**Learning objectives:**

Students know relevant technical components of energy supply systems in buildings (heating and cooling, dehumidification). They know the energy conversion processes associated with these components and can estimate their energy efficiencies as well as the most important factors influencing efficiency.

Students are familiar with the underlying physics (mostly thermodynamics) of the relevant processes. They can derive relevant figures of merit from these principles. They know the degree of technological development for the various processes and components and are aware of current research and development objectives in this field.

**Oral exam:** about 25 min.  
No tools

**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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**Exams**

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<td>Technical Energy Systems for Buildings 2: System Concept</td>
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<td>76-T-MACH-105560</td>
<td>Technical Energy Systems for Buildings 2: System Concept</td>
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Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

**Competence Certificate**

oral exam, approx. 30 minutes

**Prerequisites**

none

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

### Technical energy systems for buildings 2: System concepts

2158201, SS 2021, 2 SWS, Language: German, Open in study portal

**Lecture (V) On-Site**

**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**
3.328 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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**Exams**

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**Competence Certificate**

Prerequisite: attestation each semester by homework assignments

Written exam, approx. 3 hours

**Prerequisites**

Successful participation in the tutorial (T-MACH-105204 - Exercises in Technical Thermodynamics and Heat Transfer I)

**Modeled Conditions**

The following conditions have to be fulfilled:

1. The course T-MACH-105204 - Exercises in Technical Thermodynamics and Heat Transfer I must have been passed.

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

**Technical Thermodynamics and Heat Transfer I**

2165501, WS 21/22, 4 SWS, Language: German, Open in study portal

**Lecture (V)**

Blended (On-Site/Online)

**Content**

- System, properties of state
- Absolute temperature, model systems
- 1st law of thermodynamics for resting and moving systems
- Entropy and 2nd law of thermodynamics
- Behavior of real substances described by tables, diagrams and equations of state
- Machine processes
- Mixtures of ideal and real compounds

**Literature**

Vorlesungsriptum

Technical Thermodynamics and Heat Transfer I
3165014, WS 21/22, 4 SWS, Language: English, Open in study portal

Content
- System, properties of state
- Absolute temperature, model systems
- 1st law of thermodynamics for resting and moving systems
- Entropy and 2nd law of thermodynamics
- Behavior of real substances described by tables, diagrams and equations of state
- Machine processes
- Mixtures of ideal and real compounds

Literature
Vorlesungsskriptum
3.329 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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**Type:** Written examination  
**Credits:** 7  
**Grading scale:** Grade to a third  
**Recurrence:** Each summer term  
**Version:** 1

**Exams**

- **ST 2021 76-T-MACH-105287** Technical Thermodynamics and Heat Transfer II  
  Responsible: Maas

- **ST 2021 76-T-MACH-105287-englisch** Technical Thermodynamics and Heat Transfer II  
  Responsible: Maas

- **WT 21/22 76-T-MACH-105287** Technical Thermodynamics and Heat Transfer II  
  Responsible: Maas

**Competence Certificate**

Prerequisite: attestation each semester by homework assignments  
Written exam, approx. 3 hours

**Prerequisites**

Successful participation in the tutorial (T-MACH-105288 - Exercises in Technical Thermodynamics and Heat Transfer II)

**Modeled Conditions**

The following conditions have to be fulfilled:

1. The course T-MACH-105288 - Excercises in Technical Thermodynamics and Heat Transfer II must have been passed.

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

**Technical Thermodynamics and Heat Transfer II**

- **2166526, SS 2021, 3 SWS, Language: German, Open in study portal**
- **Lecture (V) Blended (On-Site/Online)**

**Content**

- Repetition of the topics of "Thermodynamics and Heat Transfer I"
- Behavior of mixtures
- Moist air
- Kinetic theory of gases
- Behavior of real substances described by equations of state
- Chemical reactions and applications of the laws of thermodynamics to chemical reactions
- Reaction kinetics
- Heat Transfer

**Literature**

Vorlesungsskriptum


Content

- Repetition of the topics of "Thermodynamics and Heat Transfer I"
- Behavior of mixtures
- Moist air
- Kinetic theory of gases
- Behavior of real substances described by equations of state
- Chemical reactions and applications of the laws of thermodynamics to chemical reactions
- Reaction kinetics
- Heat Transfer

Literature

Vorlesungsskriptum

3.330 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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<td>Each summer term</td>
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Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

**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 2021, 2 SWS, Language: German, Open in study portal

**Lecture (V)**
Blended (On-Site/Online)

**Content**
Meaning, Development and characterization of component states  
Description of the influence of component state on mechanical properties  
Stability of component states  
Steel manufacturing  
Component states due to forming  
Component states due to heat treatments  
Component states due to surface hardening  
Component states due to machining  
Component states due to mechanical surface treatments  
Component states due to joining  
Summarizing evaluation

**Learning objectives:**
The students have the background to evaluate the influence of manufacture processes on the compound state of metallic compounds. The students can assess the influence and the stability of compound state under mechanical load. The students are capable to describe the individual aspects of interaction of the compound state of steel components due to forming, heat treatment, mechanical surface treatment and joining processes.

**Requirements:**
Materials Science and Engineering I & II

**Workload:**
regular attendance: 21 hours  
self-study: 99 hours
Literature
Skript wird in der Vorlesung ausgegeben

VDEh: Werkstoffkunde Stahl, Bd. 1: Grundlagen, Springer-Verlag, 1984


V. Schulze: Modern Mechanical Surface Treatments, Wiley, Weinheim, 2005
3.331 Course: Ten Lectures on Turbulence [T-MACH-105456]

**Responsible:** Dr. Ivan Otic  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:**  
- M-MACH-104878 - Specification in Mechanical Engineering  
- M-MACH-105134 - Elective Module Mechanical Engineering

**Type**  
Oral examination  

**Credits**  
4

**Grading scale**  
Grade to a third

**Recurrence**  
Each winter term  

**Version**  
1

**Events**

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<tr>
<td>WT 21/22</td>
<td>Dr. Ivan Otic</td>
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**Ten lectures on turbulence**  
2189904, WS 21/22, 2 SWS, Language: English, Open in study portal

**Content**

**Contents:**
The course is aimed of giving the fundamentals of turbulence theory, modelling and simulation. Governing equations and statistical description of turbulence are introduced. Reynolds equations, Kolmogorov's theory and scales of turbulent ous are discussed. Homogeneous and isotropic turbulence. Turbulent free-shear ous and wall-bounded turbulent ous are discussed. Turbulence modelling approaches and simulation methods are introduced.

1 Introduction  
2 Turbulent transport of momentum and heat  
3 Statistical description of turbulence  
4 Scales of turbulent flows  
5 Homogeneous turbulent shear flows  
6 Free turbulent shear flows  
7 Wall-Bounded turbulent flows  
8 Turbulence Modelling  
9 Reynolds Averaged Navier-Stokes (RANS) Simulation Approach  
10 Large Eddy Simulation (LES) Approach

**Objectives:**
At the completion of this course, students  
- are able to understand fundamentals of statistical fluid mechanics, turbulence theory and turbulence modelling  
- are able to derive RANS and LES transport equations  
- get working knowledge of modelling techniques that can be used for solving engineering heat and mass transfer problems.

**Literature**

Reference texts:  
- Lecture Notes  
- Presentation slides

Recommended Books:  
# 3.332 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
### 3.333 Course: Theory of Stability [T-MACH-105372]

**Responsible:** Prof. Dr.-Ing. Alexander Fidlin  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-104853 - Major Field Theoretical Foundations of Mechanical Engineering

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**Experiments**

| ST 2021 | 2163113 | Theory of Stability | 2 SWS | Lecture / 🖥 | Fidlin |
| ST 2021 | 2163114 | Übungen zu Stabilitätstheorie | 2 SWS | Practice / 🧩 | Fidlin, Aramendiz, Fuentes |

**Exams**

| ST 2021 | 76-T-MACH-105372 | Theory of Stability | Fidlin |

**Competence Certificate**

oral exam, 30 min.

**Prerequisites**

none

**Recommendation**

Vibration theory, Mathematical Methods of Vibration Theory

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

### Theory of Stability

2163113, SS 2021, 2 SWS, Language: German, [Open in study portal](#)

**Lecture (V)**

**Online**

**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**

Course: Thermal Solar Energy [T-MACH-105225]

**3.334 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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**Exams**

| ST 2021 | 76-T-MACH-105225 | Thermal Solar Energy | | Stieglitz |
| WT 21/22 | 76-T-MACH-105225 | Thermal Solar Energy | | Stieglitz |

Legend: 🖥 Online, 🗑 Blended (On-Site/Online), 📚 On-Site, ☑ Cancelled

**Competence Certificate**

Oral examination of about 30 minutes

**Prerequisites**

none

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

**Thermal Solar Energy**

2169472, WS 21/22, 2 SWS, Language: German, Open in study portal

<table>
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<th>Lecture (V) On-Site</th>
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**Content**


In detail:

1. Introduction to energy requirements and evaluation of the potential use of solar thermal energy.
2. Primary energy source SUN: sun, solar constant, radiation (direct, diffuse scattering, absorption, impact angle, radiation balance).
5. Momentum and heat transport: basic equations of single and multiphase transport, calculation methods, stability limits. optional
6. Low temperature solar thermal systems: collector types, methods for system simulation, planning and dimensioning of systems, system design and stagnation scenarios.
7. High temperature solar thermal systems: solar towers and solar-farm concept, loss mechanisms, chimney power plants and energy production processes.

The lecture elaborates the basics of the solar technology and the definition of the major wordings and its physical content such as radiation, thermal use, insulation etc.. Further the design of solar collectors for different purposes is discussed and analyzed. The functional principle of solar plants is elaborated before at the end the ways for solar cooling is discussed.

The aim of the course is to provide the basic physical principles and the derivation of key parameters for the individual solar thermal use. This involves in addition to the selective absorber, mirrors, glasses, and storage technology. In addition, a utilization of solar thermal energy means an interlink of the collector with a thermal-hydraulic circuit and a storage. The goal is to capture the regularities of linking to derive efficiency correlations as a function of their use and evaluate the performance of the entire system.

**Recommendations / previous knowledge**

Basics in heat and mass transfer, material science and fluid mechanics, desirable are reliable knowledge in physics in optics and thermodynamics.

Oral exam of about 25 minutes, no tools or reference materials may be used during the exam.
Organizational issues
Die Veranstaltung wird nur online gehalten, falls durch Corona Einschränkungen vorgegeben werden.

Literature
Bereitstellung des Sudienmaterials in gedruckter und elektronischer Form.
3.335 Course: Thermal Turbomachines I [T-MACH-105363]

**Responsible:** Prof. Dr.-Ing. Hans-Jörg Bauer

**Organisation:** KIT Department of Mechanical Engineering

**Part of:**
- M-MACH-104848 - Major Field Energy and Environmental Engineering
- M-MACH-104878 - Specification in Mechanical Engineering
- M-MACH-105134 - Elective Module Mechanical Engineering

**Type:** Oral examination

**Credits:** 6

**Grading scale:** Grade to a third

**Recurrence:** Each winter term

**Version:** 1

### Events

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**Exam Details**

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<td>Grade to a third</td>
<td>Each winter term</td>
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**Competence Certificate**

oral exam, duration 30 min.

**Prerequisites**

none

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

**Thermal Turbomachines I**

2169453, WS 21/22, 3 SWS, Language: German, 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

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.

regular attendance: 31,50 h
self-study: 64,40 h

Recommendations:
Recommended in combination with the lecture 'Thermal Turbomachines II'.

Examination:
oral
Duration: approximately 30 min

no tools or reference materials may be used during the exam

Organizational issues
Vorlesung findet in Präsenz statt, sofern es die COVID-Inzidenzwerte zulassen.

Literature
Vorlesungsskript (erhältlich im Internet)
Sigloch, H.: Strömungsmaschinen, Carl Hanser Verlag, 1993

Thermal Turbomachines I (in English)
2169553, WS 21/22, 3 SWS, Language: English, Open in study portal
Content
Basic concepts of thermal turbomachinery

Steam Turbines - Thermodynamic process analysis
Gas Turbines - Thermodynamic process analysis
Combined cycle and cogeneration processes
Overview of turbomachinery theory and kinematics
Energy transfer process within a turbine stage
Types of turbines (presented through examples)
1-D streamline analysis techniques
3-D flow fields and radial momentum equilibrium in turbines
Compressor stage analysis and future trends in turbomachinery

Recommendations:
Recommended in combination with the lecture 'Thermal Turbomachines II'.
The students are able to explain and comment on the design and operation of thermal turbomachines in detail. Moreover, they can evaluate the range of applications for turbomachinery. Therefore, students are able to 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.

regular attendance: 31,50 h
self-study: 64,40 h

Exam:
oral
Duration: approximately 30 min

no tools or reference materials may be used during the exam

Organizational issues
Veranstaltung wird in Präsenz angeboten, sofern es die COVID-Inzidenzwerte zulassen

Literature
Vorlesungsskript (erhältlich im Internet)
Sigloch, H.: Strömungsmaschinen, Carl Hanser Verlag, 1993
### 3.336 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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**Competence Certificate**  
oral exam, duration: 30 min.

**Prerequisites**  
none

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

#### Thermal Turbomachines II

- **Code:** 2170476, **SS 2021**, 3 SWS, Language: German, Open in study portal  
- **Type:** Lecture (V)  
- **Format:** Blended (On-Site/Online)
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 2021, 3 SWS, Language: English, Open in study portal
Lecture / Practice (VÜ)
Blended (On-Site/Online)
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
Below you will find excerpts from events related to this course:

**Thermal-Fluid-Dynamics**  
2189423, WS 21/22, 2 SWS, Language: German, [Open in study portal](#)  
Lecture (V)  
On-Site

**Content**

- Fundamentals of flows and heat transfer
- Dimensionless parameters of thermal fluid dynamics
- Laminar and turbulent thermal boundary layer equations
- Velocity and temperature laws in boundary layers
- Convective heat transfer of external and internal flows
- Heat transfer analogies (Prandtl-, von Kármán, Martinelli,…)
- Methods for enhancing heat transfer
- Strategies and methods for investigation of thermal-hydraulics in R&D

The lecture provides an overview of momentum and energy transport as occurring in power engineering components and heat exchangers. On the basis of the conservation equations and the fundamentals of thermal-hydraulics, dimensionless parameters for forced and free convection are evolved. Flows close to walls play a crucial role for the convective heat transfer and for heat exchanger components. Thus, with scaling rules the laminar and turbulent thermal boundary layer equations are introduced. In the following, velocity and temperature laws of the wall as a basis for analogies and models of computational tools are discussed and the influence of roughness and surface design are shown. Concepts of state-of-the-art turbulence modelling and their applicability for different conditions or different heat transfer fluids (e.g. liquid metals, gas, oil) are described. Analogies and correlations for internal and external forced convection are developed by means of approximation concepts. Design options to enhance the efficiency and effectiveness of heat exchangers are discussed.

The objectives of the lecture are the fundamentals of thermal-hydraulics for describing and modelling convective fluid flow as occurring in power engineering components. A major objective is the description of the convective heat transfer for external and internal flows. A key issue is the transfer of analytic models and empirical results into "state of the art" computational tools and their validation by advanced experimental methods. Within the scope of the course, the students learn (a) to develop differential equation for thermal-hydraulic problems and to describe the thermal flow field by means of dimensionless parameters, (b) to transfer a real problem to an experiment or computational model, (c) to develop analogies and correlations for heat transfer processes of forced convection, (d) to select adequate computational methods/models, (e) to evaluate and select experiments including measurement techniques with adequate instrumentation for thermal-hydraulic problems and (f) to know design option for an efficient and effective heat exchange.

**Attendance time:** 21 h  
**Preparation/follow-up time of lectures, exam preparation:** 90h  
**Oral exam of about 30 min.**
Organizational issues
Die Veranstaltung wird nur online gehalten, falls durch Corona Einschränkungen vorgegeben werden.

Literature
3.338 Course: Thin Film and Small-scale Mechanical Behavior [T-MACH-105554]

**Responsible:**
- Dr. Patric Gruber
- Prof. Dr. Christoph Kirchlechner
- 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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**Events**

| ST 2021 | 2178123 | Thin film and small-scale mechanical behavior | 2 SWS | Lecture / Online | Kirchlechner, Gruber, Weygand |

**Exams**

| ST 2021 | 76-T-MACH-105554 | Thin Film and Small-scale Mechanical Behavior | Kirchlechner, Gruber, Weygand |
| WT 21/22 | 76-T-MACH-105554 | Thin Film and Small-scale Mechanical Behavior | Gruber, Weygand |

Legend: 🌐 Online, 🧪 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

**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**

**Content**
1. Introduction: Application and properties of micro- and nanosystems; Overview on size effects
2. Fundamentals: Dislocation plasticity (definition of a dislocation; dislocation density, mobility, dislocation sources, statistical aspects incl. SSDs and GNDs).
4. Interface plasticity: Compatibility, slip transfer mechanisms, expected size effects.
5. Modelling of mechanisms causing size effects in crystals and at grain boundaries, e.g. dislocation dynamics.
7. Nanocrystalline materials: Synthesis, outstanding mechanical properties

The students know and understand size and scaling effects in micro- and nanosystems based on the fundamental microstructure mechanisms at play. 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
Organizational issues
Die Vorlesung wird unabhängig von den zuvor angekündigten Vorlesungsterminen angeboten. Dazu werden die Vorlesungsfolie mit Erklärungen und Tafelaufschriften auf ILIAS bereitgestellt. Weitere Informationen zur Interaktion werden ebenfalls über ILIAS bekanntgegeben. Bei Fragen wenden Sie sich bitte jederzeit an patric.gruber@kit.edu.

Der Kursbeitritt in ILIAS erfolgt selbstständig.

Literature
2. L.B. Freund and S. Suresh: „Thin Film Materials
3.339 Course: Tires and Wheel Development for Passenger Cars [T-MACH-102207]

 Responsible: Hon.-Prof. Dr. Günter Leister
 Organisation: KIT Department of Mechanical Engineering

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

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Exams

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Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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 2021, 2 SWS, Language: German, Open in study portal

Lecture (V) Online

Content

1. The role of the tires and wheels in a vehicle
2. Geometry 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, Wheel testing
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.

Organizational issues

Voraussichtliche Termine, nähere Informationen und eventuelle Terminänderungen:
siehe Institutshomepage.

Literature

Manuskript zur Vorlesung
Manuscript to the lecture
3.340 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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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🔴 On-Site, ✗ Cancelled

**Competence Certificate**

The assessment consists of an written exam taking place in the recess period (90 min).

**Prerequisites**

none

**Recommendation**

Basic knowledge in mechanical engineering.
Annotation
Learning Outcomes
After completion of the course the Students know:

• important problems in agritechnological developments
• Customer requirements and their implementation in tractors
• Tractor technology in width and depth

Content
Tractors are one of the most underestimated vehicles in regard to performance und technics. Almost none vehicle is as multifunctional and fulfilled with high-tech as a tractor. Automatic guidance, special chassis suspension or special concepts of power trains are one of the topics where tractors are in leading position in technologies

During the lecture an overview about the design and construction and application area is given. A close look will be taken on the historical background, legal requirements, ways of development, agricultural organizations and the process of development itself.

In detail the following topics will be dealt with:

• agricultural organization / legal requirements
• history of tractors
• tractor engineering
• tractor mechanics
• chassis suspension
• combustion engine
• transmission
• interfaces
• hydraulics
• wheels and tyres
• cabin
• electrics and electronics

Literature

• K.T. Renius: Traktoren - Technik und ihre Anwendung; DLG Verlag (Frankfurt), 1985
• E. Schilling: Landmaschinen - Lehr- und Handbuch für den Landmaschinenbau; Schilling-Verlag (Köln), 1960

Below you will find excerpts from events related to this course:
**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-tec as a tractor. Automatic guidance, special chassis suspension or special concepts of power trains are one of the topics where tractors are in leading position in technologies.

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- agricultural organization / legal requirements
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- chassis suspension
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- interfaces
- hydraulics
- wheels and tyres
- cabin
- electrics and electronics

**Organizational issues**

Ort/Zeit siehe Institutshomepage

**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
**3.341 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

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 📝 On-Site, ✗ Cancelled

**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

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

- Chapter 1: Friction
  adhesion, geometrical and real area of contact, Friction experiments, friction powder, tribological stressing, environmental influences, tribological age, contact models, Simulation of contacts, roughness.
- Chapter 2: Wear
  plastic deformation at the asperity level, dissipation modes, mechanical mixing, Dynamics of the third body, running-in, running-in dynamics, shear stress.
- Chapter 3: Lubrication
  base oils, Striibeck plot, lubrication regimes (HD, EHD, mixed lubrication), additives, oil characterization, solid lubrication.
- Chapter 4: Measurement Techniques
  friction measurement, tribometer, dissipated frictional power, conventional wear measurement, continuous wear measurement(RNT)
- Chapter 5: Roughness
  profilometry, surface roughness parameters, evaluation length and filters, bearing ratio curve, measurement error
- Chapter 6: Accompanying Analysis
  multi-scale topography measurement, chemical surface analysis, structural analysis, mechanical analysis

Exercises are used for complementing and deepening the contents of the lecture as well as for answering more extensive questions raised by the students.

The student can

- describe the fundamental friction and wear mechanisms, which occur in tribologically stressed systems
- evaluate the friction and wear behavior of tribological systems
- explain the effects of lubricants and their most important additives
- identify suitable approaches to optimize tribological systems
- explain the most important experimental methods for the measurement of friction and wear, and is able to use them for the characterisation of tribo pairs
- choose suitable methods for the evaluation of roughness and topography from the nm-scale to the mm-scale and is able to interpret the determined values in respect to their effect on the tribological behavior
- describe the most important surface-analytical methods and their physical principles for the characterization of tribologically stressed sliding surfaces

preliminary knowledge in mathematics, mechanics and materials science recommended
regular attendance: 45 hours
self-study: 195 hours
oral examination (ca. 40 min)
no tools or reference materials
admission to the exam only with successful completion of the exercises

Literature

Course: Turbine and Compressor Design [T-MACH-105365]

**Responsible:** Prof. Dr.-Ing. Hans-Jörg Bauer

**Organisation:** KIT Department of Mechanical Engineering

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

**Type:** Oral examination

**Credits:** 4

**Grading scale:** Grade to a third

**Recurrence:** Each winter term

**Version:** 1

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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

**Competence Certificate**
oral exam, duration: 20 min.

**Prerequisites**
Exams Thermal Turbomachinery I & II successfully passed.

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The course T-MACH-105363 - Thermal Turbomachines I must have been passed.
2. The course T-MACH-105364 - Thermal Turbomachines II must have been passed.

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

**Turbine and compressor Design**
2169462, WS 21/22, 2 SWS, Language: German, [Open in study portal](#)
Content
The lecture is intended to expand the knowledge from Thermal Turbomachines I+II. Thermal Turbomaschinen, general overview

Design of a turbomachine: Criteria and development

Radial machines

Transonic compressors

Combustion chambers

Multi-spool installations

The students have the ability to:

- describe special types of components, such as e.g. radial machines and transonic compressors
- explain and evaluate the operation of components and machines
- interpret and apply the physical principles
- design individual components in a practical approach

regular attendance: 21 h
self-study: 42 h

Exam:
oral
Duration: approximately 30 minutes

no tools or reference materials may be used during the exam

Organizational issues
Vorlesung findet in Präsenz statt, sofern es die COVID-Inzidenzwerte zulassen.

Literature

3.343 Course: Tutorial Introduction to the Finite Element Method [T-MACH-110330]

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

<table>
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Events

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<td>Practice / 🖥️</td>
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Exams

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Legend: 🖥️ Online, 🧩 Blended (On-Site/Online), 🗽️ On-Site, ✗ Cancelled

Competence Certificate
Successful participation in this course allows for registration to the Exam "Introduction to the Finite Element Method" (see 76-T-MACH-105320)

For students of Mechanical Engineering (BSc) that have chosen the Major Field "Continuum Mechanics" the prerequisites consist of successfully solving the written homework sheets as well as the computational homework sheets during the associated computer tutorials.

For students of Mechanical Engineering that have chosen a different Major Field and for students from different fields of study the prerequisites consist of successfully solving only the written homework sheets.

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.

Due to capacity reasons it is possible that not all students of this course can be admitted to the computer tutorials. Students of the bachelor's degree program in mechanical engineering who have chosen the Major Field Continuum Mechanics (SP-Nr 13) will be admitted to the computer tutorials in any case.

If additional places are available in the computer tutorials for this course, these will be allocated according to the BSc average grade.

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

V Tutorial Introduction to the Finite Element Method
2162257, SS 2021, 1 SWS, Language: German, Open in study portal

Practice (Ü)
Online

Content
See lecture "Introduction to the Finite Element Method"

Literature
siehe Vorlesung "Einführung in die Finite-Elemente-Methode"
3.344 Course: Tutorial Mathematical Methods in Micromechanics [T-MACH-110379]

**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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**Exams**

| ST 2021 | 76-T-MACH-110400 | Tutorial Mathematical Methods in Micromechanics | Böhlke |

**Competence Certificate**

Successfully solving the homework sheets. Details are given in the first lecture.
3.345 Course: Tutorial Nonlinear Continuum Mechanics [T-MACH-111027]

**Responsible:** Prof. Dr.-Ing. Thomas Böhlke

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

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<td>76-T-MACH-111027</td>
<td>Tutorial Nonlinear Continuum Mechanics</td>
<td>Böhlke</td>
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</table>

**Competence Certificate**

Written homework problems

Successful participation in this course allows for registration to the Exam "Nonlinear Continuum Mechanics" (see 76-T-MACH-111026)

**Prerequisites**

none
**3.346 Course: Two-Phase Flow and Heat Transfer [T-MACH-105406]**

**Responsible:** Hon.-Prof. Dr. Thomas Schuelenberg  
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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<td>Two-Phase Flow and Heat Transfer</td>
<td>2 SWS</td>
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<td>Grade to a third</td>
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**Exams**

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<td>Two-Phase Flow and Heat Transfer</td>
<td>Schulenberg</td>
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</table>

**Competence Certificate**

oral exam, duration: approximately 30 minutes  
no tools or reference materials may be used during the exam

**Prerequisites**

none

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

**V Two-Phase Flow and Heat Transfer**  
2169470, WS 21/22, 2 SWS, Language: German/English, [Open in study portal]

**Content**

The students can describe two-phase flows with heat transfer as phenomena occurring in steam generators and condensers (e.g. in power stations or refrigerators). They can distinguish different flow regimes and transitions and apply two-phase flow models. The students are qualified to explain the characteristics of different flow examples (e.g. pressure drop of two phase flows, pool boiling, forced convective boiling, condensation) and can analyze two-phase flow instabilities.

- Examples for technical applications  
- Definitions and averaging of two-phase flows  
- Flow regimes and transitions  
- Two-phase models  
- Pressure drop of two phase flows  
- Pool boiling  
- Forced convective boiling  
- Condensation  
- Two-phase flow instabilities

**Literature**

Vorlesungsskript
Course: Vacuum and Tritium Technology in Nuclear Fusion [T-MACH-108784]

**Responsible:** Dr. Christian Day  
**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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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🔴 On-Site, ✗ Cancelled

**Competence Certificate**

oral examination, approx. 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 2021, 2 SWS, Language: German/English, Open in study portal  
Blended (On-Site/Online)

**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

**Organizational issues**

Anmeldung bis 20. April via E-Mail an: christian.day@kit.edu

Die Vorlesung findet an 4 Tagen in der Zeit von 08:00-17:15 Uhr am Campus Nord statt. Der Raum wird noch bekanntgegeben. Termine werden mit angemeldeten Teilnehmern Ende April für Juni vereinbart.
3.348 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

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**Events**

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**Legend:** Online, Blended (On-Site/Online), On-Site, Cancelled

**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 2021, 2 SWS, Language: English, [Open in study portal](#)

**Lecture (V)**

Online

**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.

**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 chassis regarding driving comfort and acoustic under consideration of goal conflicts.
Organizational issues
Kann nicht mit der Veranstaltung [2113806] kombiniert werden.
Can not be combined with lecture [2113806]
Genaue Termine entnehmen Sie bitte der Institushomepage.
Scheduled dates:
see homepage of the institute.

Literature
2. Russel C. Hibbeler, Technische Mechanik 3, Dynamik, Pearson Studium, München, 2006

Das Skript wird zu jeder Vorlesung zur Verfügung gestellt

Vehicle Comfort and Acoustics I
2113806, WS 21/22, 2 SWS, Language: German, Open in study portal

Content
1. Perception of noise and vibrations
3. Fundamentals of acoustics and vibrations
3. Tools and methods for measurement, computing, simulation and analysis of noise and vibrations
4. The relevance of tire and chasis for the acoustic and mechanical driving comfort:
   phenomena, influencing parameters, types of construction, optimization of components and systems, conflict of goals, methods
   of development

An excursion will give insights in the development practice of a car manufacturer or a system supplier.

Learning Objectives:
The students know what noises and vibrations mean, how they are generated, and how they are perceived by human beings.
They have knowledge about the requirements given by users and the public. They know which components of the vehicle are
participating in which way on noise and vibration phenomenon and how they could be improved. They are ready to apply
different tools and methods to analyze relations and to judge them. They are able to develop the chasis regarding driving
comfort and acoustic under consideration of goal conflicts.

Organizational issues
Kann nicht mit der Veranstaltung [2114856] kombiniert werden.
Can not be combined with lecture [2114856]

Literature
2. Russel C. Hibbeler, Technische Mechanik 3, Dynamik, Pearson Studium, München, 2006

Das Skript wird zu jeder Vorlesung zur Verfügung gestellt
### 3.349 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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#### Events

| ST 2021 | 2114825 | Vehicle Comfort and Acoustics II | 2 SWS | Lecture / Online | Gauterin |
| ST 2021 | 2114857 | Vehicle Ride Comfort & Acoustics II | 2 SWS | Lecture / Online | Gauterin |

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**Legend:** 📥 Online, 🟢 Blended (On-Site/Online), 🗣 On-Site, 🗓 Cancelled

#### 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:**

**Vehicle Comfort and Acoustics II**

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<th>2114825</th>
<th>Vehicle Comfort and Acoustics II</th>
<th>2 SWS, Language: German</th>
<th>Open in study portal</th>
<th>Lecture (V)</th>
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Module Offers in Mechanical Engineering for Exchange Students , Date: 15/09/2021  
Valid from Winter Term 2021/2022  
527
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.

Organizational issues
Kann nicht mit der Veranstaltung [2114857] kombiniert werden.
Can not be combined with lecture [2114857]

Literature
Das Skript wird zu jeder Vorlesung zur Verfügung gestellt.

Vehicle Ride Comfort & Acoustics II
2114857, SS 2021, 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
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Learning Objectives:
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Organizational issues
Genaue Termine entnehmen Sie bitte der Institushomepage.
Kann nicht mit der Veranstaltung [2114825] kombiniert werden.

Scheduled dates:
see homepage of the institute.
Can not be combined with lecture [2114825].

Literature
Das Skript wird zu jeder Vorlesung zur Verfügung gestellt.
The script will be supplied in the lectures.
### Course: Vehicle Lightweight Design - Strategies, Concepts, Materials [T-MACH-105237]

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

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

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<td>Grade to a third</td>
<td>Each winter term</td>
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#### Events

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<th>Type</th>
<th>Credits</th>
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<tr>
<td>WT 21/22</td>
<td>2113102</td>
<td>Vehicle Lightweight design – Strategies, Concepts, Materials</td>
<td>Lecture</td>
<td>2 SWS</td>
<td>Grade to a third</td>
<td>Each winter term</td>
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#### Exams

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<td>Vehicle Lightweight Design - Strategies, Concepts, Materials</td>
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<td>Vehicle Lightweight Design - Strategies, Concepts, Materials</td>
<td>Henning</td>
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</tbody>
</table>

**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), ⚡ On-Site, ✗ Cancelled

#### Competence Certificate

Written exam; Duration approx. 90 min

#### Prerequisites

none

#### Recommendation

none

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

### Vehicle Lightweight design – Strategies, Concepts, Materials

**2113102, WS 21/22, 2 SWS, Language: German, Open in study portal**

<table>
<thead>
<tr>
<th>Lecture (V)</th>
<th>Blended (On-Site/Online)</th>
</tr>
</thead>
</table>

#### Content

**Strategies in lightweight design**  
Shape optimization, lightweight materials, multi-materials and concepts for lightweight design

**Construction methods**  
Differential, integral, sandwich, modular, bionic

**Body construction**  
Shell, space frame, monocoque

**Metallic materials**  
Steel, aluminium, magnesium, titan

#### Aim of this lecture:

Students learn that lightweight design is a process of realizing a demanded function by using the smallest possible mass. They understand lightweight construction as a complex optimization problem with multiple boundary conditions, involving competences from methods, materials and production.

Students learn the established lightweight strategies and ways of construction. They know the metallic materials used in lightweight construction and understand the relation between material and vehicle body.
3 COURSES


Literature

3.351 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

<table>
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Competence Certificate
Examinations are no longer offered.

Prerequisites
none

Annotation
The lecture was cancelled for WT 19/20.
3.352 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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<td>2 SWS</td>
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<td>Lecture</td>
<td>Gauterin</td>
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</table>

**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 2021, 2 SWS, Language: English, Open in study portal

**Content**

1. Perception of noise and vibrations

3. Fundamentals of acoustics and vibrations

3. Tools and methods for measurement, computing, simulation and analysis of noise and vibrations

4. The relevance of tire and chasis for the acoustic and mechanical driving comfort: phenomena, influencing parameters, types of construction, optimization of components and systems, conflict of goals, methods of development

An excursion will give insights in the development practice of a car manufacturer or a system supplier.

**Learning Objectives:**

The students know what noises and vibrations mean, how they are generated, and how they are perceived by human beings. They have knowledge about the requirements given by users and the public. They know which components of the vehicle are participating in which way on noise and vibration phenomenon and how they could be improved. They are ready to apply different tools and methods to analyze relations and to judge them. They are able to develop the chasis regarding driving comfort and acoustic under consideration of goal conflicts.
Organizational issues
Kann nicht mit der Veranstaltung [2113806] kombiniert werden.
Can not be combined with lecture [2113806]
Genaue Termine entnehmen Sie bitte der Institushomepage.
Scheduled dates:
see homepage of the institute.

Literature
2. Russel C. Hibbeler, Technische Mechanik 3, Dynamik, Pearson Studium, München, 2006

Das Skript wird zu jeder Vorlesung zur Verfügung gestellt
3.353 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

**Grading scale** |
---|
Grade to a third

**Recurrence** |
---|
Each summer term

**Version** |
---|
1

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</table>

Legend: 🦬 Online, 🎫 Blended (On-Site/Online), 🔴 On-Site, ✗ Cancelled

**Competence Certificate**

Oral examination

**Prerequisites**

Can not be combined with lecture Fahrzeugkomfort und -akustik II T-MACH-105155

**Modeled Conditions**

The following conditions have to be fulfilled:

1. The course T-MACH-105155 - Vehicle Comfort and Acoustics II must not have been started.

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

**Vehicle Ride Comfort & Acoustics II**

2114857, SS 2021, 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.
Organizational issues
Genaue Termine entnehmen Sie bitte der Institushomepage.
Kann nicht mit der Veranstaltung [2114825] kombiniert werden.
Scheduled dates:
see homepage of the institute.
Can not be combined with lecture [2114825].

Literature
Das Skript wird zu jeder Vorlesung zur Verfügung gestellt.
The script will be supplied in the lectures.
**Course: Vibration Theory [T-MACH-105290]**

**Responsible:** Prof. Dr.-Ing. Alexander Fidlin  
Prof. Dr.-Ing. Wolfgang Seemann

**Organisation:** KIT Department of Mechanical Engineering

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

**Type**: Written examination  
**Credits**: 5  
**Grading scale**: Grade to a third  
**Recurrence**: Each winter term  
**Version**: 2

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<th>Vibration Theory</th>
<th>2 SWS</th>
<th>Lecture</th>
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<td>2161213</td>
<td>Übungen zu Technische Schwingungslehre</td>
<td>2 SWS</td>
<td>Practice</td>
<td>Fidlin, Keller</td>
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</table>

| Exams | ST 2021 | 76-T-MACH-105290 | Vibration Theory | Fidlin |

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

**Prerequisites**  
none

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

**Vibration Theory**  
2161212, WS 21/22, 2 SWS, Language: German, Open in study portal  
**Lecture (V)**

**Content**  
Concept of vibration, superposition of vibration with equal and with different frequencies, complex frequency response.

Vibration of systems with one dof: Free undamped and damped vibration, forced vibration for harmonic, periodic and arbitrary excitation. Excitation of undamped vibration in resonance.


Vibration of systems with distributed parameters: Partial differential equations as equations of motion, wave propagation, d'Alembert's solution, Ansatz for separation of time and space, eigenvalue problem, infinite number of eigenvalues and eigenfunctions.

Introduction to rotor dynamics: Laval rotor in rigid and elastic bearings, inner damping, Laval rotor in anisotropic bearings, synchronous and asynchronous whirl, rotors with asymmetric shaft.

**Literature**  
Klotter: Technische Schwingungslehre, Bd. 1 Teil A, Heidelberg, 1978

Hagedorn, Otterbein: Technische Schwingungslehre, Bd. 1 und Bd. 2, Berlin, 1987


**Übungen zu Technische Schwingungslehre**  
2161213, WS 21/22, 2 SWS, Language: German, Open in study portal  
**Practice (Ü)**

**Content**  
Exercises related to the lecture
3.355 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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<td>2 SWS</td>
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**Exams**

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<th>Organiser</th>
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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, 🗑 Cancelled

**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 2021, 2 SWS, Language: English, Open in study portal

**Lecture (V)**

Online

**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

**Organizational issues**

Vorlesungszeiten siehe ILIAS / Lecture times see ILIAS

**Literature**

Lecture slides / Vorlesungsfolien
3 COURSES

Course: Virtual Engineering I [T-MACH-102123]

3.356 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

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Events

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Exams

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Legends:
- Online
- Blended (On-Site/Online)
- On-Site
- Cancelled

Prerequisites

None

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

**Virtual Engineering I**

2121352, WS 21/22, 2 SWS, Language: English, Open in study portal

Lecture (V)
Blended (On-Site/Online)

Content
The course includes:

- Conception of the product (system approaches, requirements, definitions, structure)
- Generation of domain-specific product data (CAD, ECAD, software, ...) and AI methods
- Validation of product properties and production processes through simulation
- Digital twin for optimization of products and processes using AI methods

After successful attendance of the course, students can:

- conceptualize complex systems with the methods of virtual engineering and continue the product development in different domains
- model the digital product with regard to planning, design, manufacturing, assembly and maintenance.
- use validation systems to validate product and production in an exemplary manner.
- Describe AI methods along the product creation process.

Literature
Vorlesungsfolien / Lecture slides

**Exercises Virtual Engineering I**

2121353, WS 21/22, 2 SWS, Language: English, Open in study portal

Practice (Ü)
Blended (On-Site/Online)

Content
The theoretical concepts and contents of the lecture will be trained within practical relevance by basic functionalities of VE System solutions.
**Organizational issues**
Practice dates will probably be offered on different afternoons (14:00 - 17:15) in two-week intervals at the IMI in Kriegsstrasse 77 / Übungstermine werden voraussichtlich an unterschiedlichen Nachmittagen (14:00 - 17:15) in zweiwöchigem Rhythmus am IMI in der Kriegsstrasse 77 angeboten.

**Literature**
Exercise script / Übungsskript
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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**Events**

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<td>2/1</td>
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<td>Virtual Engineering II</td>
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</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 2021, 2/1 SWS, Language: English, [Open in study portal](#)

**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

**Organizational issues**

Zusätzliche Übungszeiten (1 SWS) werden zu Vorlesungsbegin bekannt gegeben / Additional practice times (1 SWS) will be announced at the beginning of the lecture.

**Literature**

Vorlesungsfolien / Lecture slides
3.358 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

<table>
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**Exams**

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<td>Virtual Reality Practical Course</td>
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*Legend: 🫂 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled*

**Competence Certificate**

Assessment of another type (graded)

**Prerequisites**

None

**Annotation**

Number of participants is limited

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

**Virtual Reality Practical Course**

2123375, WS 21/22, 3 SWS, Language: German/English, Open in study portal

**Project (PRO)**

Blended (On-Site/Online)

**Content**

- Introduction in Virtual Reality (hardware, software, applications)
- Exercises in the task specific software systems
- Autonomous project work in the area of Virtual Reality in small groups

**Organizational issues**

Siehe Homepage zur Lehrveranstaltung

**Literature**

Keine / None
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

<table>
<thead>
<tr>
<th>Events</th>
<th>2118097</th>
<th>Warehousing and distribution systems</th>
<th>2 SWS</th>
<th>Lecture / 🖥️</th>
<th>Furmans</th>
</tr>
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Exams

<table>
<thead>
<tr>
<th>Exams</th>
<th>76-T-MACH-105174</th>
<th>Warehousing and Distribution Systems</th>
<th>Furmans</th>
</tr>
</thead>
</table>

Legend: 🖥️ Online, 🧩 Blended (On-Site/Online), 🆗 On-Site, ❌ Cancelled

Competence Certificate
The success control takes place in form of a written examination (60 min) during the semester break (according to §4(2), 1 SPO). If the number of participants is low, an oral examination (according to §4 (2), 2 SPO) may also be offered.

Prerequisites

none

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

Warehousing and distribution systems
2118097, SS 2021, 2 SWS, Language: German, Open in study portal

Lecture (V)
Online

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

WISSER, Jens (2009)
Der Prozess Lagern und Kommissionieren im Rahmen des Distribution Center Reference Model (DCRM); Karlsruhe: Universitätsverlag

Eine ausführliche Übersicht wissenschaftlicher Paper findet sich bei:

ROODBERGEN, Kees Jan (2007)
Warehouse Literature
3.360 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

<table>
<thead>
<tr>
<th>Type</th>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
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</thead>
<tbody>
<tr>
<td>Oral examination</td>
<td>4</td>
<td>Grade to a third</td>
<td>Each winter term</td>
<td>2</td>
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**Events**

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<tr>
<th>WT 21/22</th>
<th>2161219</th>
<th>Wave Propagation</th>
<th>2 SWS</th>
<th>Lecture / 🧩</th>
<th>Seemann</th>
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**Exams**

<table>
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<tr>
<th>ST 2021</th>
<th>76-T-MACH-105443</th>
<th>Wave Propagation</th>
<th>Seemann</th>
</tr>
</thead>
</table>

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗓 On-Site, ✗ Cancelled

**Competence Certificate**

oral exam, 30 min.

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

**Wave Propagation**

2161219, WS 21/22, 2 SWS, Language: German, Open in study portal  
Lecture (V)  
Blended (On-Site/Online)

**Content**

The course gives an introduction into wave propagation phenomena. This contains both one-dimensional continua (beams, rods, strings) as well as two- and three-dimensional continua. Initial condition problems are treated. Fundamental effects like velocity, group velocity or dispersion are explained. Wave propagation is used to show the limits of structural models like beams. In addition surface waves and acoustic waves are covered.

**Literature**

**T 3.361 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

<table>
<thead>
<tr>
<th>Type</th>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral examination</td>
<td>4</td>
<td>Grade to a third</td>
<td>Each winter term</td>
<td>1</td>
</tr>
</tbody>
</table>

**Events**

| WT 21/22 | 2173571 | Welding Technology | 2 SWS | Block / Online | Farajian |

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

**Competence Certificate**  
Oral exam, about 20 minutes

**Prerequisites**  
none

**Recommendation**  
Basics of material science (iron- and non-iron alloys), materials, processes and production, design.  
All the relevant books of the German Welding Institute (DVS: Deutscher Verband für Schweißen und verwandte Verfahren) in the field of welding and joining is recommended.

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

**Welding Technology**  
2173571, WS 21/22, 2 SWS, Language: German, [Open in study portal](#)
Content
definition, application and differentiation: welding, welding processes, alternative connecting technologies.
history of welding technology
sources of energy for welding processes
Survey: Fusion welding, pressure welding.
weld seam preparation/design
welding positions
weldability
gas welding, thermal cutting, manual metal-arc welding
submerged arc welding
gas-shielded metal-arc welding, friction stir welding, laser beam and electron beam welding, other fusion and pressure welding processes
static and cyclic behavior of welded joints,
fatigue life improvement techniques
learning objectives:
The students have knowledge and understanding of the most important welding processes and its industrial application. They are able to recognize, understand and handle problems occurring during the application of different welding processes relating to design, material and production. They know the classification and the importance of welding technology within the scope of connecting processes (advantages/disadvantages, alternatives). The students will understand the influence of weld quality on the performance and behavior of welded joints under static and cyclic load. How the fatigue life of welded joints could be increased, will be part of the course.
requirements:
basics of material science (iron- and non-iron alloys), of electrical engineering, of production processes.
workload:
The workload for the lecture Welding Technology is 120 h per semester and consists of the presence during the lecture (18 h) as well as preparation and rework time at home (102 h).
exam:
oral, ca. 20 minutes, no auxiliary material
Organizational issues
Blockveranstaltung im Januar und Februar. Zur Teilnahme an der Vorlesung ist eine Anmeldung beim Dozenten per E-Mail an Farajian@slv-duisburg.de erforderlich. Vorlesungstermine und Hörsaal werden den angemeldeten Teilnehmern Anfang des Jahres mitgeteilt.
Literature
Für ergänzende, vertiefende Studien gibt das
Handbuch der Schweißtechnik von J. Ruge, Springer Verlag Berlin, mit seinen vier Bänden
Band I: Werkstoffe
Band II: Verfahren und Fertigung
Band III: Konstruktive Gestaltung der Bauteile
Band IV: Berechnung der Verbindungen
einen umfassenden Überblick. Der Stoff der Vorlesung Schweißtechnik findet sich in den Bänden I und II. Einen kompakten Einblick in die Lichtbogenschweißverfahren bietet das Bändchen Nies: Lichtbogenschweißtechnik, Bibliothek der Technik Band 57, Verlag moderne Industrie AG und Co., Landsberg / Lech
Im Übrigen sei auf die zahlreichen Fachbücher des DVS Verlages, Düsseldorf, zu allen Einzelgebieten der Fügetechnik verwiesen.
3.362 Course: Windpower [T-MACH-105234]

**Responsible:** Norbert Lewald  
**Organisation:** KIT Department of Mechanical Engineering

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

<table>
<thead>
<tr>
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<th>Credits</th>
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<th>Recurrence</th>
<th>Version</th>
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<tr>
<td>Written examination</td>
<td>4</td>
<td>Grade to a third</td>
<td>Each winter term</td>
<td>2</td>
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**Events**

<table>
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<tr>
<th>Events</th>
<th>Credits</th>
<th>Type</th>
<th>Recurrence</th>
<th>Organiser</th>
</tr>
</thead>
<tbody>
<tr>
<td>WT 21/22 2157381</td>
<td>2 SWS</td>
<td>Windpower</td>
<td>/ 🧩</td>
<td>Lewald, Pritz</td>
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**Exams**

<table>
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<th>Exams</th>
<th>Credits</th>
<th>Type</th>
<th>Recurrence</th>
<th>Organiser</th>
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<tbody>
<tr>
<td>ST 2021 76-T-MACH-105234</td>
<td>Windpower</td>
<td>Lewald, Pritz</td>
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<td>Windpower</td>
<td>Lewald</td>
<td></td>
<td></td>
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</tbody>
</table>

**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗿 On-Site, ✗ Cancelled

**Competence Certificate**

written exam, 120 minutes

**Prerequisites**

none

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

**Windpower**

2157381, WS 21/22, 2 SWS, Language: German, [Open in study portal](#)

Blended (On-Site/Online)
# 3.363 Course: Working Methods in Materials Science and Technology [T-MACH-100288]

<table>
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<tr>
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<th>Version</th>
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<tbody>
<tr>
<td>Completed coursework (practical)</td>
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<td>pass/fail</td>
<td>Each term</td>
<td>1</td>
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**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

**Responsible:** Prof. Dr.-Ing. Hans-Jörg Bauer  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-105134 - Elective Module Mechanical Engineering

<table>
<thead>
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<th>Type</th>
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<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
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<tbody>
<tr>
<td><strong>Type</strong></td>
<td>Completed coursework</td>
<td>4</td>
<td>pass/fail</td>
<td>Each term</td>
<td>1</td>
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**Events**

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<tr>
<th>Events</th>
<th>Code</th>
<th>Event type</th>
<th>Description</th>
<th>Hours</th>
<th>Grading</th>
<th>Instructor</th>
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</thead>
<tbody>
<tr>
<td>ST 2021</td>
<td>2171488</td>
<td>Workshop on computer-based flow measurement techniques</td>
<td>3 SWS</td>
<td>Practical course /</td>
<td>Bauer, Mitarbeiter</td>
<td></td>
</tr>
<tr>
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<td>2171488</td>
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<th>Event type</th>
<th>Description</th>
<th>Instructor</th>
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<tr>
<td>ST 2021</td>
<td>76-T-MACH-106707</td>
<td>Workshop on computer-based flow measurement techniques</td>
<td>Bauer</td>
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<td>WT 21/22</td>
<td>76-T-MACH-106707</td>
<td>Workshop on computer-based flow measurement techniques</td>
<td>Bauer</td>
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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ⌚ Cancelled

**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**

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<th>Code</th>
<th>Event type</th>
<th>Description</th>
<th>Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>2171488</td>
<td>Practical course (P)</td>
<td>On-Site</td>
<td>Bauer</td>
</tr>
</tbody>
</table>

Module Offers in Mechanical Engineering for Exchange Students , Date: 15/09/2021  
Valid from Winter Term 2021/2022
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 excercise

Group colloquia for each topic

Duration: approximately 10 minutes

no tools or reference materials may be used

Organizational issues
Der aktuelle Status wird auf der ITS-homepage bekannt gegeben.

Literature
Germer, H.; Wefers, N.: Meßelektronik, Bd. 1, 1985
LabView User Manual
Hoffmann, Jörg: Taschenbuch der Messtechnik, 6., aktualisierte. Aufl., 2011

Workshop on computer-based flow measurement techniques
2171488, WS 21/22, 3 SWS, Language: German, Open in study portal
Practical course (P)
On-Site
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.

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- Analog to digital conversion
- Program design and programming methods using LabView
- Data handling
- Bus systems
- Design of a computer aided data acquisition system for pressure, temperature and derived parameters
- frequency analysis

regular attendance: 52.5
self-study: 67.5

Lernziele:
Die Studenten können:

- die wesentlichen Grundlagen der rechnergestützen Messwerterfassung theoretisch beschreiben und praktisch anwenden
- nach jedem Lernabschnitt den vorgestellten Stoff anhand eines Beispiels am PC in die Praxis umsetzen

The students are able to:

- theoretically describe and explain the fundamentals of computer aided measurements and and adopt them practically
- apply the basics learned during the lecture to a practical problem in the form of a PC excercise

Group colloquia for each topic

Duration: approximately 10 minutes

no tools or reference materials may be used

Organizational issues
Ort und Zeit siehe Institutshomepage.
Praktikum findet in Präsenz statt, sofern die COVID-Inzidenzwerte es zulassen.

Literature
Germer, H.; Wefers, N.: Meßelektronik, Bd. 1, 1985
LabView User Manual
Hoffmann, Jörg: Taschenbuch der Messtechnik, 6., aktualisierte. Aufl., 2011